CAF DEVELOPMENT BANK OF LATIN AMERICA

2021 RED Report on Economic Development

Pathways to integration

Trade facilitation, infrastructure, and global value chains

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Foreword

Latin America needs to reverse its weak productivity growth trend. This is a necessary condition for post-pandemic recovery and the starting point of a convergence path towards advanced countries' per capita income levels. Trade openness and greater integration of firms in global value chains of goods and services can help achieve this objective. Trade promotes the expansion of production beyond domestic markets, generating economies of scale, greater specialization, and diversification, boosting productivity. Global value chains, in turn, drive knowledge and technology spillovers, facilitating access to critical inputs to enable productive diversification and specialization.

Most countries in the region have unilaterally and multilaterally implemented trade liberalization policies over the last 30 years through trade agreements within and with extra-regional partners. Although these policies increased trade and investment, their results have been relatively modest. Latin America's share of global exports has not changed substantially, and the impact on growth has not matched expectations.

One factor underlying this performance is that trade liberalization policies did not generate significant and sustained increases in intraregional trade. In contrast, the regional component of these flows is critical to explaining the high shares in global trade in other regions, like East and Southeast Asia, Europe, and North America.

Even considering the smaller size of their economies, which would explain Latin America's lower levels of intraregional trade, the countries of the region trade little with each other. Geographic proximity does not seem to have a significant impact in lowering trade costs as in other regions where trade between neighboring economies is higher. The natural question that emerges is what causes such poor performance?

This report explores the hypothesis that the low international integration of Latin American firms is partly due to the limited use of the regional space as a complement to a strategy of global export expansion. This hypothesis focuses on the feedback effects and benefits of regional and global openness, or what has been called «open regionalism.»

A key message that emerges in the report is that Latin America has made substantial progress in reducing tariffs and non-tariff barriers, both through unilateral strategies and regional and extra-regional negotiations. However, two crucial areas merit attention for countries to further benefit from tariff and non-tariff reductions.

First, customs and border costs must be reduced. The region needs substantial improvements in transportation infrastructure to facilitate physical integration across countries. Interconnection infrastructure is necessary not only to transport manufactured goods but also for energy connectivity, where geographic proximity plays a central role in facilitating trade.

A second area of action is increasing firms' participation in global value chains (GVC). This can be achieved by adopting domestic and regional regulations that promote productive integration between economies (e.g., rules of origin or vertical foreign direct investment incentives). The evidence from the European Union, North America, and East and Southeast Asia indicates that there is an important regional component to the development of GVCs. Both types of measures favor the trade of inputs and intermediate goods, which fosters specialization and productivity gains.

This agenda associated with trade facilitation, investment in infrastructure, and productive integration is less prone to political or ideological controversy. This agenda lays out a pragmatic path toward greater regional and global integration of Latin American economies.

CAF – development bank of Latin America, aims to support countries in the design and implementation of this agenda that highlights integration and trade openness as an effective tool to achieve the goal of greater shared prosperity in the region.

Sergio Díaz-Granados
Executive President, CAF

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The chapters were written under the responsibility of:

Chapter 1 Pablo Sanguinetti

Chapter 2 Pedro Moncarz y Marcel Vaillant

Chapter 3 Marcel Vaillant

Chapter 4 Lian Allub and Federico Juncosa

Chapter 5 Diego Barril and Walter Cont

Chapter 6 Lian Allub and Álvaro Lalanne

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Latin America's regional integration and international trade

1

Latin America's regional integration and international trade[1]

Trade openness and greater participation of firms in the international flow of goods and services promote a higher level of productivity and welfare. On one hand, the possibility of expanding production beyond the limits of domestic markets (division of labor) generates economies of scale and a greater specialization or diversification into new products. This process is strengthened by the opportunities for firms to take part in global value chains, which also promote technology and knowledge spillovers and facilitate access to critical inputs to support productive diversification and specialization.

On the other hand, trade openness encourages greater competition between firms within the economy as well as between them and external suppliers. This generates incentives to improve business management processes, increase efficiency, lower costs, and stimulates innovation. This, in turn, leads to lower prices and a higher quality of available goods and services, improving consumer welfare. Increased competition also promotes the reallocation of resources from less productive companies to more productive ones, which can take advantage of new sales opportunities created by greater access to foreign markets and the possibility of importing higher-quality inputs. Finally, a greater participation in international trade flows not only benefits firms and sectors of tradable goods, but also those that produce non-tradable goods and services and are suppliers of exporting (and importing) companies (for example, local transport, professional services, etc.). As a result, indirectly, they are integrated into global value chains, encouraging innovation and greater productivity in these sectors as well.

Over the past 30 years, most of the countries of the region have undertaken trade liberalization policies implemented unilaterally, multilaterally—through the incorporation of the General Agreement on Tariffs and Trade (GATT) since the mid-1980s—and in the context of intraregional and extra-regional trade agreements. Although these policies have generated increases in trade and investment, for the most part, their results have been modest. Moreover, their impact on growth and welfare does not match the expectations that had been brought about at the time of their implementation (Mesquita Moreira et al., 2019; Rodrik, 2006). Notwithstanding this, the region did grow fast between 2003 and 2013, when China emerged as a global trade player, facilitated by its accession into the World Trade Organization (WTO) in 2001 and its rapid economic growth during that period (Costa et al., 2016).

1. The chapter was produced by Pablo Sanguinetti, with research assistance from Ivana Benzaquen.

China's rise boosted the export of primary goods (for example, hydrocarbons, mining, and capital-intensive agriculture, among others), especially from South America, where the region has proven comparative advantages. Although this is positive, it is expected that over time these processes will give rise to productive chains (backward and forward) as other competitive sectors emerge. Examples include the production of resource-intensive manufactures (e.g., food), capital goods (e.g., light freight transport and agricultural machinery), and business and innovation services for agriculture and the oil and mining industry, among others. These linkages promote greater differentiation or productivity within sectors and drive exports of higher value added goods and services. All these processes have occurred in the region but not in the expected magnitude (Meller, 2020).

Through integration in value chains with North American countries, Mexico and some Central American countries, like Costa Rica, have seen a significant productive diversification with a strong manufacturing component. However, these transformations did not have an aggregate impact on the productivity of these economies, whose dynamism did not change substantially.

Finally, aside from manufacturing, high value-added and technological services from the digital industry and other business support services represent important opportunities that should not be ignored. These opportunities have already produced interesting—albeit limited—results in some countries (for example, Argentina, Brazil, Colombia, and Uruguay).

The participation of Latin America in world trade remains at values close to 5%, despite the trade liberalization policies in recent decades.

Based on the above, it is not surprising to conclude that these advances are partial. They have not reversed the observed trend of persistent stagnation for decades in Latin America's share of global trade flows (around 5%). This stagnation contrasts with significant increases in the share held by other developing regions, like East and Southeast Asia.

One reason for this situation is that the liberalization policies did not generate significant and sustained increases in intraregional trade. Since the mid-1990s, it has remained around 15% of total exports with little variation over the years. In contrast, when looking at the high levels of participation in global trade in other regions, like East and Southeast Asia, Europe, or North America, the regional component of these flows is a critical aspect. For example, in Europe, intraregional trade accounts for almost 60% of the total. In North America (including Mexico), it's 45%. In East and Southeast Asia, 35%. Of course, there are reasons to think that Latin America cannot aspire to reach the trade levels seen in these regions. The region's economies are smaller, and their productive structures share certain similarities, within which, as mentioned, the exploitation of natural resources plays a very important role.

However, as documented below, even after controlling for these factors, Latin American countries trade very little with each other. What have been the causes of this poor performance? What aspects of international trade costs have not been duly addressed by the negotiations carried out in recent years? To what extent is this low level of trade also related to the region's low participation in global value chains? What regulatory policies could be applied to promote greater integration of the different productive sectors in the region? What are the institutional conditioning factors that affect the progress of a policy agenda for greater regional and global integration?

This report attempts to answer these questions by exploring the hypothesis that the low participation of Latin American firms in international trade flows is due in part to the limited use of the regional scene as a complement to a strategy of global export expansion. As mentioned before, the evidence for East and Southeast Asia, North America, and Europe indeed shows that their higher levels of international trade are explained by the more intensive exchange between neighboring countries. This hypothesis focuses on the feedback effects and mutual benefits between regional and global openness, or what has been called «open regionalism.» [2]

These efforts of greater regional and global integration deployed in the region over the last three decades have recently faced some significant challenges. Global trade tensions like the China-U.S. conflict and Brexit explains in part the downward trend in trade observed since the global crisis of 2008-2009. In addition, more recently, the outbreak of the COVID-19 pandemic implied a very significant setback in trade flows during the first half of 2020 as a result of the quarantine and isolation measures imposed to try to contain the spread of the virus. Besides the temporary effects of the health crisis on trade flows,[3] one aspect that became evident during this crisis and could have more permanent effects is the fragility of global value chains in the face of interruptions in the supply of inputs. This phenomenon could reinforce processes that would lead to the return of previously off-shoring locations of productive activities (in-shoring) or their relocation in geographically proximate countries to firms' place of origin (near-shoring). These processes could promote the «shortening» of production chains, fostering a higher level of regional trade.

2. The term open regionalism first came into use in the early 1990s. It was in the context of the debate on multilateral versus preferential trade liberalization strategies, at the GATT Uruguay Round negotiations. There was skepticism about whether it would have a successful outcome. Simultaneously, the path of preferential agreements was strengthened, fundamentally at the regional level. One aspect of this debate was whether multilateral and regional negotiations were substitute or complementary strategies to achieve further trade liberalization. Alternative definitions and information on the development of the concept of open regionalism can be found in Bergsten (1997) and Ethier (1998). A pioneer application of this concept for the region can be seen in Devlin and Estevadeordal (2001a) and IDB (2002).

3. The drop in global trade in goods in 2020 was around 5% (UNCTAD 2020a). In the case of services, it was much greater (15%).

International trade is an opportunity to expand markets and obtain productivity gains for most countries in the region.

Beyond this immediate situation produced by the pandemic, we must not forget that most of the countries in the region are relatively small economies. International trade continues to be a very important factor for expanding production and promoting productivity gains that ensure sustainable income growth. As such, the participation of Latin American firms in international markets continues to be a very prominent agenda.

With that in mind, this introductory chapter proposes to explore the role of regional integration as a mechanism that can also help achieve this objective. It highlights a series of determining factors and policies that will later be examined in greater detail in the other chapters of this report.

The chapter begins with a brief conceptual framework that highlights the role of regional integration in Latin American countries' global integration strategy. This is followed by a diagnosis of the behavior of international trade flows. It delves further into the different determinants of trade costs, including tariff issues, non-tariff barriers and other aspects that affect them, such as customs and border procedures and transport and logistics infrastructure. This assessment gives rise to the development of an agenda of policy measures to strengthen integration that covers all these issues. It also includes initiatives to review regulations that affect productive integration in some specific sectors like energy. In more general terms, it looks at the participation of countries in global value chains, including those of a regional and extra-regional nature. This agenda is constructed using the contributions of the different chapters of the report. The last section discusses institutional aspects needed to implement these reforms. It examines possible political economy impediments associated with distributional and sectoral impacts of these integration initiatives. The proper handling of these costs requires state capacities and cooperation between the public and private sectors.

A central message that emerges from the discussion in this chapter—and runs throughout the report—is that sustained increases in regional trade in Latin America require a reduction in the levels of unilaterally applied tariffs which, in some cases, are still high (notably in the Southern Common Market [Mercosur] and also in the Caribbean countries [Caricom]). These high unilateral tariffs are not compatible with an open regionalism strategy. They should be complemented by bilateral or plurilateral negotiations at the subregional level to complete the areas of tariff reduction between countries and subregions that are still pending (i.e. between Mexico and Brazil).

In addition to traditional initiatives related to tariffs, action is required in two other critical aspects of integration. One is the need to work on reducing customs and border costs, along with substantive improvements in transportation infrastructure to facilitate physical integration across countries. This connection infrastructure is not only valid for the transport of goods but also for regional goods such as energy, where the advantage of geographic proximity plays a central role in facilitating trade. The second is encouraging the participation of firms in global value chains, which as will be seen, have an important regional component. This can be achieved by adopting domestic and regional regulations that promote productive integration between economies, like rules of origin or those that encourage

vertical direct foreign investment. Both types of measures favor trade of inputs and intermediate goods, which in turn foster specialization and gains in productivity.

This agenda of policies associated with trade facilitation, investment in infrastructure, and policies that facilitate productive integration are initiatives that are less subject to political/ideological controversies (compared to those of a tariff nature). Several of them must be implemented at the national level. That said, some require a certain degree of coordination between countries. The agenda lays out a pragmatic approach toward greater integration of economies at both the regional and global levels.

Why does the regional context matter for global integration?

As mentioned, there are several potential channels through which a greater participation of Latin American firms in international markets leads to increases in productivity and greater well-being. It was pointed out that access to larger markets generates gains in economy of scale and enables greater specialization, encouraging involvement in global value chains, intra-industry trade, and diversification of production. Two questions arise from these considerations. The first is: Why are regional integration schemes, understanding regional integration schemes as initiatives for the liberalization of tariff and non-tariff barriers and the coordination of other trade policies and regulations between economies that share borders or are geographically close, a useful instrument for activating these channels? Secondly, to what extent are these schemes an effective complement to global, non-preferential trade openness mechanisms (unilateral or multilateral)?

An initial answer to both questions is that when countries undertake generalized tariff reduction processes, covering all origins of imports (or most-favored-nation [MFN]), as happened in several countries in the region in the late eighties and early nineties, the lower transport and logistics costs thanks to geographical proximity become more relevant. This naturally boosts trade between neighboring economies. This, in turn, creates incentives to further reduce tariffs and other barriers to regional trade, like non-tariff barriers (e.g., the standardization of phytosanitary requirements). It also promotes trade facilitation measures like the simplification of border procedures. Many of these trade liberalization initiatives are established in the context of free trade agreements (FTAs) that ensure market access reciprocity (and stability). Physical proximity and better identification of the benefits that these actions can produce in the economies and territories involved facilitate the coordination of these policies between States and the signing of these agreements. This reciprocal exchange of liberalization measures, in turn, is reinforced by pressure from exporting sectors that benefit from these actions. In this regard, regional integration schemes converge to what has been called «natural blocs,» where the different measures to reduce trade cost, both unilateral and preferential, reinforce each other. In these natural

trade blocs gains from trade creation are maximized while losses from trade diversion are minimized (Ethier, 1998; Frankel, 1997; Garriga and Sanguinetti, 1995a, 1995b; Krugman, 1991).[4]

Regional and preferential liberalization processes are complementary to unilateral or multilateral liberalization initiatives that reduce barriers in a non-discriminatory manner.

Thus, regional liberalization processes are highly complementary to unilateral or multilateral liberalization initiatives that reduce tariffs and other barriers on a non-discriminatory basis (MFN) and with extra-regional FTAs. There is evidence and theoretical arguments that suggest that, after signing preferential FTAs, countries tend to reduce or keep external MFN tariffs low to minimize trade diversion costs that may occur due to the conceded preferences (Bohara et al., 2004; Estevadeordal et al., 2008). That said, the signing of preferential agreements can also generate a process of expansion of these treaties to other countries, in the region and outside it. As more treaties of this type are signed, more countries have incentives to also sign them so as not to lose market in their export destination economies (Baldwin and Jaimovich, 2012). This perspective, which suggests a strong complementarity of the different paths to trade liberalization, is analyzed empirically in Chapter 2.

The importance of incentives for countries in a regional context to extend liberalization measures beyond tariffs, including customs procedures and border formalities, was noted earlier. These aspects of trade facilitation in general are measures that are used on a non-discriminatory basis. They apply to all trade flows, regardless of their destination or origin. However, as discussed below and in greater detail in Chapter 3, the regional arena provides opportunities to coordinate many of these policies. The integration of joint customs control at shared borders, the establishment of international cargo movement permits, or the interoperability of digital systems for foreign trade transactions (e.g., single windows) are a few examples. In other words, the advantage of geographical proximity is largely diminished if customs and borders become barriers whose crossing implies high costs for firms.

Similarly, lower transportation costs in regional contexts are not an aspect determined by geography alone. Investment in infrastructure that connects countries—e.g., highways, bridges, and railways—is highly relevant to ensuring that geographical proximity impact trade. In other words, the «natural bloc» characteristic has an (endogenous) policy component that can be stimulated by countries' investment in physical infrastructure that facilitates connectivity between neighboring economies. This issue is very relevant in the case of regions like Latin America, where there are large countries with significant geographical barriers, as explained in detail in Chapter 4.

The context of a natural block due to substantial reductions in trade costs is clearly seen in the case of the exchange of «regional goods,» such as energy (e.g., electricity), where geographical proximity makes it possible to establish interconnection infrastructures that significantly reduce the costs

4. Welfare gains from «trade creation» occur when increased imports from countries that are members of a trade agreement replace higher-cost domestic production. On the other hand, welfare losses from «trade diversion» occur when preferential tariff reductions encourage imports from within the region to replace more efficient imports (at lower costs, excluding tariffs) from third-party countries.

of transporting these goods or services in comparison with extra-regional destinations. As will be seen in Chapter 5, within Latin America, different subregional areas have advanced in energy integration at different paces. As a result, there is still plenty of room for a greater exchange of electricity flows that reduce provision costs. This allows countries to mitigate supply and demand shocks, reduce costs of these services by attaining a larger scale of investments and production, and convert to a more environmentally sustainable generation matrix.

Geographical proximity also makes it possible to integrate countries' productive structures. Low trade costs in terms of tariffs, but above all in terms of transportation and logistics, can support the creation of regional value chains where companies located in different economies belonging to the bloc specialize in the production of certain inputs along the production chain. This generates an increase in intra-industry trade, which is promoted by the greater certainty of deliveries of components and intermediate goods and the exchange of information on production processes and mutually recognized quality standards. As described in Chapter 6, for these processes to flourish, different national technical regulations must be standardized, vertical foreign direct investment (FDI) fostered, and rules of origin policies reformulated (Cadot et al., 2006; Estevadeordal and Suominen, 2009; Mesquita Moreira, 2018; Olarreaga, 2020). In turn, this implies establishing deeper integration processes, which are not limited to the reciprocal reduction of tariffs.

However, beyond trade cost reductions that may be achieved in the region, an issue that determines the volume of trade and the magnitude of integration gains is the size of the economies and other characteristics like similarities or differences in their productive structures. In principle, there are no theoretical arguments against small countries with similar productive structures signing free trade agreements with one another. That said, the possibilities of increasing trade will be more limited. To avoid trade diversion costs, it is important that these agreements do not lead to the emergence of excessively high preferential tariffs (very high external tariffs) or other barriers like very strict rules of origin, limiting the possibility of trade with other countries. An interesting example discussed later is the case of the Central American Common Market (CACM). Despite being made up of relatively small economies, this integration initiative has increased regional trade. By strengthening the exchange of intermediate manufactured goods, it later gave rise to exports directed to North American markets. This dynamic is transforming these countries' production structures, which previously were based mainly on primary products.[5]

Associated with the smaller relative size of Latin American economies, another reason that has been pointed out for the establishment of regional integration agreements is the possibility of having greater negotiating power vis-à-vis

5. As will be seen in Chapter 2, size and production structure will be taken into account as two of the determinants of bilateral trade at the global level and in Latin America, in particular. However, its impact in the region is not very different from that in other regions of the world.

other countries or blocs with which new agreements could be established. Verifying this argument, although plausible, is complex in practice because it is not easy to find a counterfactual or comparative scenario to evaluate the results (Mesquita Moreira, 2018). Although block negotiations, in comparison with individual country approaches, can accomplish broader market access and better reciprocal conditions, the strategy and objectives to be achieved must be coordinated by the trade partners participating in the negotiations, which can lead to delays and a less agile international markets strategy. A comparison of the cases of Chile and Mercosur is a clear example. Chile has negotiated countless agreements, while the latter, due to a lack of consensus among its members, has made very little progress in its strategy of establishing new treaties with third blocs and countries. The last section of this chapter will discuss some aspects related to the political economy of trade opening processes and of integration, which can shed light on this dynamic. These aspects are associated in part with the possible sectoral and individual distributive effects within countries and also among partners that are produced by trade liberalization and integration agreements.[6]

Overview of trade in goods and services

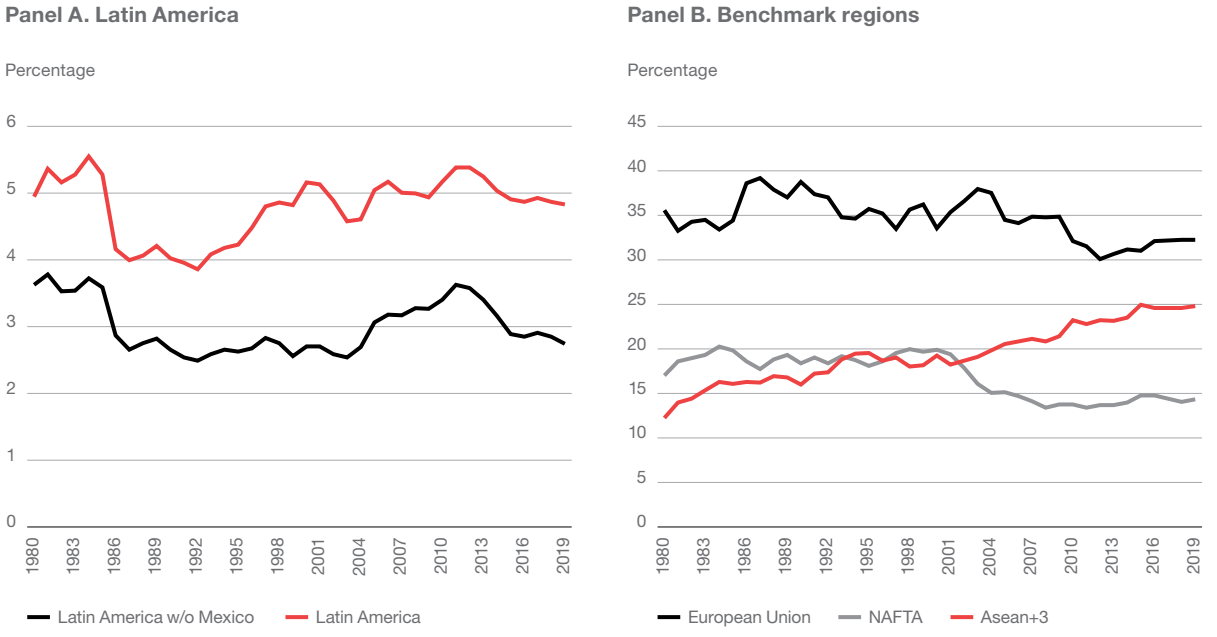
International trade indicators

Recent data on global exports and imports of goods and services suggests that Latin America has not made significant progress in terms of its participation in international markets in recent decades. Graph 1.1 shows the share of different world regions in total exports. As can be seen (panel A), Latin America has remained at a level that fluctuates between 4% and 5% since the 1980s.[7] Two factors clearly affected changes in this share over time. On the one hand, fluctuation in the price of raw materials, which dropped in the early 1980s and has recorded strong increases since the early 2000s. This last phenomenon is associated with China's irruption in the raw material markets, reinforced after its entry into the WTO, and the considerable increase in its imports of these products, driven by its rapid growth during those years.

6. Another argument in favor of integration that has made progress but not addressed in this report is the possibility of addressing externalities that may arise from shocks or uncoordinated policies that generate sudden migrations and movements of capital between adjacent economies (Bown et al., 2017). Examples include recessions that displace workers from one economy to another or differences in taxes that affect the location of investments. This may be especially relevant between neighboring locations in countries that share geographical boundaries.

7. In this chapter, the indicators at the aggregate level presented for Latin America include three Caribbean countries: Dominican Republic, Trinidad and Tobago, and Barbados. On the other hand, depending on the availability of information, data describing trade integration for all the countries of the Caribbean Community (Caricom) will also be presented.

Graph 1.1
Evolution of participation in global exports of goods and services, by region or trade bloc



Notes: The graphs show the share of world exports of goods and services over the total in Latin America (panel A) and the different regions or trade blocs (panel B). The countries included in each region or bloc can be found in the Appendix (p. 75).

Source: Authors using the WTO and UNCTAD database (2020).

On the other hand, in the mid-1990s, Mexico joined the North American Free Trade Agreement (NAFTA),[8] which caused a strong increase in trade with the United States and Canada, which, in turn, had an impact on Latin America's share in global trade. In fact, if Mexico is excluded, an important fall in the region's share of global exports is observed since the mid-1990s. It is partially reversed in the 2000s with the aforementioned increase in the prices of raw materials.

The graph (panel B) also shows the growing share of the Association of Southeast Asian Nations (ASEAN) member countries in global trade,[9] along with Japan, China, South Korea, New Zealand, and Australia (known as ASEAN+5). Largely determined by the increase in China's exports, the bloc's share has a negative impact on the other regions' share. Since the 2000s, countries in the European Union and North America (NAFTA) show reductions

8. This report focuses mainly on NAFTA since the available data and observations correspond to the period in which this agreement was in force. However, when the occasion requires it, reference will be made to USMCA, the treaty that replaced NAFTA and entered into force on July 1, 2020.

9. Asean member countries are Burma, Brunei, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

in their participation in world trade, although starting from very different levels. The EU exhibits levels above 40% during almost the entire period, while North America remains at values that fluctuate between 10% and 14%, depending on whether Mexico's exports within this subregion are included. A determining factor of these levels of participation in global trade, hinted at in this evidence and highlighted below, is the dynamics of intraregional trade in each of these blocs.

This view of a relative stagnation of Latin America's participation in international trade flows does not change significantly when evaluated in terms of the ratio of exports to gross domestic product (GDP). On average, the region's ratio rose moderately during the period of more than 30 years between 1980-84 and 2015-18, although the results show significant heterogeneity between countries. Table 1.1 presents this information, along with the import indicators and the sum of both. In South America, Paraguay stands out; it almost tripled its level of exports relative to GDP (from 13% to 35% of GDP). Other countries that were initially more open, like Chile and Uruguay, also show an increase in this indicator, although much more moderately. Argentina raised its exports to GDP ratio, but its levels still remained very low at the end of the period, as did Brazil. Among the Andean countries, Ecuador stands out, almost doubling its degree of export openness, while Peru and Colombia show more modest increases. In the latter case, the relatively low level of the indicator is noteworthy (only slightly higher than that of Argentina and Brazil). In Central America, the economies are much more open, which in part is expected for smaller economies, but the strong increase in trade to GDP in the case of Honduras, Nicaragua, and El Salvador is striking. Finally, an exceptional case is undoubtedly Mexico, which almost tripled the degree of internationalization of its economy, a remarkable increase.

Latin American exports relative to GDP increased moderately starting in 1980, rising from 25% to 29%.

Undoubtedly, the different behaviors are explained by the reasons already mentioned, which will be analyzed in detail later and in the next chapters. In the case of Paraguay, the fundamental ingredient of its trade liberalization was the improvement of the infrastructure connecting it to the rest of the world together with product innovation. Improvements in the Paraná River waterway and technological improvements in agriculture (in part supplied by neighboring countries) made it possible to expand the agricultural frontier. The export boom in Ecuador is related to the opening to foreign investment in the hydrocarbon sector and other primary products (for example, shrimp) driven by the increase in the prices of these types of goods. In Central America, the consolidation of the Central American Common Market (CACM) and participation in production chains with North America increased regional trade and extra-regional exports. In Mexico, the tariff liberalization process that began in the mid-1980s made it possible to «discover» trade opportunities with its northern neighbor based on the advantages of geographic proximity. This led to an exponential growth of bilateral trade, which gained even more momentum after NAFTA was signed.

Table 1.1
Trade openness in Latin America by country (as a percentage of GDP)

Country	1980-1984			2015-2019		
	Exports	Imports	Total trade	Exports	Imports	Total trade
Argentina	8	6	14	13	14	28
Barbados	57	58	116	42	41	83
Bolivia	26	25	51	26	33	59
Brazil	10	9	19	13	13	27
Chile	20	24	44	28	28	57
Colombia	12	14	27	15	21	37
Costa Rica	37	40	77	32	32	64
Ecuador	16	16	32	21	22	44
El Salvador	26	31	57	29	46	75
Guatemala	16	19	35	19	28	47
Honduras	27	37	64	42	60	102
Mexico	14	10	24	37	39	77
Nicaragua	20	34	54	42	54	95
Panama	55	59	115	43	47	90
Paraguay	13	19	32	37	33	70
Peru	21	21	42	24	23	47
Dominican Republic	19	28	48	24	28	51
Trinidad and Tobago	48	51	99	41	43	85
Uruguay	19	20	40	26	22	48
Venezuela	27	22	49	n.a.	n.a.	n.a.
Latin America	25	27	52	29	33	62

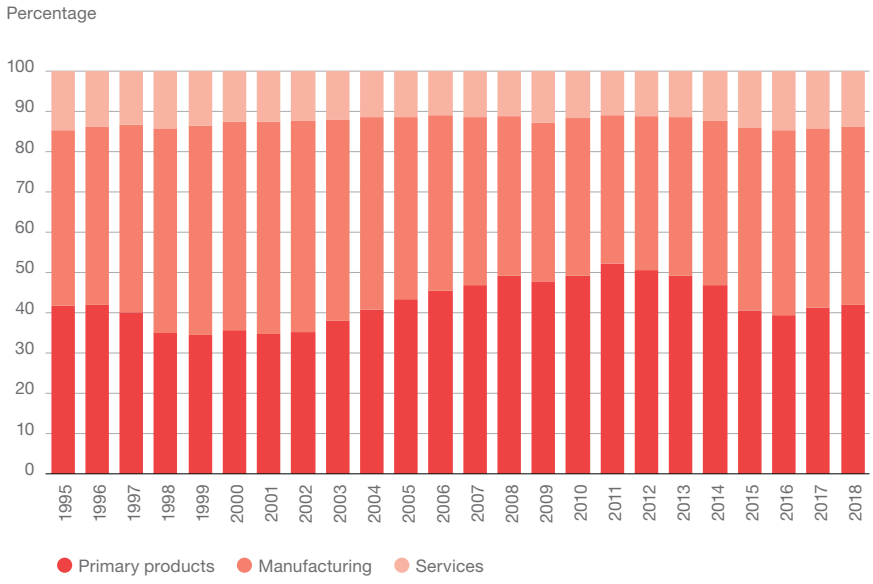
Notes: The table shows the average trade openness from 1980-1984 and 2015-2019 for the different countries, measured as the percentage in GDP of their exports, imports, and total trade level. The values for Latin America correspond to the simple average of the countries presented in the table (including Barbados, Dominican Republic, and Trinidad and Tobago); n. a. indicates no data was available.

Source: Authors using data from the World Bank (2020b) and WTO and UNCTAD (2020) for Trinidad and Tobago.

Breakdown of exports

The composition of total exports between primary goods, manufactures, and services has not changed significantly since the 1980s. However, since the boom in the price of raw materials in 2003, the share of primary goods has grown, reaching 47% of total exports for the entire region in 2014. It later fell when prices declined (Graph 1.2). Manufactures maintain a majority proportion of total exports (between 42% and 45%), although this is largely due to the contribution of Mexican exports.[10] The share of services has remained stable, varying between 10% and 14% of total exports.

Graph 1.2
Share of primary goods, manufactures (differentiating Mexico's contribution), and services in total exports for Latin America



Notes: The graph shows the breakdown of Latin American exports by sector during the period 1995-2018. The sectors considered were the primary, manufacturing and services, based on the Standard International Trade Classification, revision 3 (SITC 3). The specific Latin American countries included can be found in the Appendix (p. 76).

Source: Authors based on WTO and UNCTAD data (2020).

10. The share of manufacturing in total exports falls to approximately 16% when Mexico is excluded. See Graph A.1.1 in the Appendix.

There is also significant heterogeneity in the composition of exports among countries in the region (Table 1.2). In the case of Mexico and the Central American countries, with the exception of Panama, exports have a significant manufacturing content. In Panama, the services component is very high, while in South America, as mentioned above, exports of primary goods have a greater weight.

Table 1.2
Participation by sector in total Latin American exports (in percentage)

Country	1995			2000			2010			2018		
	Primary sector	Manufacturing	Services	Primary sector	Manufacturing	Services	Primary sector	Manufacturing	Services	Primary sector	Manufacturing	Services
Argentina	56	29	15	56	28	16	55	28	17	58	19	23
Bolivia	69	16	15	60	24	15	85	6	9	79	5	16
Brazil	40	48	12	35	50	15	55	31	14	56	30	13
Chile	72	10	18	68	13	19	76	10	14	76	12	12
Colombia	56	30	14	58	28	14	68	21	11	64	17	19
Ecuador	79	7	15	78	7	15	83	9	8	82	5	13
Peru	69	12	19	63	16	21	76	12	12	75	9	15
Paraguay	49	12	39	48	11	41	84	7	10	78	10	11
Uruguay	37	24	39	37	27	36	54	17	29	48	13	39
Venezuela	79	13	8	89	8	3	93	4	3	96	2	2
Barbados	10	12	78	11	10	79	11	11	78	11	13	75
Costa Rica	43	35	22	24	51	25	26	40	34	23	33	45
El Salvador	30	51	19	19	62	19	21	57	22	16	52	32
Guatemala	53	21	26	53	25	22	45	33	22	41	33	26
Honduras	65	7	28	23	64	13	27	51	22	27	47	27
Mexico	20	69	11	15	77	8	22	73	5	16	77	6
Nicaragua	63	16	20	68	6	27	65	5	30	41	37	22
Panama	22	6	73	23	4	72	5	58	37	6	38	57
Dominican Republic	9	55	35	8	56	36	17	36	47	19	31	51
Trinidad and Tobago	50	38	12	63	26	11	63	29	7	46	46	8

Notes: The table shows the breakdown of Latin American exports by sector during the period 1995-2018. Sectors were formed based on the Standard International Trade Classification, revision 3 (SITC 3).

Source: Authors based on WTO and UNCTAD data (2020).

Evolution of regional trade

As part of the analysis of Graph 1.1 already revealed, a proportion of the region's low share of global trade mentioned above could be explained by a limited level of intraregional trade compared to other countries and regions.

Before evaluating the intraregional trade data, it is worth reviewing the map of the main regional trade agreements that connect the different countries in the region.[11] Figure 1.1 presents that description. Throughout this chapter and the rest of the report, references will be made mainly to the North American Free Trade Agreement (NAFTA), the Southern Common Market (Mercosur), the Central American Common Market (CACM), the Andean Community of Nations (CAN), and the Pacific Alliance (PA). In addition, the Caribbean nations are integrated under the Caribbean Community (Caricom). Not all of these agreements share the same characteristics and depth in terms of liberalization policies. Mercosur, CAN, CACM, and Caricom are formally constituted as customs unions, in which a common external tariff is established in addition to the internal liberalization of import duties and non-tariff barriers (NTBs). On the other hand, the PA and NAFTA are free trade agreements, whereby the signatory countries have reduced tariff and non-tariff barriers to internal trade and coordinated a series of other policies (e.g., government procurement, rules of origin, etc.) but maintain their independence in terms of external tariffs. Table A.1.1 in the Appendix at the end of the chapter provides more details on the characteristics of each integration initiative.

The level of intraregional trade in Latin America, which represents 15% of total exports, lags far behind other blocs such as the EU (60%), NAFTA (45%), or Asean+3 (35%).

Table 1.3 presents the intraregional trade indicators. for the Latin American region as a whole, the share of intraregional exports in total exports has fluctuated around 15% since the mid-1990s, with little change over the years. These shares are much higher in other regions: close to 60% for the European Union (EU), 45% for NAFTA, and 35% for the Association of Southeast Asian Nations (Asean) member countries, together with China, South Korea, and Japan (known as Asean+3). However, within the region, there is heterogeneity among the different sub-regions. Central America has some of the highest levels of intraregional trade (between 15% and 17% in recent years).[12] Mercosur follows, registering a significant decrease in internal trade flows, from 20% in the mid-1990s to 12% in 2015-2018. On the other hand, the Andean Community (CAN), the Caribbean Community (Caricom), and the more recently created Pacific Alliance (PA) show much lower and relatively stable levels of regional trade in relation to global trade (7% for the first two and 3% for the latter).

11. In addition to these agreements, defined by their own rules and with a certain geographical affiliation, there are many other bilateral treaties between countries (approximately 33); some cover a wide range of products, while others have a partial scope. For example, the Dominican Republic is not a founding member of any of these agreements but has signed bilateral treaties with many of these blocs and individual countries. See Mesquita Moreira (2018) for more information.

12. If only exports of goods are taken into account, the proportion reaches 20-22%.

Figure 1.1
Main regional trade agreements

Notes: The figure uses a Venn diagram to illustrate the different regional trade agreements countries of the Americas have signed.

Source: Authors.

However, the behavior of these shares could reflect a greater extra-regional participation in trade flows of the countries, which proportionally reduces the share of intrazonal trade. This is generally true for the Latin American average (see Table A 1.3 in the Appendix). Between 1995-99 and 2015-18, regional exports increased threefold while total exports increased almost fourfold. The same occurs for several of the subregions, including Mercosur, CAN, and Caricom. In CACM, the increase in intra-zone trade is slightly more accelerated (15% higher) than total flows. It is also one of the blocs with the greatest increase in regional trade, with a four-fold increase during the period. The process is similar for the PA, but starting from much lower levels of trade, so that intra-zone trade is still low at the end of the period. The comparison with Asean+3 is interesting. Trade among member countries (and the total for the bloc) is very dynamic (five times higher in 2015-18 compared to 1995-99), clearly reflecting the influence of China as a new actor in the region.

Table 1.3
Evolution of intraregional exports in total exports of goods and services, by region or trade bloc (in percentage)

	1995-1999	2000-2004	2005-2009	2010-2014	2015-2018
Latin America and subregions					
Latin America	18	15	17	18	15
Mercosur	21	13	13	13	12
Pacific Alliance	3	2	3	4	3
CAN	8	8	8	7	7
CACM+DR	12	13	13	13	14
Caricom	8	8	9	8	7
Benchmark groups					
European Union	58	57	58	55	55
NAFTA	39	46	42	40	38
Asean+3	32	32	32	34	34

Notes: The table contains information on intraregional exports as a percentage of total exports of goods and services by region (average by sub-period). For the periods in which the different trade blocs were not formally constituted, trade between member countries is reported based on the current conformation of each bloc. The countries included can be found in the Appendix (p. 76).

Source: Authors using data from BACI (CEPII, 2020), BaTIS (OECD and WTO, 2020), WTO and UNCTAD (2020).

The lower level of intraregional trade is due in part to the low participation of Latin America (and its subregions) in regional value chains.

The lower dynamism of intraregional trade in Latin America could be explained in part by the lower participation of the countries of the region in global value chains, which, as will be seen later, have a strong regional component. Participation in these production linkages facilitates the exchange of intermediate inputs and intra-industry trade, which accelerates as economies specialize and production processes are fragmented into a larger number of stages.

One way to evaluate this phenomenon is simply to analyze the proportion of total exports by major product categories—in particular looking at manufactured products—going into the region (this could be compared with the proportion of total exports that are regional, presented in Table 1.3). Table 1.4 describes this information and shows that, in general, intra-bloc trade is more intensive in manufacturing goods than in primary goods or services. For example, this indicator for the period 2015-2018 is 26% in Mercosur, 17% in CAN, and 22% in Central America (although it is still low compared to ASEAN+3, Europe, and NAFTA, which are more closely aligned with the share of regional exports over the total).[13]

This greater intensity of regional trade in manufactured goods in Latin America is partly due to a certain similarity in the countries' productive structure in terms of primary goods, which weakens the opportunities for domestic trade

13. The Pacific Alliance and Caricom do not follow this pattern. In the first case, there is a certain balance among the three sectors in the destination of exports, while the second shows a greater concentration of exports of primary goods to the region.

in these products (this is more evident in South America). But it is also because geographical proximity provides opportunities for trade cost reductions that could give rise, as mentioned above, to participate in regional value chains, which in turn promotes specialization and trade in industrial goods.

Table 1.4
Evolution of the share of intraregional exports in total exports of goods and services, by sectors and regions or trade blocs (in percentage)

Region or trading bloc	Sector	1995-1999	2000-2004	2005-2009	2010-2014	2015-2018
Latin America	Primary	17	15	14	14	13
	Manufacturing	21	16	23	24	18
	Services	11	10	11	13	11
Mercosur	Primary	15	10	7	6	6
	Manufacturing	30	19	23	30	26
	Services	10	8	7	8	7
Pacific Alliance	Primary	3	3	4	3	3
	Manufacturing	3	2	3	4	3
	Services	2	2	3	3	3
CAN	Primary	6	6	5	5	5
	Manufacturing	21	19	20	27	27
	Services	3	3	3	3	3
CACM+DR	Primary	12	16	17	17	17
	Manufacturing	19	19	19	19	23
	Services	3	3	4	4	4
Caricom	Primary	14	15	15	16	15
	Manufacturing	13	11	8	7	9
	Services	3	3	2	3	3
NAFTA	Primary	42	55	55	49	47
	Manufacturing	47	54	49	48	49
	Services	20	22	19	18	16
European Union	Primary	67	67	67	64	63
	Manufacturing	59	58	59	55	56
	Services	50	50	50	49	49
Asean+3	Primary	56	57	55	57	55
	Manufacturing	28	30	29	31	31
	Services	30	29	30	31	34

Notes: The table contains information on intraregional exports as a percentage of total exports of goods and services by region (average by sub-period). The sectors were defined based on the Standard International Trade Classification, revision 3 (SITC 3). For the periods in which the different trade blocs were not formally constituted, trade between member countries is reported based on the current conformation of each bloc. The countries included in each region can be found in the Appendix (p. 76).

Source: Authors based on data from BACI (CEPII, 2020), BaTIS (WTO and OECD, 2020), WTO and UNCTAD (2020).

Another more rigorous way to measure the participation of countries in global value chains is to calculate the foreign value added of exports and assess how much of that value is regional. This «backward» measurement of participation in global value chains makes it possible to determine to what extent these production linkages promote intra-bloc trade. As discussed in greater detail in Chapter 6, global value chains fragment production processes into different stages. At each stage, the countries and companies involved use imported inputs along with local value added (labor and capital payments) to produce a new product (which may be an intermediate or final good) that is then exported. The foreign value added in a country's exports reflects the successive stages of transformation through which that product has passed in other economies.

Graph 1.3 shows the relationship between the share of foreign value added in total export value added and the share of regional value added in total foreign value added in several regions worldwide. A positive correlation can be clearly observed. This suggests that the use of imported inputs in total exports by the countries is very much determined by the provision of these inputs in the regional context. In other words, participation in global value chains has a significant regional component (Antràs and Gortari, 2020). This evidence is consistent with the fact that countries more integrated in value chains (with higher foreign value added in exports) are more regionally integrated (Johnson and Noguera, 2012). This is clear in the case of the European Union, Asean+3, and NAFTA, where regional imported value added represents between 30% and 50% of imported value added embedded in exports.

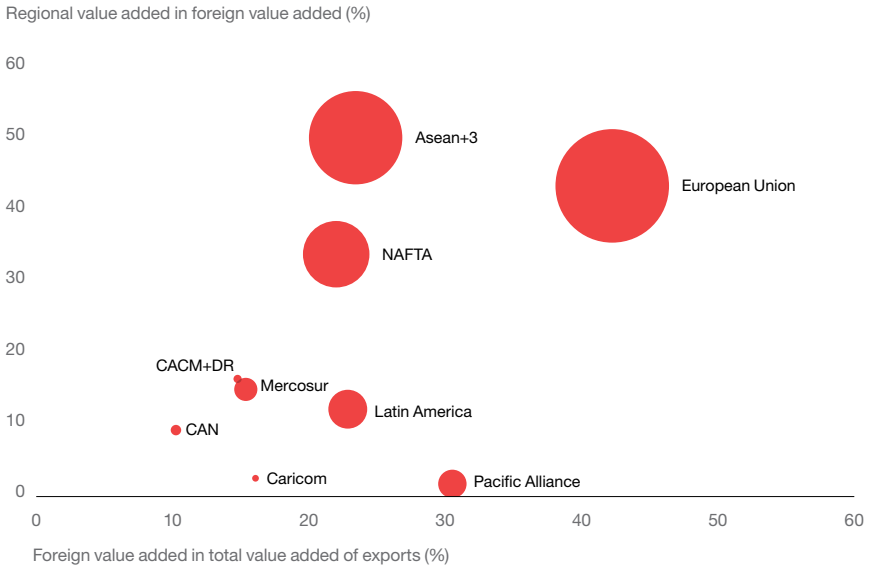
The size of the circles in Graph 1.3 measures the total value added of exports (which includes that of domestic origin). Although this magnitude partly depends on GDP, it also reflects the level of trade openness in the countries and blocs. Europe is a region that is very open to trade, followed by Asean+3 and then by NAFTA. In all cases, regional trade is a fundamental component of this level of openness.

The data for Latin America show less integration in regional value chains. For the region as a whole, imported value added is approximately 23% of the total value added of exports (not much different from NAFTA or Asean+3). However, the share of imported value added from the region is much lower (a little more than 10%).[14] Within Latin America, again we observe a considerable level of heterogeneity among different subregions. The Central American Common Market, including the Dominican Republic (CACM+DR), is the subregion with the highest integration in regional value chains, followed by Mercosur and CAN. On the opposite end, the Pacific Alliance, despite being formed by more open economies (with a greater proportion of imported value added in their exports), shows nearly null integration in regional value chains.

14. If Mexico is excluded from Latin America, the level of openness measured by the proportion of imported value added in exports falls approximately to 15%, while the share of imported inputs sourced from the region increases (22%). This is intuitively explained by Mexico's high level of openness, even though it is heavily concentrated in trade with its NAFTA partners.

Graph 1.3

Relationship between the contribution of regional value added to foreign value added, and the contribution of foreign value added to total value added of exports per trade bloc, 2019



Notes: The graph represents the relationship between the percentage of regional value added over foreign value added (Y-axis) with respect to the percentage of foreign value added in total exported value added (X-axis). The countries' exports are composed of domestic and foreign value added; in addition, the foreign value added can be regional (sourced from countries of the same region) or extra-regional (from countries outside the region). The size of the bubbles reflects total exported value added (domestic and foreign) for each region. The countries included in each region or bloc are listed in the Appendix (p. 77).

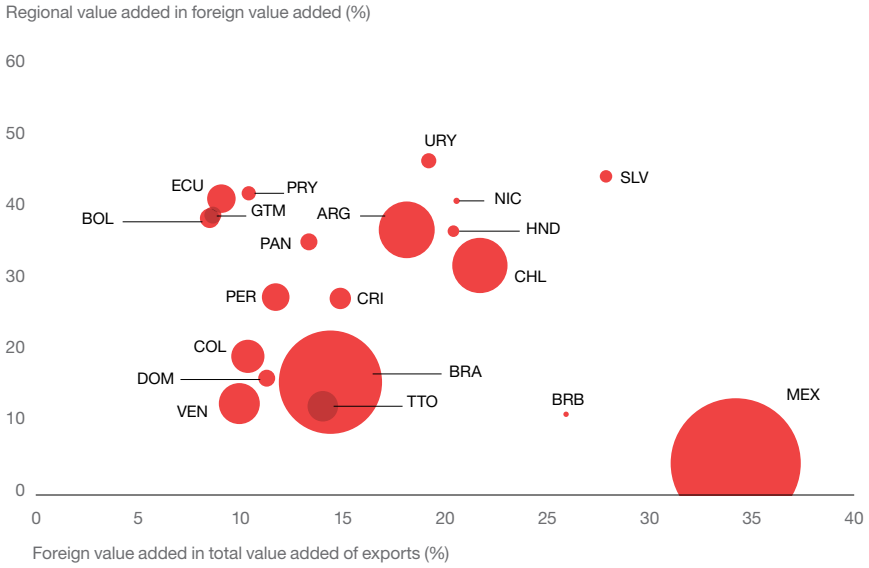
Source: Authors based on Eora data (UNCTAD, 2020a).

Graph 1.4 shows the same information but for individual countries within Latin America.[15] An analysis of the data reveals very diverse realities. Some countries, such as El Salvador and Honduras in Central America, and Uruguay and Chile in the Southern Cone, have relatively high participation in regional value chains, which in part explains their higher levels of trade openness. Others, such as Colombia and Brazil, have a low share of foreign value added in their exports and a low share of regional value added in exported foreign value added. This indicates more closed economies with limited productive integration with the rest of the region. Despite a high level of participation in regional value chains, Ecuador and Paraguay have low levels of integration of total foreign value added in their exports. This suggests that in absolute value their regional productive integration is very low. Mexico is an extreme case. It appears as one of the most open countries in terms of combining foreign value added in its exports. However, the participation of inputs from

15. In these calculations, the group of Latin American countries is taken as the benchmark region to estimate participation in regional value chains.

Latin America is almost nil. This is indicative of its strong integration with its neighbors in the north and the almost absent productive integration with its neighbors to the south.

Graph 1.4
Relationship between the contribution of regional value added to foreign value added and the contribution of foreign value added to total value added of exports per country, 2019



Notes: The graph represents the relationship between the percentage of regional value added over foreign value added (Y-axis) with respect to the percentage of foreign value added over total value added of exports (X-axis) by country. Exports from the countries are composed of both domestic and foreign value added; in addition, the foreign value added can be regional (sourced from countries of the same region) or extra-regional (from countries outside the region). The size of the bubbles reflects total exported value added (domestic and foreign) for each country. The regional value added includes that coming from the countries included in the graph. Table A 1.2 in the Appendix (p. 71) lists the countries shown in this graph according to their ISO 3 code.

Source: Authors based on Eora data (UNCTAD, 2020a).

Implications of COVID and digitalization processes for regional trade

Trade wars or natural phenomena (such as COVID-19) can drive participation in regional value chains through nearshoring processes.

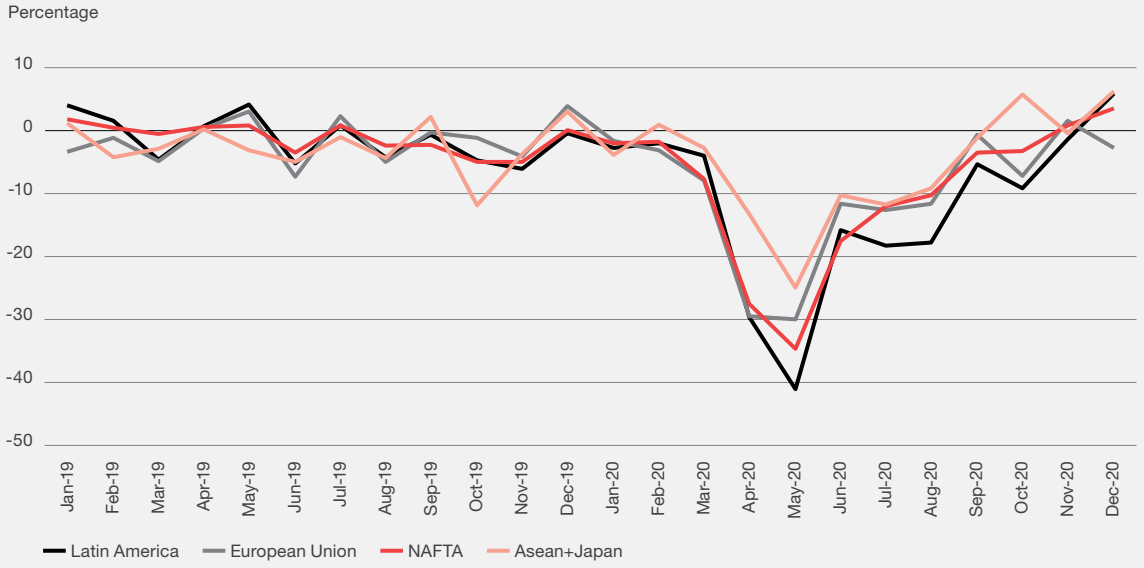
Two situational events with potentially long-term impacts have recently challenged the trends in global and regional trade flows described above. Commercial and geopolitical conflicts between China and the United States, which have been manifesting since 2018-2019, have caused disruptions in trade flows between these countries (Actis and Zelicovich, 2020; Goldberg et al., 2010). Also, the health emergency caused by the COVID-19 pandemic has seriously affected trade flows, as a result of isolation needs and the sharp drops in global aggregate demand, as explained in Box 1.1.

Box 1.1
The impact of COVID on trade flows

As a result of the COVID-19 emergency starting in early 2020, trade flows in the region suffered a very sharp drop during the second quarter of that year (close to 40%). This decrease was more pronounced than that observed for Europe, the United States, or Asia (Graph 1). By the fourth quarter of 2020, international trade had partially recovered. In Latin America, it was still 1.8% below the previous year[a].

This decline in trade can be attributed to several causes. On the one hand, lower global demand caused by social isolation and high uncertainty reduced household consumption and business investment. This phenomenon has affected not only trade volumes but also prices, especially of primary goods, such as oil, which had already recovered the values of December 2019 in the first quarter of 2021. On the other hand, on the supply side, shutdowns of productive activities and sectors affected trading of inputs along global value chains. As a result, input-output relationships transferred the shock from one economy to another. Although the effects have somewhat moderated since July 2021, they are still being felt in various sectors. One case is the automotive industry. The lack of electronic components, manufactured mainly in Asia, is delaying the recovery of production and driving up the price of these products (Konings, 2021a, 2021b; WTO, 2021).

Graph 1
Monthly YoY Growth of Total Trade



Notes: The graph shows the monthly year-over-year percentage change in total trade (exports and imports) of goods in the selected regions. Countries with complete information for the period analyzed were included in each region. A list of the countries included in each region can be found in the Appendix (p. 77).

Source: Authors based on data from ALADI (2020) and Comtrade (United Nations, 2020).

a. The decline in Latin America is an average based on the drop in Brazil, Colombia, Paraguay, and Mexico.

As already mentioned, the fragmentation of production is beneficial because it results in specialization gains throughout the entire production chain (Blyde and Volpe, 2011). However, natural phenomena or trade wars that abruptly interrupt the normal supply of inputs can threaten these gains and generate high costs. This is especially true when the fragmentation of production is accompanied by a reduction in inventories due to the implementation of online production systems (e.g., just-in-time inventory systems). As a result, they could lead to a process of re-shoring and near-shoring with firms preferring to source from suppliers that are geographically closer (within the same country or in neighboring countries). This process could give greater impetus to integration processes and regional value chains. Moreover, potentially, they could be more resilient in the face of these vicissitudes (Actis and Zelicovich, 2020).

The other global phenomenon with significant repercussions on trade flows (accelerated by the COVID pandemic) is the digitization of foreign trade processes. In addition to marketing, sales, and payment transactions services via e-commerce platforms, customs formalities and procedures (analyzed in more detail in the next section and Chapter 3) have also undergone a digital transformation. Both processes can play a leading role as a vehicle for expanding exports.

The evidence of the volume of foreign sales made via internet commerce platforms is scarce and partial.[16] However, several studies show that greater use of the Internet and broadband increases international trade of goods and services and the variety of exports.[17]

The evidence seems to support a positive correlation between the use of online stores and global e-commerce platforms, on one hand, and increased exports and market diversification, as well as lower trading costs, on the other. This suggests that the internet and e-commerce help buyers meet and interact more easily with companies in other countries, giving them access to a wider variety of products and markets (Suominen, 2019).

What is the implication of this for regional trade? How do these new connectivity-enhancing technologies challenge the impact of distance on trade? What do they mean in terms of the advantages of geography, the emergence of natural blocs, and the trend toward regionalization of trade?

16. Globally, the United Nations Conference on Trade and Development (UNCTAD, 2019) estimates that cross-border business-to-consumer (B2C) trade accounts for 10% of total e-commerce sales.

17. See Freund and Weinhold (2004; 2002); Ricker (2014, 2015); Osnago and Tan (2016); World Bank (2016).

It is to be expected that these effects depend on the type of product in question. In the case of primary or final and intermediate manufactured products, their consumption requires physical movement. Although platforms can speed up and reduce the cost of accessing customers (a particularly important advantage for SMEs), the physical part of the transaction is unavoidable. They require complementary storage, logistics, and transport infrastructure. As these costs decline at the regional level, the digitization of transactions could imply more trade. Technology lowers some of the transactional and procedural (i.e., custom) costs of trade, while geographical proximity helps with those related to transportation. In other words, in this case, in reducing certain barriers to trade, digitization makes those barriers associated with distance more visible.

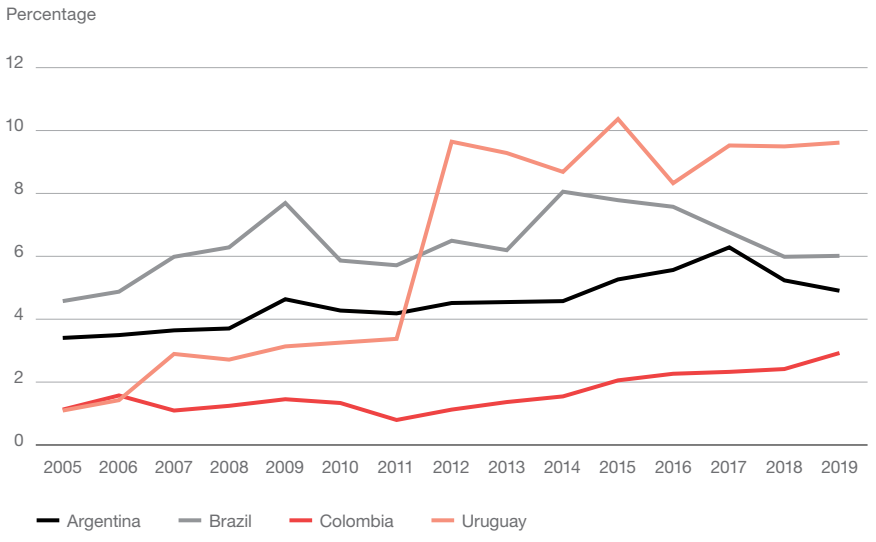
In principle, this would not occur with those products whose consumption does not require physical transportation or whose transportation cost is greatly reduced via digital media. This would be the case of those exports associated with professional consulting and technological services and with entertainment services, among others. However, preliminary evidence in the case of the United States suggests that, even in these products, consumption is higher for exports from geographically proximate countries (Blum and Goldfarb, 2006; Goldfarb and Tucker, 2019; Lendle et al., 2016). Aspects associated with language and culture may also play a role in this pattern.

The possibility that the digitization of cross-border trade will promote a higher level of exports of knowledge-intensive services is relevant in the context of some countries in the region that are already taking advantage of this possibility through the emergence of technological startups. These firms offer business and technological services (software for e-commerce, website design and management, cybersecurity, data storage, administrative management, education, job training, etc.) to foreign companies (global and regional), which outsource part of their production processes to suppliers in the region. For Latin America as a whole, these exports still do not represent a very significant value in total exports (around 2% compared to the OECD average of almost 7%). However, foreign sales of technological and knowledge services have become more dynamic in recent years in a subset of countries. Moreover, a good part of these services is sold in regional markets. The most notable case is that of Uruguay, where services have grown from 3% to almost 10% of total exports in the last decade (Graph 1.5).

E-commerce can help drive the internationalization of Latin American companies by facilitating access to new customers and reducing transaction costs.

Consequently, it can be concluded that the emergence and massification of cross-border e-commerce can also be an instrument for boosting the internationalization of Latin American companies with regional markets still playing an important role in this strategy.

Graph 1.5
Share of exports of technological services in total exports



Notes: The graph shows the value of technology and knowledge services exports as a percentage of total exports of goods and services for Argentina, Brazil, Colombia, and Uruguay. Services were categorized based on the 2010 Extended Balance of Payments Services Classification Manual (EBOPS 2010). Items SJ1 (research and development services), SJ2 (professional and management consulting services), and SJ3 (technical, commercial, and other business services) were considered as technological and knowledge services.

Source: Authors based on WTO and UNCTAD data (2020).

Trade costs

The determinants of international trade are multiple and have been explained in various ways. These include the traditional theory of comparative advantages based on factor endowments; the approach that highlights the differences in sectoral productivity between countries due to technology; and the one that emphasizes gains in economies of scale, which in turn allow greater specialization and generation of varieties and promote intra-industry trade (inputs). All these theoretical arguments are compatible with the so-called «structural gravity model of international trade,»[18] which explains bilateral export flows between countries focusing on two determinants. On the one hand, by different factors that determine trade costs (e.g. distance, transport and logistics costs, tariffs, etc.) and, on the other, by the size of the economies in relation to the world economy. This model has been the subject of multiple empirical tests over the last 20 years and has shown

18. See Novy (2013).

surprising robustness in terms of its results and predictive capacity.[19] More recent efforts (Anderson and van Wincoop, 2003; Novy, 2013) show that in order to correctly estimate the effect of trade costs on bilateral exports, domestic trade must also be included. This is because the existence of international trade costs not only generates substitution between imports from different origins but also between imports from different origins and locally produced goods.[20]

Chapter 2 develops new estimates of the structural gravity model that serve to quantitatively assess the impact on trade flows of preferential trade agreements, changes in MFN tariffs (unilateral and multilateral openness), the productive structure or comparative advantages, the effect of geography (e.g. distance) and variables that make explicit the complementarity between regional integration and (non-discriminatory) global openness.[21]

It is useful to first look at the indicators that summarize the aggregate effect of international trade costs. While consistent with the gravity model of trade (Novy, 2013), they do not arise from econometric estimates. These international trade cost indicators measured in relation to domestic trade costs are inversely related to the ratio between the geometric average of international bilateral trade flows and domestic trade in each country,[22] as described in Box 1.2.

This «proximity» indicator, which measures the ratio between external and internal trade and, as mentioned, behaves inversely to the ratio of international trade costs relative to domestic trade costs (Moncarz et al., 2021), can be easily calculated once the gross value of trade flows between countries and domestic trade data are available.[23,24] Graph 1.6 shows estimates of the evolution of the proximity indicator at the start and the end of the 1995-2015 period, differentiating intraregional from extra-regional trade using manufacturing exports of each country or region. This distinction illustrates the integration pattern of each trade bloc and to what extent it has been affected by the evolution of trade costs within or outside the region. In the Graph, the extension of the lines describes the magnitude of the expansion of trade, while their slope, in comparison with the 45-degree line, shows the bias in terms of trade within the regions vis-à-vis the rest of the world.

19. Yotov et al. (2016) present a practical guide to trade policy analysis using the structural gravity model.

20. See derivation of the model in the Appendix of Chapter 2.

21. Chapter 3 extends this analysis to incorporate variables associated with trade facilitation.

22. The consistency of this indicator with the structural gravity model is proven by the fact that it uses domestic trade flows to infer the magnitude of international trade costs relative to domestic trade costs.

23. The proximity indicator can be computed using the total value of exports or those referring to specific products or sectors (e.g. manufactured goods).

24. Moncarz et al. (2021) explain in detail the methodology for calculating the gross value of domestic trade using countries' national accounts data. See summary in the Appendix to Chapter 2 (p. 104).

Box 1.2
Aggregate trade cost indicators

Based on Novy (2013), one can derive the formula that links the ratio of the (geometric) average of bilateral trade between countries *i* and *j* and domestic trade to the inverse of the bilateral trade costs between these countries relative to domestic trade costs as shown in the following formula,

$$\left(\frac{x_{ij}x_{ji}}{x_{ii}x_{jj}}\right)^{\frac{1}{2}} = \left(\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{-\left(\frac{1}{2}(\sigma-1)\right)} \quad (1)$$

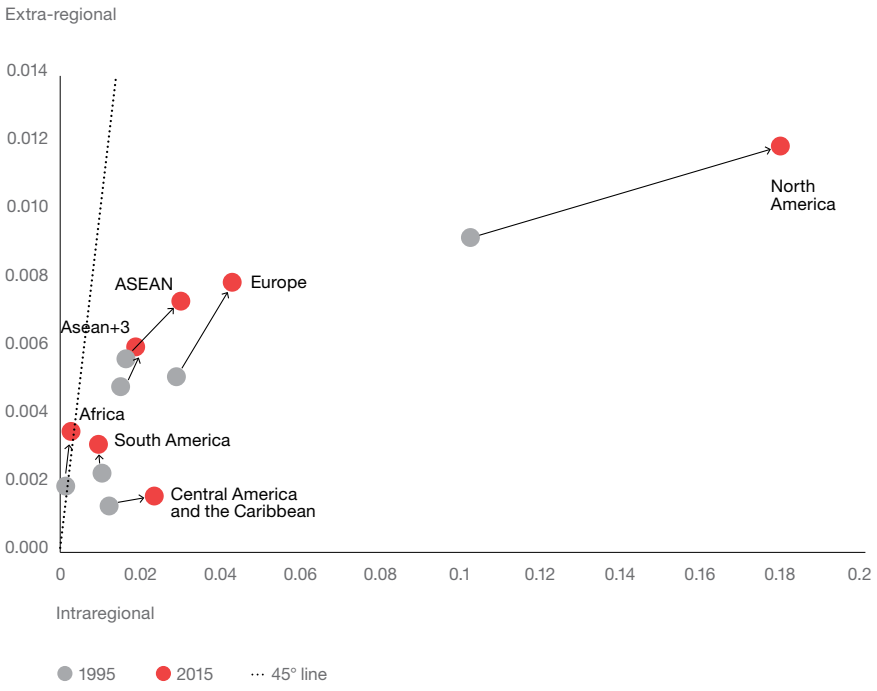
Where x_{ij} represents the exports from country *i* to country *j*; and x_{ii} is the domestic trade of country *i* (x_{jj} measures it for country *j*); t_{ij} represents the trade costs involved in exports from *i* to *j*; t_{ii} is the domestic trade costs within country *i* and $\sigma-1$ (with $\sigma>1$) is the elasticity of trade relative to its costs, which in this version of the model depends on the elasticity of substitution between both imported and domestic varieties, a parameter determined by preferences.

Equation (1) shows that bilateral international trade flows between *i* and *j* relative to domestic trade (an indicator of «proximity» between pairs of countries) will be higher the lower the geometric average of trade costs between *i* and *j*, and the higher the costs of trading domestic goods. At the same time, given these relative costs, the lower the elasticity of trade determined by the substitution between varieties imported from different origins, and between these and those of domestic origin (σ), the greater will be the increase in bilateral trade between countries *i* and *j*. This makes it more difficult to avoid those costs by replacing imports from other origins or with domestic production.

Source: Authors based on Novy (2013).

North America (including Mexico) and the EU stand out at one extreme, showing a significant increase in trade, both globally and within the region but which clearly was more intensive at the regional margin. This would reflect larger reductions in the relative costs of trade between neighboring countries than with extra-regional partners. (In both cases, the reduction was greater than the decline in domestic costs). Asean, which is made up of developing countries with smaller economies, also shows a marked reduction in trade costs, with a greater bias in favor of trade within the region. The same effect occurs when the larger Asian economies (Asean+3) are added, although to a lesser degree. The information for Latin America shows that, in the case of Central America and the Caribbean, there has also been a significant expansion of international trade (and the implied trade cost reduction) with greater weight within the subregion. Conversely, South America stands out at the other extreme. The increase in international trade is much lower. At the same time, there is a greater bias toward extra-regional markets. This suggests that trade costs were reduced in a greater proportion toward these destinations compared to those located within the region. This evidence reaffirms part of what was seen in the previous section, which showed simpler indicators of the evolution of trade. Finally, in the case of sub-Saharan Africa, trade expansion (and cost reduction) remained practically above the 45% line, suggesting a balanced pattern of evolution between regional and extra-regional destinations.

Graph 1.6
Proximity indicators by region and destination, 1995 and 2015



Notes: The graph shows the estimates of the proximity indicators (inverse of trade costs) comparing the years 1995 and 2015, for various regions of the world and distinguishing intraregional trade (X-axis) from extra-regional trade (Y-axis). The extension of the lines describes the integration pattern of each trade bloc and the extent to which this is determined by the evolution of trade costs within and outside the region, while its slope compared to the 45-degree line shows the bias it has had in terms of trade within the regions vis-à-vis the rest of the world. The countries included in each region can be found in the Appendix (p. 71).

Source: Authors based on data from Moncarz et. al (2021).

These aggregate estimates of trade costs described by the proximity indicators summarize a series of tariff, non-tariff, regulatory, and trade facilitation barriers, as well as transportation and logistics costs that affect the competitiveness of firms in the region in relation to the rest of the world. Although useful for a macro evaluation of the degree to which the sum of these costs has affected the pattern of international integration of Latin America, they are not practical for a policy discussion. They cannot help to identify which trade barriers are most relevant and what type of measures should be applied to foster the exchange of goods and services, especially at the regional level, where there is a marked lag. Some indicators that help to assess the magnitude of each of these barriers are briefly described below.

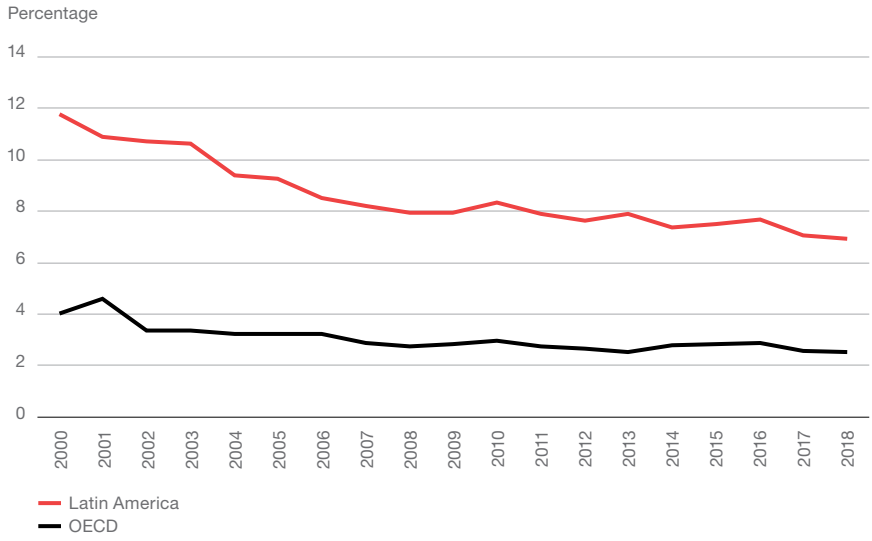
Between 1995 and 2015, the proximity indicators (ratio of international trade to domestic trade) for South America showed a small expansion, especially in terms of intraregional trade.

Tariffs and non-tariff measures

Despite various liberalization initiatives, tariffs in Latin America are still high compared to developed economies.

Since the mid-1980s and early 1990s, the region has undergone trade liberalization processes at the unilateral level and in the context of FTAs negotiated with both regional and extra-regional partners. These processes have led to significant reductions in the effective tariffs applied to imports. However, as shown in Graph 1.7, they are still high in relation to what is observed on average for developed countries.

Graph 1.7
Evolution of the average tariffs applied in Latin America and OECD countries



Notes: The graph shows the evolution of the average tariffs applied to all products in Latin America and OECD countries. Regional tariffs are calculated as the simple average of the tariffs applied by the countries in each region. A list of the countries included in each region can be found in the Appendix (p. 78).

Source: Authors based on data from the World Bank (2020e).

However, the information on tariffs by subregional groupings for 2017 shows significant heterogeneity (see Table 1.5).[25] On one hand, Caricom and Mercosur countries maintain high levels of import duties compared with other Latin American subregions or external trade blocs. For example, external tariffs reach 12% in the Caribbean, although internal tariffs are much lower (2.7%). Mercosur, in turn, applies tariffs that reach almost 8% on average to NAFTA, the EU, and the Asean+3, and uses similar tariffs within the region for Central

25. The tariffs used for Graph 1.7 and Table 1.5 are not strictly comparable because they correspond to different sources. The tariffs shown in the table have been updated to reflect in each case the existence of free trade agreements that modify the tariff rates, making them different from those declared by the countries as MFN. See detail in Teti (2020).

American countries.[26] On the other hand, negotiations between Mercosur and the Pacific Alliance countries have largely reduced trade protection (with tariffs of 1.6%), although the agreements between Mexico and the largest Mercosur economies (Brazil and Argentina) continue to be limited and significant tariff barriers persist (Mesquita Moreira, 2018; Mesquita Moreira et al., 2019). In addition, the internal liberalization within Mercosur has been completed for the most part, with average tariffs close to zero. This is also observed in the other trade blocs (main diagonal of Table 1.5), where internal tariffs are very low (zero for the EU and NAFTA and 2% for Asean+3).[27]

The Pacific Alliance levies the lowest tariffs on other countries and regions (less than or close to 2%, except for Asean+3 members, reaching 4.5%) as a result of the multiple agreements signed by its member states with other trade blocs. Within the Alliance, the internal tariff is close to zero. Central America is a similar case, although it applies slightly higher tariffs: external tariffs of 4% to 6% and internal tariffs of 2.8%.

By type of product, the information shows that Mercosur levies higher import duties to manufacture goods compare to the agricultural sector (livestock, hunting, forestry, and fishing), while Central America and Pacific Alliance member countries show the opposite behavior (see Appendix Table A 1.4). Exports of agricultural goods from Latin America (and Mercosur in particular) also face higher tariffs in the EU and Asean+3.

Table 1.5
Internal and external tariffs by trade bloc (as a percentage), 2017

Importing region	Exporting region							
	Mercosur	Pacific Alliance	CAN	CACM+DR	Caricom	European Union	NAFTA	Asean+3
Mercosur	0.04	1.55	0.55	7.59	7.77	7.78	6.75	7.77
Pacific Alliance	1.23	0.34	0.62	2.31	5.03	1.09	0.55	4.50
CAN	0.69	1.04	0.26	6.15	6.70	4.29	4.30	7.09
CACM+DR	5.37	2.79	4.58	0.65	4.54	3.82	2.05	5.34
Caricom	12.24	12.10	12.10	11.49	2.57	6.91	12.25	12.26
European Union	3.57	0.60	0.37	0.45	0.02	0.00	1.75	2.30
NAFTA	2.15	0.42	0.98	1.01	2.68	1.42	0.24	2.95
Asean+3	6.87	5.86	6.28	6.83	6.91	6.17	6.46	1.98

Notes: The table shows the average tariffs applied in 2017 (as a percentage). The importing region is the trade bloc that applies the tariff, while the exporting region is the one whose products are subject to these duties. The countries included in each region can be found in the Appendix (p. 78).

Source: Authors based on Teti data (2020).

26. Mercosur's external tariffs were increased during the 2010-2015 period. See Chapter 2.

27. Asean+3's relatively high tariffs with other regions are due to tariffs levied by South Korea on agriculture goods. If this country is excluded, these rates drop by almost 1 percentage point. The internal tariff within Asean is also significantly lower (0.68%).

In summary, considerable progress has been made in the tariff reductions applied to imports, except in Caricom, which maintains high duties with almost all the blocs. Beyond this case, there is still work to be done. For example, Mercosur still maintains high protection vis-à-vis countries in other Latin American subregions (such as Central America) and those outside the region, as well as in some sectors, such as manufacturing. Other subregions (such as the Pacific Alliance) have high tariffs for some agricultural goods. On the other hand, there is room to reduce tariffs between Central America and the rest of the subregions of Latin America, as well as between the largest countries in the region: Mexico, on the one hand, and Argentina and Brazil, on the other. Chapter 2 quantitatively assesses the impact of these tariff barriers on trade flows—including those established in the context of FTAs and those established under MFN rules.

Non-tariff barriers (NTBs) are classified into technical and non-technical measures. Technical measures include sanitary and phytosanitary measures, along with labeling and technical product requirements, including certification, tests, and inspection. These technical measures should not necessarily be viewed as trade restrictions that decrease welfare. Many of them aim to safeguard the quality of products and the sanitary safety of people and farming. What is important is that these requirements are implemented transparently and predictably.

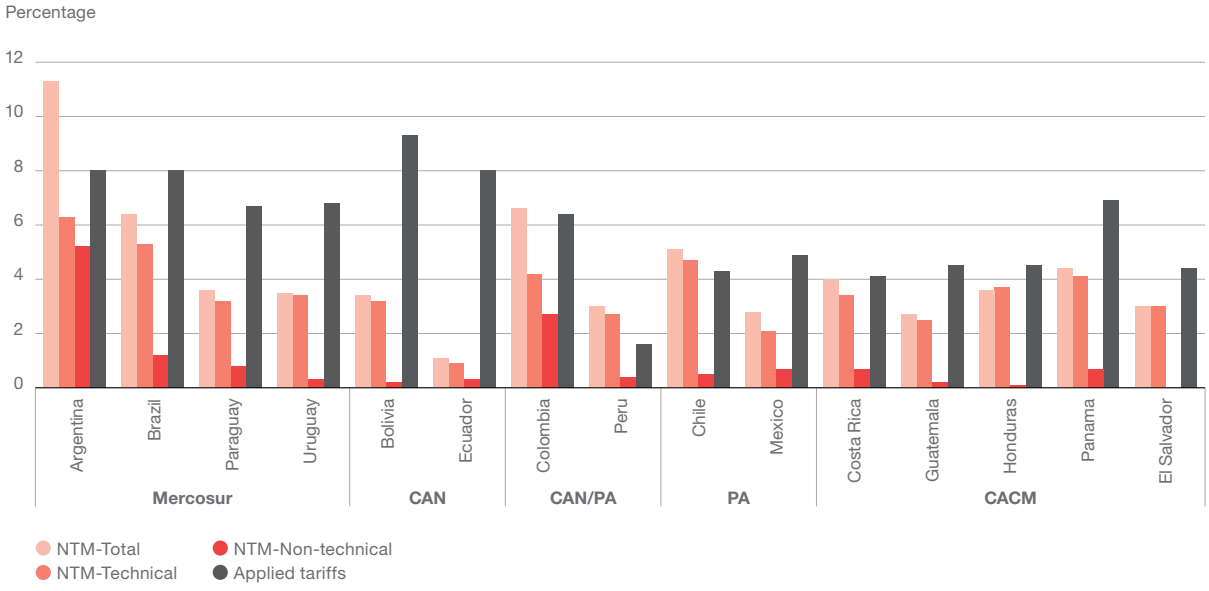
Non-technical measures include trade restrictions that are hard to justify from a welfare perspective. These include anti-dumping, compensatory, and safeguarding measures, along with quantitative restrictions, like license requirements, quotas, and other measures to control quantities, in addition to prohibiting imports that are unrelated to sanitary and phytosanitary measures, or technical barriers. Non-technical barriers also include price controls on imported goods to support or stabilize the internal price of competing products or increase tax revenues.

Evidence on the use or application of each of these non-tariff measures over the total of these regulations (see Table A 1.5 in the Appendix) indicates that sanitary and phytosanitary measures are the most common. Next come the requirements associated with product labeling and technical conditions.

Comparatively, the least used are non-technical measures, such as anti-dumping and safeguards, non-automatic licenses, quotas, bans, and other quantitative controls. These measures have much more impact in terms of restricting trade flows. Moreover, they are subject to stricter regulations by the World Trade Organization and their application is also more restricted for intraregional trade within free trade agreements (although not necessarily against third countries). Within the region, Caricom is the subregion that most intensively uses this type of restriction (with a 60% share of all measures), which is consistent with the high level of tariffs seen previously. Mercosur (7%), CAN (7%) and the PA (6%) follow. The EU also applies them with a certain degree of intensity (11% of the total).

The relative use of different types of non-tariff measures does not allow us to assess the level of restrictions that these barriers imply. To do this, it would be necessary to estimate the impact they have on the price of imports, by calculating a tariff equivalent of these barriers. The available evidence on tariffs equivalent to non-tariff barriers shown in Graph 1.8 suggests that these may represent important obstacles to trade and in several cases be comparable in magnitude or even higher than tariff barriers.[28] For example, within Mercosur, the sum of the costs of technical plus non-technical measures in Argentina results in an import tariff equivalent to 11%, higher than the average external tariff (8%). In the case of the Pacific Alliance countries, Colombia has an equivalent NTB of 7%, while the average tariff is 5.7%.[29] Negotiating free trade agreements (regional and extra-regional) makes it possible to progressively reduce these barriers or, at least, homogenize them and limit their discretional use. As will be seen in Chapter 2, these negotiations have had a visible impact on the prevalence of NTB barriers and bilateral trade.

Graph 1.8
Equivalent rate of non-tariff barriers by countries and blocs



Notes: The graph presents an average estimate for the 2013-2015 period of the ad-valorem equivalent of non-tariff measures (NTMs). They are calculated as the equivalent tariff necessary to obtain the same change in the quantity imported achieved with non-tariff barriers. The estimations are shown for total ad-valorem equivalent tariffs and their breakdown into technical measures (sanitary and phytosanitary, labeling requirements, among others) and non-technical measures (trade measures, quantitative restrictions, price controls, financial measures, among others). The graph also shows the tariffs applied in 2017.

Source: Authors based on data from AVE (World Bank 2020a) and Teti (2020)

28. There are no estimates available on equivalent rates of non-tariff barriers for Caricom countries.

29. This is also the case for the EU and NAFTA, where the tariff equivalent of NTBs is quite higher (6.5% vs. 1-1.2%), given the relatively low level of applied tariffs. The difference is much smaller in Asean+3 countries (6.3% vs. 5.2%).

Customs, logistics, and transport costs

The costs originating from customs formalities and procedures should be added to the costs represented by tariffs and non-tariff barriers, both for imports entering Latin American countries and for exports to regional and extra-regional destinations. Those corresponding to logistics associated with the transport of goods should also be considered. Evidence shows that, as tariffs and other non-tariff barriers decline, these components of trade costs begin to play an increasingly important role in countries' competitiveness. As such, the simplification of customs procedures and the improvement in logistics and transportation infrastructure—domestic and that connecting with international markets—can play a very relevant role in the expansion of trade (Mesquita Moreira et al., 2013; Mesquita Moreira et al., 2008; Volpe Martincus, 2016).

Customs, logistics, and transportation costs can have a greater impact on regional trade, especially when tariff barriers have been reduced, making these costs more visible.

Even though these measures, in principle, do not differentiate between the origin of imports and the destination of exports, they may have a higher impact on regional trade. In a context of lower MFN tariffs, the reduction of these other trade costs could lead to a more than proportional increase in regional trade and encourage the signing of trade agreements that further reduce tariffs. These policies will strengthen the process of open regionalism, given that regional trade does not increase with distortions leading to trade diversions, but because of measures that result in trade creation. (IDB, 2002; Garriga and Sanguinetti, 1995a). Chapter 3 (on customs procedures and trade facilitation) and Chapter 4 (on transport and logistics costs) look into this in greater detail.

The importance of costs associated with customs and border formalities, logistics, and transportation should not be underestimated. For example, the National Logistics Survey in Colombia indicates that these can reach 25% of the value of sales (micro-enterprises are excluded); this value should be compared with logistics costs of 13.5% for operations in the domestic market [Consejo Nacional de Consultoría, 2021a]. On average, logistics costs in Latin America associated with foreign trade vary between 18% and 35% of the value of the product. They can reach more than 45% for SMEs, while they range between 15% and 18% for larger companies (FIEL, 2021; Guasch, 2011). These estimates clearly suggest that these expenditures are significantly higher than those currently represented by the tariff and non-tariff barriers discussed above.

As mentioned, two components are included within the international trade logistics system. The first has to do with trade facilitation processes related to customs procedures. This encompasses cargo tracking and inspection, risk management, delivery and verification of documentation (e.g., rules of origin and sanitary and phytosanitary certificates). The use of information and communication technologies (ICT) and single windows for foreign trade (SWFT) can help to facilitate and expedite these procedures. The second relates to the infrastructure of transport services, which includes both the transshipment nodes for external trade (comprising ports, airports, and border crossings) and cargo movements (comprising domestic and international roads, maritime traffic, and air transport). Table 1.6 summarizes these components.

Table 1.6
International trade components of the customs and logistics system

Components	Functions	Instruments and processes
Transport services infrastructure	Foreign trade transshipment nodes	Ports, airports, and border crossings
	Cargo transfer	Roads, maritime traffic, and air transport
Trade facilitation	Customs procedures	Delivery and verification of documentation, use of ICT and single windows for foreign trade (SWFT) Easy Export Programs (e.g., Exporta Fácil) Cargo tracking and inspection (risk management) Authorized economic operators (AEO) International cargo circulation permits issued under the International Transit of Goods system (Tránsito Internacional de Mercancías, TIM)

Source: Authors.

These two areas of intervention are very significant because they represent very concrete measures that countries can apply, both unilaterally and in the context of free trade agreements. These actions are not controversial, as is generally the case with tariff measures. Moreover, they have the potential to significantly increase firms' opportunities to access international markets. The following section summarizes in more detail some of the policy initiatives on trade facilitation and logistics and transport services that are highly relevant to setting up an agenda that promotes regional and global integration.

A policy agenda to strengthen regional and global trade integration

The diagnosis presented in the previous sections shows that Latin America's participation in global trade is low and has been stagnant for decades. This is explained in part by the low level of intraregional trade. Consequently, a policy agenda that promotes greater involvement of the region's firms in international trade flows should also contemplate a greater exploitation of the opportunities that are available within the continent, as a complement to global trade strategies. In fact, as mentioned in the conceptual section both types of liberalization paths are mutually reinforcing. (Chapter 2 will explore this in greater detail.) It has already been seen how the significant levels of trade among EU, NAFTA, and ASEAN+3 member countries explain a large part of the expansion of international trade in these economies. This brings the question: Why has Latin America failed to make progress in this area despite more than 30 years of free trade agreement initiatives at the regional level? We discuss below a policy agenda to tackle this question by proposing concrete measures to strengthen regional and global integration. This agenda summarizes the main results and conclusions presented in the rest of the report's chapters.

Tariffs and non-tariff barriers

The evidence previously presented on trade costs shows that, on the tariff side, there has been progress in tariff reduction among the signatories of the main trade agreements in the region. In some cases, non-preferential tariff reductions (applied to MFN duties) also have been implemented. Nonetheless, there are still a few gaps between subregions and countries that need to be filled. They include trade liberalization between Central America (and the Caribbean) and South America as well as between the region's large economies (Mexico, on the one hand, and Argentina and Brazil, on the other).[30] This can occur either through the mechanism of non-preferential liberalization (on a MFN basis) or through plurilateral negotiations. Non-tariff barriers also remain important. As documented, in some cases, they involve relatively high tariffs equivalents, which should either be eliminated or homogenized to ensure greater transparency and predictability in the way they are applied.

Chapter 2 provides evidence of the fact that the persistence of these tariff and non-tariff barriers is one of the reasons for the historically low dynamism of trade within Latin America. Using data for the period 1995-2015 for the manufacturing and agricultural sectors, a structural gravity trade equation is estimated where the exchange of goods between two countries depends on the size of the economies and the costs of trade (including trade barriers and transport/distance costs). The empirical exercise also considers the exchange of these products inside and outside the countries. One of the main objectives of this estimation is to analyze the effects of the main free trade agreements (FTAs) in Latin America. The results show that the establishment of an FTA expands trade in manufactured goods in the Central American Common Market (CACM), accounting for more than 10% of the variation in the bloc's internal exports during the period analyzed. On the contrary, its contribution in the most important plurilateral agreements in South America was much lower: 3.5% in the Andean Community of Nations (CAN); 4.5% in Mercosur.

This exercise identifies not only the existence of a treaty and the level of preferences it grants but also the extent to which the countries that make up each agreement have signed other arrangements with third economies or groups of countries. The accumulation of agreements is a factor that could increase bilateral trade between countries (beyond the existence of a preferential agreement between them) since it implies the removal of different trade obstacles and homogenization of regulations (e.g., non-tariff barriers). Many of these measures are applied on a non-preferential basis. Therefore, they also boost bilateral trade, over and above what is attributable to the presence of tariff preferences established in a particular FTA. The evidence confirms a positive result for this factor, reflecting the complementarity between preferential liberalization strategies and those of a unilateral or multilateral (non-preferential) nature.

30. Caricom faces the important task of reducing MFN tariffs and NTB, which, as we have seen, are among the highest in the region.

Another defining aspect of open regionalism is the extent to which the signing of preferential trade agreements at the regional (and extra-regional) level has been accompanied by the reduction of MFN tariffs (generalized reductions without distinguishing the country of origin of imports). The lowering of these tariffs can also have an important impact on trade within regional agreements despite their non-preferential nature. This could reinforce the effect of geographical proximity (e.g., the reduction of non-preferential tariffs makes the advantages of lower transport costs more visible). The evidence seems to support this hypothesis since this variable (reduction of MFN tariffs) explains a significant part of the increase in bilateral trade. In the case of Mercosur, it had a significant negative effect (-7%) because these tariffs were raised for this bloc during the period under analysis. The opposite occurred in CAN and CACM, where the reduction of MFN tariffs accounted for 21% and 15.5% of the increase in regional trade, respectively.

These results allow us to conclude that trade liberalization was relevant to increasing trade in some of the sub-regional agreements in Latin America, but not in others. In CACM, which stands out because trade in manufacturing increased fivefold between 1995 and 2015, the paths of preferential and non-discriminatory liberalization aligned. In CAN, the channel of MFN tariff reduction was active, whereas in Mercosur the sum of both effects was almost nil.

Preferential and non-preferential trade liberalization was a catalyst for intraregional trade in the Central American Common Market and the Andean Community but had almost no effect on Mercosur.

In addition to trade liberalization, estimates under the gravity model of trade can assess the effect of more structural variables, like geography (e.g., distance). An aspect worth analyzing is whether the low trade observed in the region could also be explained by the fact that the advantage of geographic proximity within Latin America is not as relevant as in other blocs in terms of lower transportation and logistics costs. In other words, if the effective distance is larger than what the physical proximity among the countries would suggest, compared with other regions of the world. The data seems to confirm this hypothesis, suggesting that border requirements and formalities need to be simplified to drive trade in Latin America, not just a lowering of tariffs and non-tariff barriers. Moreover, transport infrastructure must be improved, and productive integration fostered. These topics will be discussed below.

Trade facilitation and digitization of foreign trade services

The costs originating from customs formalities and procedures involve time and resources that reduce the productivity of firms and economies as a whole. In turn, this may be particularly important for SMEs, whose lower volume of operations means that these costs have a greater effect on their competitiveness.

Trade facilitation can solve some of the barriers or obstacles previously indicated. Chapter 3 offers a detailed analysis of these initiatives. These interventions include the simplification, standardization, digitization, and harmonization of the different procedures, documents, payment of fees, certification of technical requirements, and inspection of merchandise, among other mandatory formalities for the movement of goods, services, or productive factors among countries, which impact the final cost for consumers. The WTO

Full implementation of the Trade Facilitation Agreement (TFA) could reduce global trade costs by between 12% and 18%.

Trade Facilitation Agreement (TFA) has encouraged many of these actions at the multilateral level since it came into force in 2017. According to estimates by the WTO (2015a) and the Organization for Economic Cooperation and Development (OECD, 2018), TFA's comprehensive application could reduce trade costs globally by between 12% and 18%, and the greatest gains would go to low-income countries. In this regard, the OECD stresses that the policies that will contribute most to reducing trade costs are measures to harmonize and simplify trade documents, the automation of border processes, the optimization of trade procedures and formalities, and the availability of information on practical aspects of trade.

Four instruments stand out among those most widely used by countries to implement these trade facilitation measures: the single window for foreign trade (SWFT) to facilitate the digitalization and simplification of customs formalities in one portal concentrating all foreign trade operation procedures; the implementation of the Exporta Fácil (EF) program, aimed at expanding the participation of SMEs in exports by introducing simplified postal services; the so-called Authorized Economic Operator (AEO) to certify companies with proven capacities and compliance with foreign trade operation requirements to reduce controls on them; and the International Transit of Goods system (Tránsito Internacional de Mercancías, TIM), which facilitates the international transport of export goods entering and leaving the territory of a country with the aim of reaching a third market.

Most trade facilitation measures are applied on a non-discriminatory basis, favoring all foreign trade transactions, irrespective of the origin or destination of goods. However, it is worth highlighting the progress of other initiatives like those for the interoperability of foreign trade databases (e.g., the mutual recognition of digital rules of origin certificates) and, particularly, the interoperability of SWFTs between neighboring countries or the international transit agreements (TIM). The implementation of these trade facilitation measures requires a certain degree of reciprocity in terms of how they are applied. Therefore, their effective implementation should be supported by a broader agreement that facilitates policy coordination among countries.

This was the case for some of the regional integration schemes in Latin America. In particular, the Pacific Alliance has implemented an initiative to connect (make them interoperable) the single windows established in each member country. CAN and Mercosur set the same objective, but fall short in the implementation. In terms of TIM, the MCCA has a very coordinated process to facilitate international cargo transportation between member countries.[31] Multilateral institutions are cooperating with governments to strengthen these trade facilitation policies by supporting coordination and joint work among countries that share borders. This is the case, for example, of the Comprehensive Border Management Program (PROGIF for its acronym in Spanish) recently launched by CAF-development bank of Latin America. Its main objectives and scope are described in Box 1.3.

31. See Chapter 3 for more information.

Box 1.3
CAF's Comprehensive Border Management Program (PROGIF)

CAF's Integrated Border Management Program seeks to support LAC countries in their efforts to respond to the current challenges of trade facilitation and integration by adopting a comprehensive approach to border management. It seeks to prioritize strategic interventions that provide solutions to the problems identified in the territory, with a vision that integrates different sectors and relevant stakeholders. PROGIF has two objectives:

1. Contribute to expanding **access to global markets** through trade facilitation.
2. Promote intraregional trade that promotes **productive linkages and local development**.

The purpose of the program is to identify gaps in border infrastructure. This could include an integrated border service center, such as a binational customs, to improve its operability in different activities like phytosanitary controls and migratory processes. It also promotes regulatory improvements that will allow for the correct standardization of tax regulations and other policies affecting the exchange of goods and services between the countries.

Some of the interventions already implemented under the program include the Rumichaca Binational Border Care Center between Ecuador and Colombia; the project for the integrated development of Mexico's southern border (Tabasco) with Guatemala; and the development of a border center near the new bridge over the Paraná River between Argentina and Paraguay.

Source: Authors with the collaboration of Ana María San Juan.

Another important aspect of trade facilitation concerns the mechanisms applied to trade in services. They include transport and courier services, on the one hand, and logistics, on the other. These services play a key role in the internationalization of economic activity and are highly complementary to the trade facilitation measures for goods discussed above as well as to investments in transport infrastructure, which are discussed in the next section. The key measures here have to do with the adaptation of domestic regulations, ensuring that they are consistent with international standards. It could also imply the homologation of these norms between countries belonging to an economic integration agreement. The objective of these policies is to ensure greater competition (free entry of firms into these service sectors and the possibility of allowing foreign suppliers) and foster regulatory transparency and predictability. All this results in lower prices and higher quality for these activities that are so important for international trade. In this regard, the most recent free trade agreements (signed since 2000) have made substantial progress in the liberalization of trade in these services (an interesting example is the Pacific Alliance).

Transport and logistics infrastructure for trade and development

Logistics expenses associated with transport are a fundamental component of trade costs. Not only do these costs refer to infrastructure in ports, airports, border crossings, and international highways, but also to the internal transportation infrastructure that connects different territories of the country with the exit points. In the case of Latin America, this factor seems more relevant given the evidence presented in Chapter 2 (summarized in the section «Does Latin America trade little?»), which shows that distance within the subcontinent has a more negative impact on trade flows than in other regions of the world, caused in part by poor connectivity infrastructure.

Chapter 4 focuses on the role of transport and logistics infrastructure in the physical integration of LAC countries and its implications for trade and regional value chains. The inherent complexity of analyzing the impact of these initiatives is rooted in two central characteristics. First, the network structure of transportation implies the presence of substantial indirect effects, in addition to the direct effects of changing connectivity within and between countries. An improvement in the connection between two locations allows for a reduction in the costs of trade between them, which fosters productive specialization and an increase in trade flows. However, localities that are farther away from the improved transportation facilities may face comparatively higher transportation costs after the change, and this lowers their competitiveness due to the increasing relative difficulty of accessing inputs or markets. These effects may in turn be magnified or tempered by the migration of workers and firms. Their decision to relocate will depend on congestion costs (e.g., higher land prices) versus agglomeration gains (proximity to other producers and skilled labor) in localities whose connectivity is improved by the renovation or construction of infrastructure.

Approximately 95% of South America's foreign trade operations involve maritime transport.

In analyzing the transportation infrastructure that supports international trade in the region, the first thing that stands out is that approximately 95% of South America's total foreign trade operations are carried out via sea, according to data for 2018. River and lake transport accounts for 3% of the total, land transport for 2%, and air or rail transport for less than 1% (FIEL, 2021).[32] This distribution differs from that of North and Central America, where road traffic occupies 42% of the total volume moved internationally, 10% corresponds to rail transport, and 48% to maritime transport (ECLAC, 2019a).

South America's concentrated transport distribution in the maritime mode is partly explained by the increased share of trade in agricultural and mining goods in recent years, which in general demands port infrastructure to facilitate bulk cargo. Moreover, most of this production is destined for

32. The low volume of air trade is clearly associated with the higher unit cost of transportation; therefore, it is concentrated in some particular shipments linked to mail and, above all, foreign trade in products of higher unit value or perishable goods (medicines and medical supplies; cash, securities, credit cards, precious metals and jewelry; spare parts and industrial parts; fresh food; flowers; live animals; electronic products).

extra-regional destinations, making maritime transport the most suitable due to its lower costs. For its part, intraregional trade is more intensive in land transport. For example, available data for 2017 indicates that the main mode of transport is maritime with 47.7% of the total value, followed by road transport, 46.4% (FIEL, 2021).

A more specific analysis of the road network, which, as indicated, is very relevant for regional trade, shows that in terms of key coverage indicators, such as the number of kilometers of road per 1,000 square kilometers, the region has a very low density (200 km of road per 1,000 km^2) compared to OECD countries. Beyond coverage, quality is also important. A typical indicator of this is the percentage of paved roads, which determines, for example, traffic speed. There is considerable heterogeneity in terms of this indicator in the region despite progress in recent years, especially of primary roads. Over 90% of the road network in Panama, Mexico, and Uruguay is paved, dropping to as low as 20% in Bolivia and Colombia.

This low density and wide disparity in road quality affect the possibility of firms accessing consumers and customers in domestic and regional markets (cities in neighboring countries). Upgrades in road infrastructure that result in increases in average speeds could lead to substantial improvements for businesses in terms of sales to these markets. For example, the estimations developed in Chapter 4 show that if an average speed of 90 Km per hour can be achieved thanks to an upgrade in road infrastructure, this could more than double market access in domestic markets in the cases of Bolivia and Colombia; in terms of reaching costumers in neighboring countries, road improvements could multiply by 2 or even 3 the number of potential consumers relative to the current local market.

Increases in market access are an intermediate indicator of the potential benefits of improved transport infrastructure. As mentioned before, the final impacts on the connected cities or countries will depend on the incidence of direct and indirect effects caused by the improved road network on the local and regional economic geography that supports it. Quantitative spatial models, where all these effects can be taken into account, must be used to assess these effects more accurately. As an example, Chapter 4 describes an exercise carried out for the Santa Cruz-Puerto Suarez highway, which is part of Bolivia's main integration corridor connecting the country's eastern and western borders. This infrastructure is very critical for a landlocked country like Bolivia, which has to ship its exports over land. The results show that the project promotes more trade between the cities and countries connected by the infrastructure. While most of the localities have registered important positive effects, they are more evident for those closer to Bolivia's border with Brazil (e.g., Santa Cruz de la Sierra, Montero, and Trinidad).

These results suggest significant gains by improving the infrastructure that supports international trade in the region. This will allow firms to access global markets with their exports and strengthen regional trade. This requires efforts in terms of public and private investment in infrastructure. The region invests between 2% and 3% of GDP in infrastructure, which is

no small sum in times of fiscal austerity (although considerably less than what other developing regions, such as East and Southeast Asia, allocate). However, it is paramount to establish priorities and bear in mind that some of these resources must also be earmarked for the maintenance of these facilities, which in the case of roads, for example, is critical. Efficient management of transport infrastructure assets for international trade is, therefore, a key component of integration policies. This issue is taken up later in the final section.

Opportunities and challenges for energy integration

Geographic proximity could facilitate productive integration and trade beyond traditional goods and services, and include the exchange of energy flows, particularly electricity. Electricity cannot be stored and must be transported through special interconnection infrastructures that drive up transport costs, except for relatively short distances. It also requires coordination by national dispatch systems that may have different prices and operation rules. For this reason, electricity is a tradable good but only in regional contexts. Chapter 5 describes the opportunities and challenges offered by the integration of the region's energy markets with a focus on electricity.

The potential benefits of energy integration include reduced production costs, greater supply security and price stability, as well as the potential to contribute to environmental sustainability.

Electricity trading potentially yields benefits through improved supply security and price stability. Both aspects may be affected by supply shocks (caused by weather conditions or other natural events) and seasonal changes in demand. Electricity trade also generates opportunities to streamline investment decisions at the regional level, taking advantage of economies of scale that reduce production costs and prices on a more permanent basis. This impacts the welfare of households and the productivity of many sectors of the economy that use this input. Finally, energy integration allows the use of less polluting energy sources contributing to environmental sustainability.

Progress toward regional energy integration in Latin America has been heterogeneous. Central America has taken a significant step forward in forming a regional electricity market and completing the physical interconnection between all the countries involved. South America, in contrast, has only achieved bilateral interconnections (more so in the Andean subregion than in the Southern Cone)[33] and the joint exploitation of shared resources, such as binational hydroelectric dams (mainly in the Southern Cone). Although many countries' energy policies list integration among their objectives, it has been quite difficult to implement.

The evidence shows that, despite the multiple benefits of integration, the volume of electricity exchanges amounts to 4% of consumption in Central America and 0.5% of consumption in South America (once the exchanges from binational hydroelectric dams are eliminated). In the latter subregion, there is underutilization of the existing interconnection infrastructure and

33. In this report, the term Southern Cone encompasses a broader geographic area, including Brazil and Paraguay, in addition to Argentina, Chile, and Uruguay.

also important institutional obstacles prevail. For example, energy security mandates lead countries to seek self-supply (beyond having cheaper and more environmentally efficient options in neighboring countries) or countries lack robust regulatory frameworks to support integration initiatives. In contrast, the exchange of electricity in Central America, through the Regional Electricity Market (MER for its acronym in Spanish), has grown steadily. Nevertheless, this process has yet to overcome the challenges inherent in the search for greater harmonization and integration of the system.

If countries are to be more flexible in their conception of energy security, especially in South America, certainty in the availability of electricity in the expanded market must be generated. In other words, the rules of the game must be defined (regulations, rules for the functioning of markets -contracts or opportunities-, sanction mechanisms, conflict resolution, and regulatory harmonization, among others) so as to provide predictability.

This institutional framework is built on two properties that energy trade must satisfy: value added for the participants (so that they are interested in participating voluntarily) and future predictability (the necessary volumes will be available on the market, at market prices, when needed.) The experience in Central America is moving in this direction, while in South America it is still at an exploratory stage.

Productive integration: participation in global value chains

The trade costs outlined in the previous sections (tariffs, non-tariff barriers, trade facilitation, transportation costs, and even those affecting energy trade) can also limit countries' productive integration. Productive integration refers to the extent to which the production processes of different economies are linked through participation in global value chains (GVCs). Participation in GVC means that inputs manufactured in one country are used to produce intermediate goods in other economies, which in turn are exported to third countries that manufacture the final goods. Graphs 1.3 and 1.4, presented earlier, used the imported value added (VA) contained in a country's or region's exports as a measure of this participation. One aspect that stood out was that a high proportion of this imported VA came from geographically close countries. This suggests that global value chains are highly developed at the regional level and are a major determinant of the level of trade integration between neighboring countries.

Chapter 6 analyzes this type of production linkages in more detail, and evaluates how these initiatives result in increased trade and productivity for the participating firms, sectors, and countries.

The participation of domestic companies in global value chains can also indirectly affect local companies that are their suppliers or customers.

Gains in economies of scale and specialization drive this process of production fragmentation. As a result, the production process is broken down into different stages. They are then carried out in different countries and plants based on differences in costs and comparative advantages of each location. Participation in these value chains not only includes companies directly involved in foreign trade activities, whether they export their products or import parts needed for their production, but also includes domestic companies brought into the chain indirectly as suppliers of inputs or customers of those firms. In this group of indirectly affected activities, the role of the service sector is particularly important, since this is often how a product can be differentiated and add value to exports.

One way to measure the effective participation of countries in GVCs is to estimate how much of the value added (VA) produced is exported (forward linkages). Alternatively, and conversely to the previous concept, it is possible to measure how much foreign value added is used in the production of final goods within a country (backward linkages). This way of measuring the participation of an economy in production chains and its implications for the flow of international trade is very different from the classic way of measuring participation in international trade using the gross value of exports and imports.

Mexico is the leading country in the region in terms of VA exports, which is attributable to its participation in regional value chains (RVC) since joining NAFTA: its exported value-added increased from 10% of the country's total VA in 1990 to 20% in 2015. Of this total, a little less than half (8%) corresponds to the participation in RVCs. On a lower rung are the South American countries of the Pacific area (Chile, Colombia, Ecuador, and Peru), with increases in exported VA until 2006, which then reverted after the 2008-2009 crisis, to reach 16 % in 2015. In contrast to Mexico, the driver of exported value-added in these Pacific economies has been their participation in extra-regional value chains (EVCs) as suppliers of basic inputs. On the other hand, the contribution to exported VA by providing inputs in RVCs is very small. Central America is more stable and with slightly lower levels (growing to 16% in 2006 and then reaching 13% in 2015). The sale of inputs destined for North America makes participation in EVCs also important here. Finally, Mercosur represents the most closed subregion, with a share of 11% of exported VA in total VA at the end of the period (with peaks of 15% in 2004-2006). Like in the Pacific area countries, Mercosur's exported VA is determined by the provision of basic inputs in EVCs (approximately half of the total), with a very low generation of exported VA through RVCs.

The information on participation in forward chains can be combined with that referring to backward chains. By considering not only the flow of exports but also imports, it is possible to assess whether each country's participation in production chains is at the beginning, an intermediate point, or the end of the process. In addition, it makes it possible to estimate the net balance of trade in terms of added value.

This information shows that, as a general rule, in the case of extra-regional value chains, the region is heavily skewed toward the last stage of the production process, finishing final goods with inputs from countries outside the region. This is particularly pronounced in the case of Central American countries, which import inputs from the United States, and is less prevalent in the case of South America. With regard to regional chains, as already mentioned, the most notable case is Mexico because of its relationship with NAFTA. Its participation is more skewed toward the termination of final goods with inputs from its northern neighbors.

Latin American countries participate in value chains as process finishers in extra-regional chains. Mexico is the exception given its high degree of integration with its NAFTA partners.

In summary, LAC's participation in value chains, with the exception of Mexico, tends to be mainly as process finishers in extra-regional chains, with a very limited role for RVCs. The low regional integration in productive processes explains in part the low level of intra-zone trade when Latin America is compared with more integrated regions, such as North America, Europe, or Southeast Asia.

Specific policies to promote GVCs include those that improve the productive environment. They tend to attract vertical foreign direct investment (FDI), since it is often multinational companies (including Latin American multinationals—multilatinas) that promote these linkages between plants located in different countries. Equally important are policies that encourage domestic linkages between these companies and local firms through, for example, supplier development programs.

Another key aspect are rules-of-origin regulations. Rules of origin determine the minimum domestic value added required for a finished product to be traded between FTA members so that they benefit from tariff preferences. If these rules are very strict, the possibility of generating productive chains is lost. This problem may be exacerbated if the multiple FTAs in the region have incompatible regulations. The evidence shows that complicated rules of origin associated with preferential agreements in the region have indeed constituted a barrier to integration. This is seen not only in regional value chains but also globally since they make it difficult to use inputs originating in the rest of the world. The solution to this type of problem lies in the standardization of these regulations, and in allowing the accumulation of these domestic value-added requirements between partner countries belonging to different agreements. The Pacific Alliance has taken a step in this direction.

Finally, there are other national regulations on special import regimes (generally temporary) for firms that export their products. They also play an important role in promoting participation in value chains, especially if they do so near the end of the production process. In this regard, most countries in the region have special regimes that allow duty-free imports of inputs with the condition that they are used for export. These regimes are widely used in all Mercosur countries. The Pacific countries of South America use them although they are less prevalent. In Central America and Mexico, exports from customs areas or special free trade zones are central to their export strategies.

Institutional factors for sustaining integration policies

As highlighted throughout the chapter, Latin America has made progress in its strategy for international integration through significant efforts to open trade in the past 30 years. This push has combined strategies of unilateral liberalization during the ‘80s and ‘90s with multilateral negotiations, such as the incorporation of several countries in the GATT, and regional agreements established in the mid-nineties that gained momentum during the first decade of the 2000s. In the beginning, these agreements were focused on upgrading existing sub-regional initiatives (CAN, CACM, Caricom) or creating new ones (Mercosur). Later, they were extended to bilateral FTAs (led by Chile and Mexico) that covered ties between countries in the region not encompassed in these treaties. The Pacific Alliance, which emerged in 2011, was the result of the consolidation of these bilateral FTAs that already united Chile, Colombia, Peru, and Mexico. This push toward regional integration led to 33 agreements, which in practice cover approximately 85% of trade across LAC (Mesquita Moreira, 2018). Simultaneously, several countries signed North-South agreements, the most emblematic of which was NAFTA in 1994, partnering Mexico with its neighbors to the north. Chile, Colombia, Peru, and Mexico also continued to undertake extra-regional initiatives with the United States, Europe, and several countries in Asia.

Despite all these efforts, the results in terms of the region’s participation in international trade flows, measured by its share of global exports, have not been stellar. A similar conclusion emerges when using the ratio of exports or total trade to GDP indicator, although there is much heterogeneity between countries. Nevertheless, even though measuring the impact of trade on growth poses a major challenge (Pavcnik, 2017), available estimates suggest that there have been positive impacts (Estevadeordal and Taylor, 2013; Mesquita Moreira et al., 2019),albeit, not on the scale expected.

These mixed results of integration may be partially due to the fact that the spillover effect of openness measures on sectors of the economy in terms of increases in trade, productivity, and formal employment has been limited in most countries (CAF, 2018). This may have contributed to some disillusionment with the idea that trade liberalization was an essential element to promote development in the region (Rodrik, 2006). This report emphasizes that these less-than-stellar results are explained in part by the fact that the regional market has not been a place that businesses, mainly small and medium-sized enterprises, have been able to take advantage of to integrate commercially and productively, accessing opportunities to increase sales and jobs.

In part, this shortcoming can be attributed to the partial progress (and in some cases, regression) of several trade liberalization policies discussed in the previous section (developed in more detail in the rest of the chapters). As mentioned, the integration agenda can be broken down into three core aspects. The first is the reduction of unilaterally applied tariff levels, which in some cases are still high (notably in Caricom and Mercosur) and incompatible with a strategy of open regionalism; this should be complemented by bilateral

or plurilateral negotiations at the subregional level, to complete the tariff reduction among countries and subregions.

Beyond these traditional initiatives of liberalization, two other critical aspects require action. One is the need to work on reducing customs and border costs, and on substantive improvements in transportation infrastructure to facilitate physical integration across countries, including infrastructure that fosters energy integration. The other is related to domestic and regional regulations (e.g., rules of origin) that facilitate productive integration between economies, promoting participation by firms in global value chains that, as shown, have an important regional component. Both types of measures favor exchange of inputs and intermediate goods, which in turn foster specialization and gains in productivity.

The distributive impacts of trade openness

What are the institutional and political constraints that could derail progress in implementing these policies? In the first place, it is fair to mention that in the cases where subregional FTAs have experienced delays in their development, or even setbacks (such as Mercosur and CAN), this has been due in part to the negative impacts of macroeconomic crises on trade policies, both unilateral ones as well as those established under agreements. Ideological issues and political volatility have also gotten in the way of consensus on measures between countries to reduce barriers and expand trade.

Aside from these situation-specific reasons—governments and crises pass—, there are more structural factors that could unleash resistance to measures aimed at opening trade and integration. Although theoretical and empirical evidence suggests that trade openness and integration policies have a positive effect on productivity and income at an aggregate level in economies or regions, a key aspect that also has theoretical and empirical backing is that these benefits are not equally distributed across the different economic stakeholders participating in these initiatives. Openness and increased trade can have distributive consequences between sectors that are more or less prepared to compete in international markets, among workers with different levels of education, or even among countries of different sizes that decide to integrate.

There is a large literature analyzing the impacts of trade policy and, more generally, globalization on employment and wages in sectors and regions exposed to external competition and on wage inequality between more and less-educated workers.[34] This literature has documented, for example, the effects of China's surge in trade flows and how this has affected regions and sectors of traditional manufacturing in the United States and other developed countries, causing sharp drops in employment, especially when there is little mobility of workers across sectors and regions (Author et al., 2013; Pierce and

34. One aspect to keep in mind is that trade is not the only or even the most relevant force affecting inequality or labor markets and wages in certain sectors. Within the so-called globalization process, technological change is a much more relevant aspect (Acemoglu, 1998; Helpman, 2016; Leamer, 1996).

Schott, 2016). Such effects of openness have also been found in developing countries and in Latin America in particular, as in the case of Brazil (Menezes-Filho and Muendler, 2011; Pavcnik, 2017).

Trade openness generally benefits more educated workers, who work in more productive firms and can take better advantage of access to larger external markets.

There is also abundant evidence of the effect of openness on wage income inequality in developed and developing countries, including some in the region (Attanasio et al., 2004; Bustos, 2011; Galiani and Sanguinetti, 2003; Goldberg and Pavcnik, 2007). Openness in this case benefits highly educated workers, who work in firms with higher productivity that can better withstand external competition or take advantage of foreign markets or import higher-quality inputs.

Finally, there is the concern about the asymmetric effects of integration processes in countries of very different sizes, especially when developing economies are involved. Large partners' export sectors can exert pressure to maintain higher external tariffs against third countries, take advantage of the expanded regional market to increase their exports, causing trade diversion costs in smaller countries (Moncarz et al., 2016). Clearly, this can occur in the case of customs unions (CU), like Mercosur where a common external tariff is defined.

In addition to generating resistance to these policies among directly impacted stakeholders, these events and the sector-based or distributive consequences of trade openness can weaken the public perception regarding the benefits of integration policies. The available evidence is based on surveys. It suggests that while most of the population in developed and developing countries recognize trade openness as a good thing, it also suggests that people recognize that it could negatively impact employment and salaries in certain sectors (Mezquita Moreira et al., 2019; Pavnick, 2017).

It is therefore not surprising that these distributive consequences and perceptions can lead to political pressure in favor of measures to prevent trade openness, whether unilateral or in the context of FTAs. The case of Brexit in the EU is paradigmatic of this new «anti-integration» environment that seems to have taken hold in certain countries, especially developed ones, in recent years.

Compensation programs are the best response to these fears and sectoral pressures, which could thwart (or set back) the processes of trade liberalization. Programs can take the form of policies for training workers and strengthening productive capacities in firms and sectors that might be impacted. Another very important aspect is that these liberalization processes, especially those established within the framework of agreements, must be gradual. This gives firms and workers time to adjust to the new context of intensified competition and take advantage of new market opportunities. All this, in general, is envisaged in the liberalization processes that countries have faced, although the implementation of these programs has not always been satisfactory (Pavcnik, 2017).

State capacities to uphold policies of international integration

To what extent have these political economy considerations affected, or could they negatively affect, the institutional capacities of countries to move forward with the agenda of regional and global integration as laid out previously?

Tariff measures are the most contentious. An example of this is the efforts and time Mercosur and the EU have spent negotiating an agreement on the mutual reduction of tariffs and other non-tariff barriers (NTBs).[35] Nevertheless, in most of the other countries in the region, tariff barriers and other NTBs have been substantially reduced as a result of the many intra- and extra-zone agreements that have been signed. Measures to ensure that these trade opportunities spill over to broader sectors of the productive network of the economies are still pending. This is why it is necessary to complement tariff reductions with trade facilitation, logistics, infrastructure, and productive integration measures.

This is a much more pragmatic agenda, less subject to ideological arguments and, therefore, less contentious. However, the effective implementation of these measures still requires important capacities and coordination within the public sector, with the private sector, and among governments. As seen, trade facilitation requires the simplification and digitization of different types of processes and procedures that lead to delays and make compliance with customs and border requirements more costly. This requires not only investment in hardware and software but also coordination efforts across different areas and government agencies involved in foreign trade operations, unifying records, and fostering the interoperability of information

The agenda of trade facilitation, infrastructure and logistics, and productive integration is more pragmatic, less subject to ideological discussions and therefore less conflictive.

and oversight systems. Moreover, these information systems that support foreign trade procedures can become sites that provide other financial and business consulting services to firms, especially SMEs that always find foreign trade operations more complex and costly. The example of Peru and Costa Rica (see Chapter 3) with their updated single window programs are very interesting cases of progress in this direction.

As for interventions to reduce the costs of transportation logistics and infrastructure, and facilitate physical connections between countries, this requires public capacities to design, assess, and implement investment projects. Even though these projects can be carried out with the intervention of the private sector, through public-private partnership (PPP) schemes, the capacity of the sectoral public agencies in charge of identifying and evaluating the economic, social, and environmental impacts of the projects is very critical. These infrastructures not only serve to connect countries, but to also link production points within the countries with international connection nodes (ports, airports, and border crossings). In addition, this not only means

35. Mercosur is currently undergoing a complex negotiation process to reduce its external tariff. As mentioned, it is one of the highest in the region. This has affected not only the expansion of trade with the rest of the world, but also trade among member countries.

building new roads and ports but also that these investments should receive adequate maintenance.

At the same time, when improving international connections between neighboring countries or those that belong to the same region, it is very important to coordinate these investments among the different governments involved. A new highway (or railroad) that dramatically reduces the costs and times of moving freight to a border is of no use if on the other side of the border similar actions do not take place. This coordination could be facilitated through specific bilateral negotiations or the existence of deeper integration schemes to create room for dialogue and collaboration among the different national agencies in charge of these areas. These actions could be further facilitated if agreements provide for the creation of funds for joint financing of these investments. Along these lines, several sub-regional integration agreements have launched initiatives of this type, such as the MERCOSUR Fund for Structural Convergence (Fondo para la Convergencia Estructural del Mercosur, FOCEM), CAN's Andean Road Infrastructure Committee, the Pacific Alliance Infrastructure Fund (PAIF) and the Mesoamerica Project. On a regional basis, the Union of South American Nations (Unión de Naciones Suramericanas, UNASUR) has absorbed the Initiative for the Integration of the Regional Infrastructure of South America (IIRSA) within the framework of the South American Council of Infrastructure and Planning (Consejo Suramericano de Infraestructura y Planeamiento, COSIPLAN).

The outcome of these initiatives of sub-regional funds to coordinate integration infrastructure investments has been lackluster, due to a lack of government financial resources and limited capacities to identify and evaluate joint projects. However, activities in the framework of COSIPLAN have made progress, partly thanks to the financial support and technical aid from the main multilateral development banks in the region (such as CAF – development bank of Latin America and the Interamerican Development Bank, IDB).

With regard to measures to facilitate productive integration, the different countries must standardize their regulations on domestic content requirements or rules of origin. It also requires that they coordinate incentives that promote vertical foreign direct investment (FDI) that favor the creation of regional and global value chains, and regimes that facilitate the importation of inputs destined for export products. Coordination is crucial between FTA-member countries. They should seek to promote productive specialization and greater value-added production in intraregional trade and with third countries, avoiding obstacles to domestic trade or regulations that could lead to trade diversion. As mentioned before, FTA member countries can implement rules of accumulation for national content requirements to facilitate this. However, to put these rules into practice, the mechanisms of integration must be more robust and prevent unilateral policies. (An example is the establishment of duty-free zones that weaken the concession of preferential tariffs to neighboring countries or disregard aspects of rules of origin.)

In this regard, the institutions that coordinate these policies within trade agreements need to be strengthened, particularly those that oversee compliance with the commitments that countries have agreed to fulfill.

Mercosur and CAN are clear examples where countries violate the measures established in the treaties. This is detrimental to coordination and progress in other joint actions, such as negotiations to liberalize trade with third countries or blocs. It can generate an unequal distribution of the benefits of integration to the detriment of the smaller economies, which lose the most due to the lack of access to their regional partners and the lack of alternatives in extra-regional markets.

Returning to the national context, a key aspect of these trade facilitation, infrastructure and logistics, and productive integration policies is their continuity over time regardless of changes in government. It is also important to coordinate their design and implementation with the private sector, without allowing private interests to divert them from their purpose. Moreover, their evaluation and rationale for their implementation must be based on positive and measurable impacts on the economy's aggregate productivity.

Continuity in trade facilitation, infrastructure and logistics, and productive integration policies is key to producing the desired results.

The creation of productivity commissions composed of government and private sector representatives could help meet these objectives. These institutions must have the technical capacities to provide opinions and recommendations, which might not be binding but help to shape the public discussion regarding the design and implementation of such trade openness policies, with evidence-based impact analysis. An interesting example of this type of instrument exists in Australia and, more recently, Chile has also adopted this type of scheme. Alternatively, the countries could form roundtables by sector to discuss different aspects of trade openness policies and regional agreements. These forums must include representatives from the export sectors and those that compete with imports, which could potentially incur costs related to these initiatives. Providing visibility to potential winners and losers of these policies, helps to generate consensus around actions that could allow these new productive opportunities to be leveraged. At the same time, such visibility makes it possible to design programs aimed at moderating the negative effects on sectors that must transform to be competitive in the new scenario of a more open economy. Peru has been a good example of the use of these forums and Argentina has developed a similar model.

This domestic institutional framework in charge of coordinating and maintaining actions with the private sector over time, is complementary to the aforementioned strengthening of the institutional framework of supra-national agreements, such as Mercosur, CAN, the Pacific Alliance, CACM, and Caricom. Such agreements help generate support and overcome interests opposing policies of integration. However, experience has shown that, without a clear alignment of national interest in favor of these policies, progress is weakened.

In summary, processes of integration require the institutional framework and state capacities for their design and implementation. These must be aligned with the interests of the sectors that will benefit from these initiatives and, at the same time, serve to reduce the costs of and transform the activities that could face greater competition. This requires not only resources but also capacities for coordination of these initiatives across different state agencies, the private sector, and other governments.

Keys to fostering regional and international trade integration

1 Over the last 30 years, most Latin American countries have unilaterally and multilaterally implemented trade liberalization policies within the framework of regional and extra-regional trade agreements, resulting in a reduction of tariffs and non-tariff barriers.

2 Reductions in trade costs observed in the region have not been able to reverse the decades-long trend of stagnation in Latin America's share of global trade flows. One explanation for this phenomenon is that the adopted liberalization measures did not generate significant and sustained increases in intraregional trade.

3 Open regionalism proposes a complementarity between preferential and non-preferential opening strategies in contexts where geographical proximity boosts regional trade, given the lower transportation costs, which become more visible when tariffs and non-tariff barriers decline. This process maximizes profits from trade creation and minimizes losses from trade diversion.

4 Openness levels vary greatly across the region. Central America has the highest level, with high participation of the manufacturing sector. In South America, Chile, Paraguay, and Uruguay stand out as open economies, and Argentina, Brazil, and Colombia have low levels of openness, with high participation of the primary sector in all of them. Finally, Mexico's incorporation into NAFTA led to a significant increase in the internationalization of its economy, with the predominance of manufacturing trade.

5 The share of intraregional exports in Latin America has fluctuated around 15% since the mid-1990s with little change over the years. There is certain heterogeneity among the different sub-regions.

6 The lower level of intraregional trade in Latin America is partly due to low integration in regional value chains. For the region, the imported value added incorporated in exports is approximately 23% of the total value added from external sales, but the share of imported value added from the region is very low (just over 10% of the total imported value added).

7 The unilateral, preferential, and multilateral trade liberalization processes undertaken by the region's economies in recent decades have led to significant reductions in the effective tariffs applied to imports. Nevertheless, they are still high in relation to the average observed for developed countries. They exhibit heterogeneity among the subregions.

8 Non-tariff barriers can involve significant restrictions to trade and are comparable in magnitude to tariff barriers. Negotiating free trade agreements (regional and extra-regional) makes it possible to progressively reduce these barriers or, at least, homogenize them and limit their discretional use.

9 The simplification of customs procedures and the improvement of logistics and transport infrastructure (domestic and connecting with international markets) can play a very important role in the expansion of trade. On average, logistics costs in Latin America associated with foreign trade vary between 18% and 35% of the value of the product, although they can exceed 45% for SMEs.

10 Openness and increased trade can have distributive consequences on sectors that are more or less exposed in the context of international competition, among workers with different levels of education, or even among countries of different sizes that decide to integrate. These facts and the sector-based or distributive consequences of trade openness generate resistance to these policies among directly impacted stakeholders, and can weaken public perception regarding the benefits of integration policies.

11 Reducing trade costs through trade facilitation, logistics and infrastructure improvements, and productive integration is a much more pragmatic agenda, less subject to ideological discussions and, therefore, less conflictive than other measures. The effective implementation of this last agenda requires important public capacities and coordination within the public sector, with the private sector, and among governments.

Appendix

Table A 1.1
Trade agreements included in the Report

First name	Type	Member countries
Central American Common Market (CACM)	Customs union	Costa Rica, Guatemala, Honduras, Nicaragua, Panama, and El Salvador
Andean Community of Nations (CAN)	Customs union	Bolivia, Colombia, Ecuador, and Peru
The Common Market of the Southern Cone (Mercosur).	Customs union and economic integration agreement	Argentina, Brazil, Paraguay, and Uruguay
Pacific Alliance (PA)	LAC and IEA free trade agreement and economic integration agreement	Mexico, Chile, Colombia, and Peru
Caribbean Community (CARICOM)	Customs union and economic integration agreement	Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Granada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago
North American Free Trade Agreement (Nafta)/United States-Mexico-Canada Agreement (USMCA)	Free trade agreement and economic integration agreement	Canada, United States, and Mexico
Association of South-East Asian Nations (ASEAN)	Free trade agreement	Burma, Brunei, Cambodia, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, Thailand, and Vietnam
ASEAN - China - South Korea - Japan (Asean+3)	Free trade agreement and economic integration agreement	ASEAN countries, China, Japan, and South Korea
Asean+3 - Australia- New Zealand (Asean+5)	Free trade agreement and economic integration agreement	ASEAN+3 countries, Australia and New Zealand
European Union (EU)	Customs union and economic integration agreement	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden
European Union and European Free Trade Areas (EU+EEA)	Free trade agreement	European Union countries, Albania, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Kosovo, North Macedonia, Moldova, Montenegro, Norway, United Kingdom, Serbia, Switzerland, Turkey, and Ukraine

Source: Authors based on the World Trade Organization (WTO) site.

Table A 1.2

ISO3 code reference for Latin American countries included in the analysis

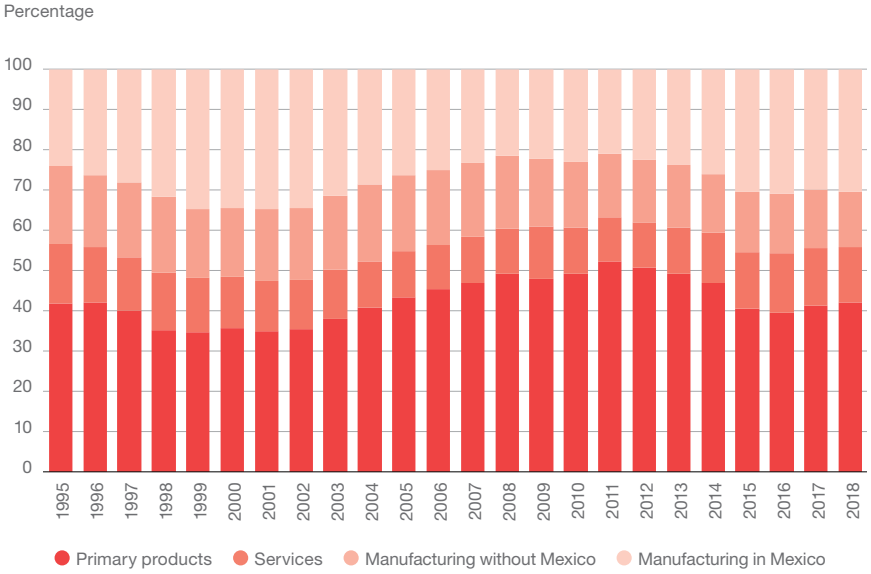
Country	ISO3 Code	Country	ISO3 Code
Argentina	ARG	Honduras	HND
Barbados	BRB	Mexico	MEX
Bolivia	BOL	Nicaragua	NIC
Brazil	BRA	Panama	PAN
Chile	CHL	Paraguay	PRY
Colombia	COL	Peru	PER
Costa Rica	CRI	Dominican Republic	DOM
Ecuador	ECU	Trinidad and Tobago	TTO
El Salvador	SLV	Uruguay	URY
Guatemala	GTM	Venezuela	VEN

Notes: Latin America also includes Barbados, the Dominican Republic, and Trinidad and Tobago.

Source: Authors.

Graph A 1.1

Share of primary goods, manufactured goods (differentiating the contribution of Mexico) and services in total exports for Latin America



Notes: The graph shows the composition by sector of Latin American exports, separating out Mexico in the case of the manufacturing sector. It breaks down exports in the primary sector, manufacturing, and services as a percentage of total exports. The categorization of sectors was based on the Standard International Trade Classification, revision 3 (SITC 3). A list of the countries included in Latin America can be found in the Appendix (p. 79).

Source: Authors based on WTO and UNCTAD data (2020).

Table A 1.3
Evolution of intraregional and total exports
(average 1995-1999 = 100)

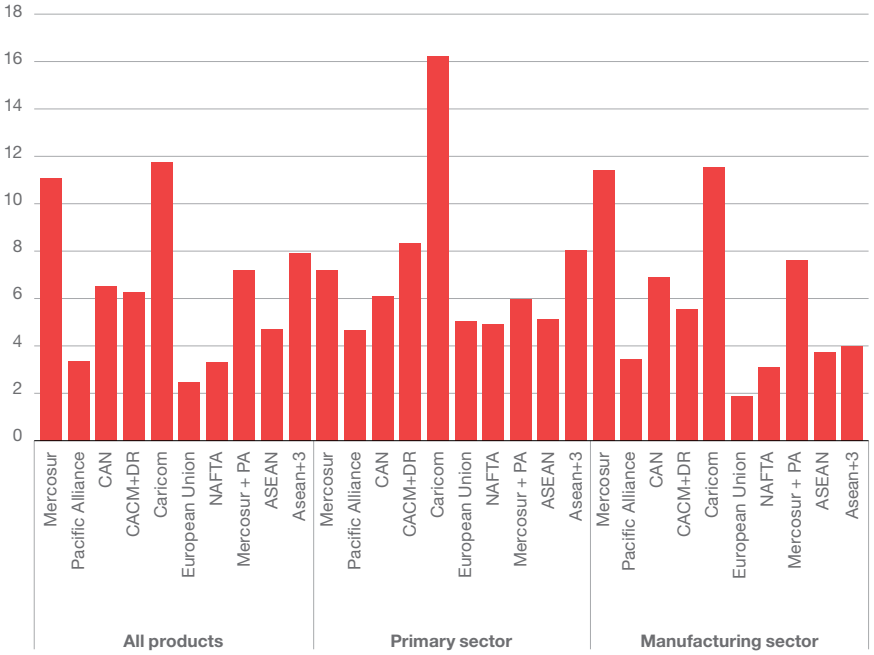
		1995-1999	2000-2004	2005-2009	2010-2014	2015-2018
Latin America	Intraregional	100	117	258	377	299
	Total	100	140	264	383	360
Mercosur	Intraregional	100	83	170	260	208
	Total	100	128	271	404	359
Pacific Alliance	Intraregional	100	130	329	525	444
	Total	100	149	255	366	388
CAN	Intraregional	100	132	286	468	396
	Total	100	127	303	514	440
CACM+DR	Intraregional	100	144	262	394	415
	Total	100	130	244	358	360
Caricom	Intraregional	100	139	259	295	215
	Total	100	142	254	302	274
NAFTA	Intraregional	100	156	208	263	265
	Total	100	131	192	255	269
European Union	Intraregional	100	129	233	269	276
	Total	100	130	233	284	291
Asean+3	Intraregional	100	150	293	469	506
	Total	100	147	288	431	471

Notes: The table shows the evolution of the volume of intraregional and total exports, normalized to value 100 over the average for the years 1995-1999. The countries included in each region or bloc can be found in the Appendix (p. 79).

Source: Authors using data from BACI (CEPII, 2020), BaTIS (OECD and WTO, 2020), WTO and UNCTAD (2020).

Graph A 1.2

Average tariffs applied by sector (in percentage), 2014-2018



Notes: The graph shows the average tariffs applied (in percentage) by trade bloc for total products and their breakdown between the primary and manufacturing sectors. The average value for the last five years available (2014-2018) is displayed. The categorization of sectors was based on the Standard International Trade Classification, revision 3 (SITC 3). Manufactured products are found in sections 5-8 of SITC 3, excluding item 68. The primary products are found in sections 0-4 of SITC 3 plus item 68 (non-ferrous metals). The countries included in each region or bloc can be found in the Appendix (p. 79).

Source: Authors based on data from the World Bank (2020e).

Table A 1.4

Average tariffs applied between regions by sector (percentage), 2017

Sector	Importing region	Exporting region							
		Mercosur	Pacific Alliance	CAN	CACM+DR	Caricom	European Union	NAFTA	Asean+3
Agriculture, hunting, forestry, and fishing	Mercosur	0.0	1.4	0.4	7.0	7.1	7.1	6.3	7.1
	Pacific Alliance	1.9	0.5	1.0	3.1	6.5	1.5	0.7	6.3
	CAN	0.6	1.4	0.3	7.9	8.4	5.0	5.7	9.2
	CACM+DR	7.9	4.1	6.7	0.9	6.6	5.6	3.1	7.8
	Caricom	18.4	18.1	18.1	17.0	2.2	13.0	18.4	18.4
	European Union	5.9	1.0	0.7	1.0	0.0	0.0	2.8	3.8
	NAFTA	2.9	0.6	1.3	1.5	4.2	1.7	0.3	4.4
	Asean+3	11.2	9.5	10.1	11.2	11.4	9.7	10.4	3.9
Mining and quarrying (excluding sector 11)	Mercosur	0.0	0.6	0.2	3.3	3.4	3.4	2.9	3.4
	Pacific Alliance	0.3	0.2	0.3	1.1	2.9	0.3	0.2	2.1
	CAN	0.3	0.3	0.2	2.4	2.9	1.8	1.4	3.0
	CACM+DR	2.3	1.0	1.8	0.3	2.1	1.8	0.8	2.4
	Caricom	7.2	7.2	7.2	6.9	2.8	2.0	7.2	7.2
	European Union	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NAFTA	0.3	0.1	0.2	0.1	0.3	0.3	0.0	0.4
	Asean+3	2.3	2.0	2.1	2.2	2.2	2.1	2.2	0.5
Manufacturing	Mercosur	0.1	2.6	1.0	12.5	12.8	12.8	11.1	12.8
	Pacific Alliance	1.5	0.3	0.6	2.8	5.7	1.5	0.7	5.1
	CAN	1.1	1.4	0.2	8.2	8.8	6.1	5.8	9.1
	CACM+DR	5.9	3.3	5.2	0.8	4.9	4.1	2.3	5.8
	Caricom	11.2	11.1	11.1	10.6	2.8	5.7	11.2	11.2
	European Union	4.8	0.8	0.4	0.4	0.0	0.0	2.4	3.0
	NAFTA	3.3	0.6	1.4	1.5	3.6	2.3	0.4	4.1
	Asean+3	7.1	6.0	6.6	7.0	7.1	6.7	6.8	1.5

Notes: The table shows the average rates applied (in percentage) for 2017, by sector. The importing region is the trade bloc that applies the tariff, while the exporting region pays the tariff. The categorization of sectors was based on the Standard International Trade Classification, revision 3 (SITC 3). The countries included in each region can be found in the Appendix (p. 80).

Source: Authors based on Teti data (2020).

Table A 1.5
Use of non-tariff measures: percentage over total measures by region or bloc, 2018 (or latest year available)

Measurement	Mercosur	Pacific Alliance	CAN	CACM+DR	Caricom	European Union	NAFTA	Asean+3	Total
Sanitary and Phytosanitary	40.6	53.3	35.1	62.1	27.5	27.2	42.2	35.4	25.2
Technical barriers to trade	26.1	28.1	19.5	23.8	4.4	42.9	22.0	11.4	10.6
Pre-shipment inspections and other formalities	11.8	4.0	1.7	2.3	1.3	18.4	21.1	2.2	7.5
Non-automatic licensing, quotas, prohibitions and quantity control	6.8	6.7	37.4	2.1	60.1	10.6	3.0	6.2	13.1
Price control, including taxes and additional charges	0.9	2.6	3.0	3.6	0.7	0.0	1.2	1.1	9.4
Financial measures	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Measures affecting competition	0.0	0.2	0.1	0.0	0.1	0.1	0.0	0.1	1.7
Trade-related investment measures	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Export-related measures	13.0	5.1	3.2	6.2	5.9	0.7	10.6	43.6	32.2
Total	100	100	100	100	100	100	100	100	100

Notes: The table shows the share of each type of non-tariff measure with respect to total non-tariff barriers for 2018 (except in the cases of Asean+3 where the 2016 values for China, Japan and South Korea were used; CACM+DR, the 2016 value for Antigua and Barbuda was used; and NAFTA, the 2017 value for Canada was used). Since the same measure may affect several products, there are different ways to account for them. In this table each measure is multiplied by the number of products to which it applies. A list of the countries included can be found in the Appendix (p. 80).

Source: Authors based on TRAINS data (UNCTAD, 2020b).

Graph 1.1 Clarifications

The following countries and territories are included taking into account information about their participation in exports of goods and services:

Latin America: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

NAFTA: United States, Canada, and Mexico.

Asean+3: Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

Graph 1.2 Clarifications

The following countries and territories are included taking into account information about their participation in total exports of primary goods, manufactures, and services:

Latin America: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

Table 1.3, Table 1.4 and Table 1.5 Clarifications

The indicators reported in each table correspond to the following countries and territories:

Latin America: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

Pacific Alliance: Chile, Colombia, Mexico, and Peru.

CAN: Bolivia, Colombia, Ecuador, and Peru.

CACM+DR: Costa Rica, Dominican Republic, Guatemala, Honduras, Nicaragua, Panama, and El Salvador.

Caricom: The Bahamas, Barbados, Belize, Dominica, Granada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic , Slovenia, Spain, and Sweden.

NAFTA: United States, Canada, and Mexico.

Asean+3: Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

Graph 1.3 Clarifications

The following countries and territories with information on their foreign and regional value added in total exports are included:

Latin America: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

Pacific Alliance: Chile, Colombia, Mexico, and Peru.

CAN: Bolivia, Colombia, Ecuador, and Peru.

CACM+DR: Costa Rica, Dominican Republic, Guatemala, Honduras, Nicaragua, Panama, and El Salvador.

Caricom: Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Granada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

European Union (EU): Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

NAFTA: United States, Canada, and Mexico.

Asean+3: Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

Graph 1 of Box 1.2 Clarifications

The monthly year-on-year variation in the volume traded for the following list of countries and territories are considered:

Latin America: Argentina, Barbados, Bolivia, Brazil, Colombia, Mexico, Paraguay, and Uruguay.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

NAFTA: United States, Canada, and Mexico.

Asean+Japan: Burma, Brunei, Cambodia, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

Graph 1.7 Clarifications

Information on the evolution of average tariffs applied in Latin America and in the OECD for the following countries and territories are considered:

Latin America: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

OECD: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Rep., Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

Table 1.5 Clarifications

The following countries and territories with information are considered:

Latin America: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

Pacific Alliance: Chile, Colombia, Mexico, and Peru.

CAN: Bolivia, Colombia, Ecuador, and Peru.

CACM+DR: Costa Rica, Dominican Republic, Guatemala, Honduras, Nicaragua, Panama, and El Salvador.

Caricom: Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Granada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

NAFTA: United States, Canada, and Mexico.

Asean+3: Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

Graph A.1.1 Clarifications

The participation in exports by economic sector for the following countries and territories are included:

Latin America: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

Graph A.1.2 Clarifications

The average bilateral tariffs applied by sector and trade bloc for following countries and territories are included:

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

Pacific Alliance: Chile, Colombia, Mexico, and Peru.

CAN: Bolivia, Colombia, Ecuador, and Peru.

CACM+DR: Costa Rica, Dominican Republic, Guatemala, Honduras, Nicaragua, Panama, and El Salvador.

Caricom: Antigua and Barbuda, Bahamas, Barbados, Dominica, Grenada, Guyana, Jamaica, Suriname, and Trinidad and Tobago.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

NAFTA: United States, Canada, and Mexico.

Asean+3: Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

Table A 1.3 Clarifications

The following countries and territories are considered with information on intraregional and total exports:

Latin America: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

Pacific Alliance: Chile, Colombia, Mexico, and Peru.

CAN: Bolivia, Colombia, Ecuador, and Peru.

CACM+DR: Costa Rica, Dominican Republic, Guatemala, Honduras, Nicaragua, Panama, and El Salvador.

Caricom: Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Granada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

NAFTA: United States, Canada, and Mexico.

Asean+3: Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

Table A.1.4 Clarifications

The average bilateral tariffs applied by sector and trade bloc for following countries and territories are included:

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

Pacific Alliance: Chile, Colombia, Mexico, and Peru.

CAN: Bolivia, Colombia, Ecuador, and Peru

CACM+DR: Costa Rica, ++Dominican Republic, Guatemala, Honduras, Nicaragua, Panama, and El Salvador.

Caricom: Antigua and Barbuda, Bahamas, Barbados, Dominica, Grenada, Guyana, Jamaica, Suriname, and Trinidad and Tobago.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

NAFTA: United States, Canada, and Mexico.

Asean+3: Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

Table A.1.5 Clarifications

The average bilateral tariffs applied by sector and trade bloc for following countries and territories are included:

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

Pacific Alliance: Chile, Colombia, Mexico, and Peru.

CAN: Bolivia, Colombia, Ecuador, and Peru.

CACM+DR: Costa Rica, Dominican Republic, Guatemala, Honduras, Nicaragua, Panama, and El Salvador.

Caricom: Antigua and Barbuda, Bahamas, Barbados, Dominica, Grenada, Guyana, Jamaica, Suriname, and Trinidad and Tobago.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

NAFTA: United States, Canada, and Mexico

Asean+3: Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

The impact of trade costs

2

The impact of trade costs [1]

Intraregional trade in Latin America, as discussed in the previous chapter, is limited, showing poor growth dynamics compared to other regions. The objective of this chapter is to understand the reasons for this lackluster performance. To do this, it explores the effects of trade policy and the influence of other factors associated with geography (for example, distance and proximity). A fundamental component of trade costs is the transportation costs that must be incurred to move goods from the place of production to where they are to be consumed.[2] As a result, trade tends to expand between economies that are geographically close. Hence, it is only natural that integration initiatives have a regional component. These initiatives include the preferential reduction of tariffs between member countries, along with other measures and policies that affect trade costs, for example non-tariff (technical) barriers, trade facilitation (e.g., simplification of customs and border procedures), investments in physical infrastructure (e.g., roads), homogenization of regulations on trade in services (such as transportation and logistics), and public procurement.

Geography fosters the existence of «natural blocs», where all these integration measures mutually reinforce each other, supporting trade and productive integration. They also offset possible trade diversion costs that tariff preferences could imply.[3] Thus, in part, regionalization has driven the boom in trade and globalization in the last 30 years.

The quantitative analysis developed in this chapter seeks to answer three central questions related to regional integration processes in general and their effects on Latin America in particular. First, what the impact of regional trade agreements has been on trade flows and to what extent these agreements have significantly boosted trade among member countries in the region.

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1. The chapter was written by Pedro Moncarz and Marcel Vaillant.

2. In this case, consumption also includes the use of goods as inputs for production.

3. Krugman (1991) argues in favor of the natural bloc hypothesis based on the idea that trade cost savings more than offset eventual trade diversion losses. Frankel (1997) reviews the empirical literature indicating that a critical aspect in verifying this outcome is the relative magnitude of regional versus extra-regional trade costs.

Trade between two economies is directly proportional to their size and inversely proportional to the costs of trade between them.

The second question addressed is to what extent regional free trade agreements (FTAs) were a successful complement to other openness initiatives pursued concurrently. In this regard, it is important to note that regional trade agreements have been a vehicle for trade liberalization, but not the only one. Simultaneously, countries unilaterally reduced most-favored-nation (MFN) tariffs, supported various trade facilitation measures, engaged in multilateral negotiations through the World Trade Organization (WTO) round mechanism, and signed bilateral or plurilateral agreements with countries and regions outside Latin America and the Caribbean (LAC). This possibility of complementarity between the signing of regional FTAs and these other actions is associated with the hypothesis of open regionalism.[4]

The third question is whether, aside from trade policy, the low trade observed in the region stems from the fact that the advantage of geographical proximity within Latin America does not have a significant correlation in terms of lower transportation costs and other coordination initiatives (e.g., the simplification of border formalities) which might boost trade in goods and services. In other words, is the effective distance greater than what the physical proximity among the countries would suggest, compared with other regions of the world? This question is central because, if the answer is that geography plays a limiting role in intraregional trade, policies in favor of integration should also focus on other aspects, including transport infrastructure and connectivity and trade facilitation.

The structural gravity model of trade

These questions will be answered with the help of the estimation of an econometric model based on the gravity approach to international trade. Just as the law of gravity proposes that the force exerted between two bodies is directly proportional to the product of their mass and inversely proportional to the distance between them, the simplest version of the structural gravity model of trade (SGMT) proposes that trade between two economies is directly proportional to their size (generally measured by GDP) and inversely proportional to trade costs, approximated by geographic variables (distance and proximity, among others) and trade policy variables.

4. The term open regionalism first came into use in the early 1990s. It was in the context of the debate on multilateral versus preferential trade liberalization strategies, at Uruguay Round of the General Agreement on Tariffs and Trade (GATT). There was skepticism about whether it would have a successful outcome. Simultaneously, the path of preferential agreements was strengthened, fundamentally at the regional level. One aspect of this debate was whether multilateral and regional negotiations were substitute or complements strategies to achieve further trade liberalization. Alternative definitions and information on the development of the concept of open regionalism can be found in Bergsten (1997) and Ethier (1998). A pioneer application of this concept for the region can be seen in Devlin and Estevadeordal (2021b).

This model has been subject to multiple empirical tests in the last 20 years and has shown a surprising robustness in terms of its results and predictive capacity.[5] According to the version of the model developed by Anderson and van Wincoop (2003), the basic equation describing the evolution of bilateral trade between two countries has the following form:[6]

$$X_{ijt} = \frac{(Y_{it}E_{jt})}{Y_t}\left(\frac{c_{ijt}}{\Pi_{it}P_{jt}}\right)^{1-\sigma} \tag{2.1}$$

where: X_{ijt} are exports from country i to country j; Y_{it} is the production of country i; E_{jt} is total expenditure of country j; Y_t is world production;[7] c_{ijt} represents trade costs for exports that go from i to j; Π_{it} is the price index in i, while P_{jt} is the price index in country j. On the other hand, $1-\sigma$ with $\sigma>1$ represents the elasticity of trade with respect to costs. All variables have a subscript t, indicating the period (year) to which they correspond.

The equation of gravity (2.1) implies that, under equal conditions, larger countries trade more with each other. Bilateral trade costs (c_{ijt}) decrease trade, but must be measured relative to price indices (Π_{it} and P_{jt}). Anderson and van Wincoop (2003) refer to these price indices as «multilateral resistance» (MR) variables, because they represent the average trade costs that i and j have with all other partners.[8] It is intuitively understandable why a higher level of trade costs of the country j with all other partners (P_{jt}) would lead to an increase in its trade levels with i. This is because it makes this country more competitive in the market j, given the trade costs between i and j (c_{ijt}). The same happens if it increases Π_{it}, since, in this case, what increases are country i's trade costs with all its other partners, which reduces the demand for the good exported by i in every market worldwide, reducing its price in the domestic market (net of the cost of trade), which increases exports to j, given the trade costs (c_{ijt}).

The effect of the relative costs of bilateral trade $\left(\frac{c_{ijt}}{\Pi_{it}P_{jt}}\right)$ affects trade flows through the coefficient $1-\sigma$. As indicated, this exponent measures the elasticity of bilateral trade with respect to trade costs which, in this version of the model, depends on the elasticity of substitution σ between varieties (imported and domestic alike), a parameter determined by consumer preferences. Thus, given the relative trade costs between i and j, the higher the elasticity of trade, determined by the degree of substitution between imported (from different origins) and domestic varieties, the lower the bilateral exchange will be, since it

5. The gravity model of trade dates back to the contributions of Tinbergen (1962) and Pöyhönen (1963). The empirical ability to explain bilateral trade flows came from Anderson (1979). In the 1980s and 1990s, others made contributions (Bergstrand, 1985, 1989; Deardorff, 1998) but it did not find a strong microeconomic basis until the beginning of this century, with the contributions of Eaton and Kortum (2002) and Anderson and van Wincoop (2003).

6. See Appendix (p. 108) for the formal derivation of the equation.

7. It is important to note that, unlike what is known as the naive specification of the gravity equation, the structural model uses production and expenditure levels rather than GDP levels (which correspond to the notion of value added).

8. See the Appendix (p. 108) for more information.

is easier to avoid incurring these costs by replacing imports from other origins or, alternatively, with domestic production.

A key aspect emerges from the reasoning developed previously. The structural gravity model of trade, in its theoretical version, is a general equilibrium model, where the supply of a country (measured by the value of its production) is equal to the sum of the demands of all countries for this country's production, which necessarily includes the domestic demand for its own production.

Changes in trade costs not only affect trade between one country and different external partners but also domestic trade volume vis a vis international trade.

Intuitively, the model implies that a change in bilateral trade barriers affects not only international trade in goods between different origins, but also domestic trade. For example, if country's i trade barriers with all other countries fall, some of the goods that country *i* used to consume internally are now shipped to foreign countries. Therefore, it is not only international trade that is affected by trade barriers with the rest of the world, but also internal trade of products sold internationally. For this reason, it is necessary to incorporate domestic trade in the empirical estimations of the gravity model of trade. This issue was not duly taken into account in many previous gravity model estimates. Two things contributed to this. On the one hand, theory development (Anderson and van Wincoop, 2003; Novy, 2013) only recently made it evident that this is a prerequisite for correctly identifying the impact of trade costs on international flows. On the other hand, domestic trade data (in gross production values to match export/import information) for many countries and years was incomplete.[9]

Returning to equation (2.1), the bilateral trade costs (c_{ijt}), which affect trade «proximity» between country *i* and country *j*, include a broad set of factors that can be classified into different categories. On the one hand, there is trade policy. Because free trade agreements imply the reduction of bilateral tariffs and other measures, such as non-tariff barriers (quantitative restrictions on imports, licenses, technical barriers such as phytosanitary certificates, etc.), signing them has an impact on bilateral trade. These agreements, as will be seen, can be more or less comprehensive. They encompass free trade zones (FTZs), where basically only intra-zone tariffs are reduced; customs unions (CUs), in which a common external tariff is added; or economic integration agreements (EIAs), which involve disciplining other domestic policies (e.g., public procurement, investment, competition, intellectual property, etc.) and the liberalization of services. Likewise, these different free trade agreements can be regional, when they are carried out between neighboring countries geographically, or extra-regional, involving countries or regions distant from each other. In any case, as mentioned and as will be documented below, in practice, free trade agreements have

9. Vaillant et al. (2020) highlight some exceptions. Authors like Dai et al. (2014) or Bergstrand et al. (2015) include internal trade flows in their estimates. Recently Baier et al. (2019) paid particular attention to the issue of including domestic trade in their analysis of the impacts of free trade agreements. The main outcome of incorporating domestic trade is that the estimates of the impact of these agreements on bilateral flows are positive and significant with a greater scope.

a strong regional component, especially the more comprehensive ones (customs unions or economic integration agreements).[10]

Tariff reduction policies include those that are non-discriminatory in the sense that they apply to all trading partners across the board (e.g., tariff reduction under MFN regimes). These policies, in many cases, were complementary to FTA-driven liberalization processes.[11] They can boost trade between FTA partners, especially at the regional level, since the effect of lower tariff barriers is reinforced by lower transportation costs induced by physical proximity (Ethier, 1998; Garriga and Sanguinetti, 1995b) even though, as mentioned, they do not discriminate between origins. The estimates presented below will focus on measuring the impact of these trade policies associated with both FTAs and tariff reductions under MFN schemes.

On the other hand, variable c_{ijt} also includes a series of indicators that are associated with the reduction of costs that have to do with the facilitation of trade. They include the simplification of customs procedures, digitalization of these processes, improved inspection processes and activities that take place at border crossings, among others. As explained in Chapter 1, these measures can represent a significant portion of trade costs once tariffs and other non-tariff barriers are reduced. In principle, trade facilitation measures apply generally to all trading partners and therefore do not discriminate between pairs of countries. However, FTAs, the more comprehensive ones in particular, may involve coordination of these measures among member countries. This is especially true in the context of regional FTAs, where physical proximity could lead to agreements on reciprocal recognition of certificates, exchange of information, and ease at border crossings.

The infrastructure associated with ports, airports, roads, and digital connectivity is also a fundamental element that impacts trade costs, via transport costs. These factors are also added in component c_{ij}. These costs, in general, are associated with geography: the longer the distance, the higher the freight payments. That said, there have been important technological changes that have effectively reduced the physical distance and the burden of these expenses.[12]

10. There is another set of agreements, referred to as other preferential trade agreements (OPTA), which includes partial agreements between developing economies and non-reciprocal agreements between developed and developing economies. The estimates presented below will include OPTAs within the ALC category.

11. Strictly speaking, MFN tariff reduction is not a policy that affects the cost of bilateral trade for each pair of countries *ij* over time. However, there are changes that occur in period *t* in country *j* for every exporter country *i*. This is because the change is on a non-discriminatory MFN basis. It promotes substitution between domestic and international trade; in other words, it generates more trade openness.

12. Since the 1980s, the process of unitization of cargo (thanks to the widespread use of containers) has progressively triggered a set of transformations in international transport, affecting both the scale and efficiency of port operations. This explains the predominance of maritime transport in international flows. It is also one of the factors that contributed to the process of fragmentation of production and the subsequent growth in the trade of inputs. Bernhofen et al. (2016) presents empirical evidence that supports this hypothesis.

In addition to size, economies' productive structures also affect the level of bilateral trade between countries.

In any case, beyond these technological changes, countries that share borders or are geographically close may have an advantage in terms of this location factor. Road transport can connect cities in neighboring countries in a short time and at relatively low costs; so can rail transport, whose cost per unit transported is even lower. However, it is important to emphasize that physical proximity does not in itself imply effective proximity if the necessary investments and infrastructures to connect countries do not exist. In other words, natural blocs have a geographic first nature, but they also have an «endogenous» second nature, stemming from public policy decisions, which could enhance the effect of geographic drivers on trade.

As noted above, trade costs aside, bilateral trade depends on the size of the economies. This is true for Latin America, given that, on average, the region's economies are small and, unlike in North America, Europe or Asia, countries are not so large that they can become the «factory» that drives regional trade. In addition to size, the production structure matters. Although the structural gravity model is compatible with different trade theories (Novy, 2013), it may be relevant, at least during the first stage of integration processes, that exchange is governed by the comparative advantages that each country has with respect to the rest of the world (Deardorff, 1998). Under this scenario, in the case of two economies with similar specializations—especially when these specializations are determined by exogenous factors, such as the presence of certain natural resources (e.g., minerals)—bilateral trade may be lower. In the case of intraregional trade, one explanation for Latin America's low trade levels is their similar productive specialization and, therefore, limited trade complementarity (IMF, 2017; Mesquita Moreira, 2018).

In any case, this could be a transitory effect, since integration and the processes of investment and innovation and participation in production chains that it promotes may eventually change the productive fabric, specialization and, therefore, trade flows.[13] There are plenty of examples in the world—and in the region—of this transition toward more diversified economies. For example, Mexico and its integration into the North American Free Trade Agreement (NAFTA); the more recent process in some Central American countries, where the most outstanding case is Costa Rica; and, obviously, the cases of East and Southeast Asia.

13. Cooper and Massell (1965) suggest that policy makers may favor industrialization and are willing to pay a certain cost in terms of static income to achieve this goal. Once markets are grouped under an FTA, the industrialization objective can be achieved with a lower level of tariff protection because the regional demand faced by industrial producers is greater. This allows them to reduce costs, compared to the case of serving their smaller domestic markets. These ideas of the 1960s remain prevalent in the region, even though international conditions have changed dramatically. The fundamental mechanism was not regional integration per se. Rather it was the ability to integrate into value chains that promoted the change in export structures and, with it, the ability to reach higher levels of complexity in production.

From theory to data: estimating the structural gravity model of trade (SGMT)

In using the equation (2.1) as the motivation for an empirical analysis to estimate the various impacts of the determinants of bilateral trade, it must first be recognized that, in the gravity equation, the variables appear in multiplicative form. For this reason, it is natural to think of a logarithmic linear transformation to apply the traditional ordinary least squares (OLS) estimator. However, this logarithmic transformation implies challenges when there are zeros in bilateral trade relations between pairs of countries, since this information would not be taken into account for the estimations. This, in turn, could bias the results, since, precisely, a very low level of exchange (borderline zero) could in part be explained by the presence of significant trade costs summarized in c_{ijt}.

To solve this and other challenges involved in estimating the structural gravity model, the most recommended and best-practice specification is the use of a Poisson pseudo maximum likelihood (PPML) estimator, represented in the following generic equation (Larch et al., 2019; Yotov et al., 2016):

$$x_{ijt}^{s} = \exp(\psi_{it}^{s} + n_{jt}^{s} + \mu_{ij}^{s} + \beta_{1}^{s} ALC_{ijt} + \beta_{2}^{s} NMF_{ijt}^{s} + \beta_{3}^{s} CC_{ijt}) \times \varepsilon_{ijt} \qquad (2.2)$$

The variable x_{ijt}^{s} denotes exports from the sector s (e.g., manufacturing and agricultural goods) from country i to j in the year t, which also includes domestic trade, meaning «exports» that i makes to itself (x_{iit}^{s}). As explained above, considering domestic trade is critical to identify without bias the effects of the different variables that affect international trade costs. ψ_{it}^{s} and n_{jt}^{s} are temporary binary variables (dummies) for the country of origin (i) and the destination country (j), which control for multilateral resistances —the terms Π_{it} and P_{jt} of the equation (2.1) that describe the time evolution of each country's average trade costs vis-à-vis all the other partners— and the level of production in the country of origin and total expenditure in the country of destination. They also capture any other time-varying unobservable variables or characteristics of the exporter and importer.[14] The term μ_{ij}^{s} denotes a constant fixed effect affecting the exports of i to j (which differs from μ_{ji}^{s} associated with the reverse flow). The term represents the time-invariant trade costs associated with geography (e.g., distance, whether the countries share a border or physical infrastructure linking them which has not changed over time) and with any other variable affecting trade that is held constant (e.g., whether the two countries share the same language).

The term ALC_{ijt} represents a vector of preferential trade policy indicators between i and j in the year t. This vector can include a dummy variable that captures whether both countries belong to an FTA (whether this is a FTZ, CU

14. These variables do not capture the impact of the MFN rate variable. That variable's value is 0 for domestic trade, whereas this is not the case for the temporary fixed effects mentioned above.

or IEA) in the year *t* and incorporate directly the applied tariffs or preferential tariffs granted by the country *j* to the country *i* based on the signed agreements. Estimating the impact of these variables helps to answer the first question posed earlier regarding the effects of regional FTAs on trade flows. The vector of ALC_{ijt} variables includes other preferential tariffs ($OAPC_{ijt}$) granted unilaterally by country *j* to country *i* (e.g., the generalized system of preferences that rich countries offer to those with lower per capita income).

The NMF variable describes the non-preferential trade policy related to changes over time of the general tariff applied by countries. This indicator describes unilateral liberalization policies and multi-lateral negotiations that take place in the context of the WTO.

Finally, the trade complementarity variable CC_{ijt} represents an addition to the basic structural gravity model discussed previously and captures the differences in productive structures between countries or, alternatively, the degree of trade complementarity. The estimation uses an indicator developed by Flores (2020), which qualifies bilateral trade relations based on the structure of comparative advantages and disadvantages at the product level.

Although the analysis focuses on Latin America, the estimates include a broad sample of countries (112, representing 95% of international trade), which makes it possible to build a comparative diagnosis with the rest of the regions and countries of the world. The analysis period is 1995-2015, the most recent timeframe for which all the necessary information is available.[15]The economy was broken down into two sectors using the United Nations International Standard Industrial Classification of All Economic Activities (ISIC): the primary sector[16] (ISIC AB, rev. 3) and manufacturing (ISIC D, rev. 3). The estimation by sector was performed following the recommendations in the literature to facilitate the comparison of the results (Larch et al., 2019).[17] Equation (2.2) is estimated simultaneously for the two sectors, using data at two-year intervals within the period considered. Domestic trade data were calculated using a production database Y_{it} and a total exports database X_{it} ($x_{iit}=Y_{it}-X_{it}=Y_{it}-\sum_{j\neq i}x_{ijt}$).[18] The applied tariff information was obtained from Teti (2020).[19]

15. See Appendix (p. 109) for more information about the databases used to construct the variables included in the estimation.

16. ISIC categories A and B include agriculture, livestock, hunting, forestry, and fisheries. In this chapter, for practical reasons, they are collectively referred to as' primary goods' or simply referred to as primary sector or agriculture.

17. Mining was not included, since the internal trade estimates were not consistent or replicable for the same time period.

18. See Appendix (p. 109) for specifics on the domestic trade calculation.

19. Special thanks to Feodora Teti (ifo Institute, Leibniz Institute for Economic Research, University of Munich) for providing the applied tariff data, which enabled the calculation of preference margins and MFN rates. Although these data are essential for the correct estimation of trade costs, they are not available on a bilateral and disaggregated by product basis.

Before turning to the regression results, it is relevant to provide a descriptive analysis of the evolution of global trade from the database to be used in the econometric analysis. In particular, the analysis below shows the evolution of trade flows by distinguishing between preferential and non-preferential trade links, and the extent to which these have a regional versus extra-regional component (see Table 2.1).

International trade tripled from 1995 to 2015, driven by preferential trade. In particular, trade activities developed within the framework of regional agreements.

In the two decades studied, preferential trade grew more than non-preferential trade. Within the former, extra-regional trade registered the most dynamic flow in the period. This change occurred especially in the extensive margin, through an increase in the number of liberalized relations using this modality. This is partly explained by the fact that at the beginning of the period a series of regional preferential agreements were already consolidated: the European Union (EU), the North American Free Trade Agreement (NAFTA), the Association of Southeast Asian Nations (ASEAN), the Southern Common Market (Mercosur), the Andean Community of Nations (CAN), and the Central American Common Market (CACM).[20] In addition, during the 2000s, the emergence of inter-bloc or bilateral agreements between countries in different regions was important. That said, as shown in Table 2.1, intraregional preferential trade in absolute terms is the largest and tripled in the case of manufactured goods between 1995 and 2015.

Table 2.1
Overall trade development by major region and in two sectors (millions of USD)

	Primary sector			Manufacturing sector		
	1995	2015	Ratio	1995	2015	Ratio
Preferential	103,672	292,217	**2.8**	2,040,650	7,447,521	**3.6**
Intraregional	67,574	171,512	2.5	1,710,915	5,130,291	3.0
Extra-regional	36,098	120,706	3.3	329,735	2,317,230	7.0
Non-preferential	62,736	151,616	**2.4**	1,465,967	3,487,986	**2.4**
Intraregional	7,100	6,261	0.9	261,334	274,040	1.0
Extra-regional	55,636	145,355	2.6	1,204,633	3,213,946	2.7
Total	166,408	443,833	**2.7**	3,506,617	10,935,507	**3.1**

Notes: ISIC Revision 3 is used for the primary sector (Sector AB) and manufacturing (Sector D). A list of the countries included in the analysis can be found in the Appendix (p. 111) .

Source: Authors based on data from Dynamic Gravity Dataset (Gurevich and Herman, 2018).

20. Table A 1.1 (p. 70) identifies the member countries of each agreement.

Table 2.2 describes the results of the estimation of equation (2.2) breaking down the results by type of product (primary versus manufacturing).[21] The first column shows the specification that includes only the binary variable ALC_{ijt}, which is positive and significant. Maintaining other factors constant, the value of the coefficient indicates that the existence of a FTA increases trade by approximately 25% for agricultural goods and 20% for manufactured goods. On average, and for the world as a whole, it is clear that FTAs have been relevant in promoting trade among the countries that integrate.

Table 2.2
Variable drivers of bilateral trade: trade policy and productive structure

	(1)	(2)	(3)	(4)
		Primary sector		
ALC_{ijt}	0.2462***	0.0411		
$ALC_{ijt} \times ln(1+MP_{ijt})$		2.3352***	2.1350***	2.9823***
$ln(1+NMF_{jt})$[a/]		-7.0837***	-6.3149***	-5.9882***
$OAPC_{ijt} \times ln(1+MP_{ijt})$		1.6823***	2.2683***	1.5640***
$ALC_{ijt} \times NALC_{it}$			0.0098***	0.0039**
$ALCi_{jt} \times NALC_{jt}$			-0.0011	-0.0055***
$NALC_{it} \times NALC_{jt}$				0.0002***
CC_{ijt}				0.9320***
		Manufacturing sector		
ALC_{ijt}	0.1975***	0.0733***		
$ALC_{ijt} \times ln(1+MP_{ijt})$		0.8303**	0.4845*	1.2745***
$OAPC_{ijt} \times ln(1+MP_{ijt})$		1.1044***	1.6039***	1.3724***
$ln(1+NMF_{jt})$[a/]		-7.0837***	-6.3149***	-5.9882***
$ALC_{ijt} \times NALC_{it}$			0.0071***	0.0052***
$ALC_{ijt} \times NALC_{jt}$			0.0004	-0.0029**
$NALC_{it} \times NALC_{jt}$				0.0001***
CC_{ijt}				1.2756***
Observations	245,080	245,080	245,080	245,080

Notes: Data are used at two-year intervals for the period 1995-2015. All regressions include fixed effects of origin-sector-time, destination-sector-time, and origin-destination-sector. ISIC Revision 3 is used for the primary sector (Sector AB) and manufacturing (Sector D). * indicates a 10% statistical significance, ** indicates a 5% statistical significance, and *** indicates a1% statistical significance. A list of the countries included in the analysis can be found in the Appendix (p. 111).

a/ Does not correspond to estimates at the sector level.

Source: Authors based on Moncarz et al. (2021).

21. See Moncarz et al. (2021) for more information regarding the estimates and other results.

In Column (2) we add the interaction of the binary variable ALC with the preferential margins granted in these agreements to assess whether a central aspect of these arrangements, such as the tariff reductions applied, are relevant to increase trade. The same column includes the variable that reflects other preferences granted unilaterally (OAP_{ijt}) and also the variable that describes the non-preferential trade policy, represented by the most favored nation applied tariffs (NMF_{jt}).[22]

The results show that the variables measuring preferences within FTAs are significant and positive for both sectors, although their impact is greater for primary goods. At the same time, the magnitude and, in the case of agriculture, the significance of the variable indicating the effect of a free trade agreement weaken (ALC_{ijt}). This suggests that the reduction of applied tariffs partly explains the increase in trade, although in the case of industrial goods there are other aspects established in the FTAs (for example, the elimination of non-tariff barriers), which, depending on their depth, also promote trade. This effect implies a first level of heterogeneity between different FTAs depending on the level of preference within the agreement and other reciprocal liberalization measures that are established. On the other hand, increases in the MFN tariff (which does not distinguish by sector) reduce bilateral trade.

In Columns (1) and (2), the use of the binary variable to identify the existence of trade agreements assumes that their impact is homogeneous regardless of the number of agreements that countries have signed with third nations. However, it is to be expected that this will not be the case. Column (3) incorporates interactions between the dummy ALC and the number of preferential agreements signed with other partners by the country of origin (*i*), on the one hand, and the country of destination (*j*), on the other.[23] In terms of the exporting country's interaction, $ALC_{ijt} \times NALC_{it}$, the inclusion of this new variable measures the extent to which an exporting country with the greatest number of trade agreements signed with third countries benefits from increases in productive efficiency (for example, due to greater scale or competition) and learning in the use of preferences, and can therefore take better advantage of the opening of a new market. This hypothesis is confirmed, given the positive and significant result of the coefficient related to the variable $ALC_{ijt} \times NALC_{it}$, and suggests a positive answer to the second question posed in the introduction to the chapter, referring in this case to the existence of significant complementarity between the various free trade agreement initiatives, both regional and extra-regional. On the other hand, the inclusion of the variable $ALC_{ijt} \times NALC_{jt}$ tries to capture the fact that the more open the importing country (measured by the number of free trade agreements signed with third countries), the lower the preference that country *i* gets in market *j* and, therefore keeping other factors

22. For the estimation of the MFN tariff effect, the tariff applied by the importing country *j* to all origins is used (therefore the subindex is *jt*) and the restriction was imposed as the same for both sectors. The result obtained is in line with what is cited in the literature regarding the value of trade elasticity (Head and Mayer, 2014; Yotov et al., 2016).

23. Once the variables of the number of agreements and trade complementarity are included, the dummy variable ALC ceases to be significant. This is explained by the fact that the other drivers added in these other regressions (e.g., number of agreements signed with other partners and regions) capture part of the benefits of integration schemes, beyond the reciprocal reduction of tariffs (preferences). For this reason, in the specifications of Columns (3) and (4) the dummy variable ALC is not introduced.

constant, the smaller the increase in exports from *i* to *j* that occurs as a result of a preferential agreement between the two economies. This variable is not significant in this case, although it is in the specification of Column (4) that incorporates all the variables of interest.

The accumulation of free trade agreements is consistent with non-discriminatory global openness. This confirms the hypothesis that regionalism complements and strengthens multilateral openness.

Finally, this last column incorporates the variable that results from multiplying the number of trade agreements with third partners that both country of origin *i* as well as the country of destination *j* ($NALC_{it} \times NALC_{jt}$) have and the trade complementarity variable (CC_{ijt}). Variable $NALC_{it} \times NALC_{jt}$ is directly associated with bilateral trade between *i* and *j*, as it confirms the positive and significant value of the coefficient in Table 2.2. This variable captures the cumulative process of preferential trade liberalization of both the country of origin and the country of destination. Although these are preferential liberalization policies, as they accumulate and the two countries sign more and more agreements, the final effects end up being consistent with a non-discriminatory global liberalization strategy, since trade between *i* and *j* increases, regardless of the existence of a reduction in preferential tariffs between them. This confirms the hypothesis that regionalism is complementary and strengthens multilateral openness. Again, it provides a positive answer to the second question outlined in the introduction on how the strategy of regional openness and non-discriminatory openness can be strengthened (Baldwin, 2006).

There is a political economic basis for the mechanism that is triggered in this process of greater bilateral trade between *i* and *j* in the context of the accumulation of greater preferential agreements with other countries and regions. This is because FTAs tend to weaken the interests of sectors that compete with imports and reinforce those with export activities and those that use imports as inputs. This process also drives the reduction of other non-discriminatory barriers (non-tariff, regulatory, trade facilitation, etc.), increasing bilateral trade between countries.[24] This result suggests that the process of signing agreements within and outside the region underwent during this period has boosted trade liberalization as a whole (open regionalism). Moreover, fears about possible negative effects (stumbling blocks) on trade due to this flurry of preferential negotiations did not materialize.

Finally, the variable that describes trade complementarity between the two countries in a bilateral relationship shows, as expected, that those countries that do not share the same comparative advantages (their production structure is more complementary) trade more.

24. As indicated in the text, the effect of this variable identifies the complementarity that is established between preferential and multilateral agreements based on the MFN principle. This alignment is greater as agreements evolve from a FTZ and CU to an IEA. Import tariffs discriminate by origin, favoring only the partner. However, when a national treatment rule is established in an IEA or when other barriers to trade are eliminated and facilitation mechanisms are implemented, these improvements occur for all origins, within and outside the agreement. The future agenda of multilateralism will have the challenge of collaborating in the necessary harmonization of existing trade agreements (multilateralization of regionalism).

Table 2.3 uses the coefficients obtained from the regression (presented in Table 2.2) to analyze the impact of the different variables that determine bilateral trade flows at the extremes of the period analyzed. The column marked ALC presents the values of the variables associated with the dummy variable ALC and preferential margins, in addition to their interactions with the number of agreements signed by the countries of origin and destination. The column marked NMF refers to the effect of the non-discriminatory MFN tariff liberalization policy. The column marked NALC shows the effect of the FTA cumulation process of the countries of origin and destination ($NALC_i \times NALC_j$). Finally, the column marked CC shows the effect of the production complementarity variable.

An increase in the indicator presented in each column (in 2015 compared to that calculated for 1995)[25] means that the variable analyzed had a greater impact on bilateral trade toward the end of the period compared to the start year.[26]

Table 2.3
Impact of different trade drivers on the evolution of bilateral trade between 1995 and 2015

	ALC[a/]	NMF	NALC	CC
		Primary sector		
1995	1.1668	0.5303	1.0440	1.4627
2015	1.1471	0.6325	1.2472	1.4544
		Manufacturing sector		
1995	1.0922	0.5894	1.0208	1.6789
2015	1.1377	0.6778	1.1130	1.6605

Notes: The results of Column (4) of Table 2.2 were used to create this table. The values correspond to the simple averages of the proximity of each country in its role as an exporter. ISIC Revision 3 is used for the primary sector (Sector AB) and manufacturing (Sector D). A list of the countries included in the analysis can be found in the Appendix (p. 111). Variables are abbreviated in Spanish. ALC = FTA, NMF = MFN, NALC = Number of FTA's signed and CC = trade complementarity.

a/ Only takes into account the pairs of countries that have an FTA in the year in question.

Source: Authors based on Moncarz et al. (2021).

The table shows that bilateral trade for both types of goods increased between 1995 and 2015 thanks to all the factors mentioned, except for the component referring to productive complementarity, which showed a very slight decrease, and the ALC component for the primary sector. The impact of FTAs is considerable for manufactured goods (up 4.2%). Liberalization via MFN tariff

25. The indicators in Table 2.3 are obtained by multiplying the value of the estimated coefficients in Column (4) of Table 2.2 by the values of the different explanatory variables, for each bilateral relationship. Then, for each of these variables, the weighted average is calculated, using as a weight the importance of total bilateral trade in the exporter's total exports.

26. The impact of variables referring to unilateral preferences is negligible or even tends to slightly decrease bilateral trade; as such, they are not included in the analysis.

reductions is significant for both products (19.3% for primary goods and 15% for manufactured goods). The effects associated with the NALC variable that describes «open regionalism» is also strong (19.5% for primary goods and 9% for manufactured goods). This result is key to understand the global liberalization process that has taken place since 1995, with a strong bias in terms of preferential agreements. The evidence shows, as indicated above, that, once this process become widespread, it complements liberalization under more conventional non-preferential schemes (unilateral or multilateral) that affect the MFN tariff.

Implications for Latin America and international comparisons

How much do trade policies explain bilateral trade in the region?

The analysis developed so far shows the impact of preferential and non-preferential trade policies at the global level, without distinguishing between regions and, in particular, without specifically analyzing Latin America. This section shifts the focus to analyze in depth the implications for the region in comparative terms. As a first step, it is useful to review the data describing the changes in trade flows during the period under analysis for different regional integration schemes. Likewise, an assessment of the changes in trade policies during that period under the different agreements is pertinent.

As indicated, there is an association between preferential trade liberalization and geography. Globally, Table 2.1 shows that regional trade in 2015 is mostly preferential: countries have incentives to reduce trade costs where they are already naturally low. The first wave of preferential liberalization was regional. Each subregion has a plurilateral agreement that groups them together. Table 2.4 disaggregates the information for the three Latin American plurilateral agreements: the CACM, CAN, and Mercosur.[27] These three agreements cover most of the region's countries. They are then compared with the three plurilateral treaties that function as global nodes: NAFTA, the European Union and European Free Trade Areas (EU+EEA)[28] and the Association of Southeast Asian Countries plus China, Japan, and South Korea (ASEAN+3).[29] The results for Latin America confirm what was presented in Chapter 1. CACM's trade performance is better than CAN and Mercosur, which show less dynamic flows between all regions.

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27. In this chapter, the CACM does not include Panama because it was not a member of the agreement for most of the analysis period. The Pacific Alliance was not included because it was an agreement established toward the end of the period under review (i.e., 2011). For a list of the countries included in each agreement, see the Appendix (p. 111).

28. Mexico was included in NAFTA. The European Free Trade Area includes all the EU's free trade zones on the continent.

29. Asean+3 does not include Burma, Brunei or Cambodia due to lack of information.

Table 2.4
Evolution of intraregional and extra-regional trade by sector (millions of USD)

	Primary sector			Manufacturing sector		
	1995	**2015**	**Ratio**	**1995**	**2015**	**Ratio**
Intraregional	74,674	177,772	**2.4**	1,972, 249	5,404,331	**2.7**
Mercosur	1,970	2,336	1.2	12,641	29,153	2.3
CAN	93	221	2.4	1,425	6,598	4.6
CACM	99	304	3.1	1,514	8,292	5.5
NAFTA	11,329	34,425	3.0	277,785	921,462	3.3
Asean+3	2,070	11,891	5.7	29,955	665,581	22.2
EU+EEA	46,163	92,026	2.0	1,274,687	2,621,208	2.1
Extra-regional	91,734	266,061	**2.9**	1,534,368	5,531,176	**3.6**
Total	166,408	443,833	**2.7**	3,506,617	10,935,507	**3.1**

Notes: ISIC Revision 3 is used for the primary sector (Sector AB) and manufacturing (Sector D). A list of the countries included in each group can be found in the Appendix (p. 111).

Source: Authors based on data from Dynamic Gravity Dataset (Gurevich and Herman, 2018).

Of course, trade flows are partly explained by the evolution of trade costs and, within these, tariffs play a central role. Tariff levels in Latin America have already been described in Chapter 1. However, no distinction has been made between those corresponding to MFN levels and those applied under preferential tariff regimes. It is important to describe the evolution of both types of tariffs because, as mentioned globally, both trade liberalization paths have worked in a complementary manner during the period.

In order to measure the magnitude of liberalization under both mechanisms, two indicators were constructed in Table 2.5: one to reflect non-discriminatory liberalization (MFN) and another to quantify the level of preferential liberalization.[30] Both are constructed as the ratio between 2015 and 1995 in the MFN tariff,[31] on the one hand, and preferential tariffs,[32] on the other.

30. Preferential liberalization refers to the reduction of tariffs with trading partners belonging to an agreement in relation to those corresponding to third countries (MFN tariffs). See Appendix (p. 110) for the formal calculation of the tariff preference.

31. MFN liberalization is observed when the indicator is less than one; if it is greater, protection increased. MFN tariffs are obtained as a simple average from group members. See Appendix (p. 110) for more information on the calculation of the indicator.

32. The relationship between the MFN tariff and the preferential tariff applied measures the preferential margin of the trade relation. A simple average is calculated for each group and then the rate of change. If the indicator is greater than one, preferences increased, i.e. applied tariffs fell more than MFN tariffs. See Appendix (p. 110) for more information on the calculation of the indicator.

Globally, the reduction in non-discriminatory most-favored-nation (MFN) tariffs has been greater than the increase in tariff preferences.

The results show that MFN liberalization was relatively higher than preferential liberalization. In the period analyzed, Mercosur stands out for the absence of non-preferential liberalization and even its reversal.[33] The second conclusion emerging from Table 2.5 concerns a heterogeneous behavior in relation to preferences. For example, within the region, CACM's preferential tariffs on manufactured goods dropped significantly; they increased slightly in Mercosur and remained unchanged in CAN. On the other hand, in the case of primary goods, CAN made progress in terms of preferences granted. This was not the case in Mercosur. CACM reduced them. In NAFTA, preferences increased very slightly for primary goods but fell for manufacturing, while they were almost unchanged for the EU+EEA. On the other hand, for Asean+3, they went up in both types of goods. Clearly, this heterogeneous process reflects the combined effect of the policies implemented in terms of reducing MFN tariffs (which tend to reduce preferences in LAC), the deepening of tariff liberalization processes within already established agreements (which tend to increase preferences) and the signing of new preferential agreements (intraregional and extra regional), which tend to dilute the margins that countries obtain for their exports in the regional markets with which they had initially signed preferential agreements. The fact that the reduction in MFN tariffs at the global level (last row of Table 2.5) has been more marked than the increase in preferences shows that the liberalization process, in which the proliferation of preferential agreements has been relevant, has not implied in practice a significant increase in these margins that could entail significant trade diversion costs.

Table 2.5
Changes in trade policy, 1995-2015 (final/start ratios)

	MFN Liberalization		Preferences	
	Primary sector	Manufacturing sector	Primary sector	Manufacturing sector
Intraregional	**0.958**	**0.958**	**1.005**	**1.001**
Mercosur	1.000	1.005	1.000	1.011
CAN	0.976	0.957	1.019	1.000
CACM	0.961	0.960	0.967	0.967
NAFTA	0.988	0.956	1.003	0.989
Asean+3	0.932	0.941	1.049	1.033
EU+EEA	0.956	0.969	0.995	0.994
Extra-regional	**0.956**	**0.944**	**1.000**	**0.991**
Total	**0.957**	**0.955**	**1.004**	**0.999**

Notes: ISIC Revision 3 is used for the primary sector (Sector AB) and manufacturing (Sector D). A list of the countries included in each group can be found in the Appendix (p. 108).

Source: Authors based on Teti (2020).

33. In different years, Mercosur recorded increases in the Common External Tariff (CET) on sectoral lists (e.g., textiles and clothing), which later were not returned to their original level.

Using the estimation discussed in the previous section, it is possible to decompose the contribution of each factor that influences bilateral trade, as shown in equation (2.2), making specific reference to the region's FTAs (Mercosur, CAN, and CACM) and comparing them with NAFTA, EU+EEA, and Asean+3. As described in this equation, these factors are associated with the size of the markets. They are corrected for multilateral resistances, productive specialization, through the trade complementarity (CC) measure, and the different variables that explain preferential and non-preferential trade policies.[34] The exercise is carried out on observed trade, which implies adding the so-called statistical estimation error. The proposed decomposition has computational limitations in the number of factors to be considered. For this reason, it is broken down into four factors: market size corrected for resistance and complementarity; preferential trade policy (FTA) in its direct and indirect channels; non-discriminatory trade policy (MFN); and statistical error.

Table 2.6 presents the results of the decomposition. The first two columns show both the level of trade at the end of the period and its variation in absolute terms; Column (7) shows the variation in percentage terms. The rest of the columns break down this variation according to the different drivers previously indicated (including the unexplained part or statistical error), both in absolute level (Columns 3 to 6) and their percentage participation in this variation Columns (8 to 10).

The estimated SGMT shows a much better fit to intraregional manufacturing trade than to agriculture trade. In manufacturing, plurilateral agreements in Latin America (Mercosur, CAN, CACM) and in East and Southeast Asia (Asean+3) overestimated trade to a considerable extent. In the case of NAFTA and the EU, the SGMT underestimated trade observed in agriculture, albeit to a much lesser extent. This result, however, is somewhat expected. Trade in primary goods has a greater component of interregional flows, due to global comparative advantages, than trade in manufactures. In addition, agricultural trade is comparatively much smaller.

For these reasons, the description of the results focuses on manufacturing trade. In terms of the magnitude and dynamics of the absolute variation, intraregional trade under FTAs in Latin America is small compared to NAFTA, the EU, and Asean+3. However, this should not be surprising, given the different sizes of these economies. The increase in intraregional trade in the Asean+3 countries, multiplied by a factor of 8+, is worth noting. This variation is largely explained by the effect of market size corrected by multilateral resistances. This is shared by most of the other integration agreements discussed in Table 2.6. Typically, SGMT estimates show that bilateral trade flows are largely determined by countries' production and expenditure levels —and their variations— over time.

34. This exercise faces some technical problems due to the fact that these different factors enter in multiplicative form in the equation. However, the problem can be solved by applying Bennet's decomposition for the aggregation of multiplicative factors (de Boer and Rodrigues, 2020).

Table 2.6

Decomposition of intraregional trade drivers for selected plurilateral trade agreements, 1995-2015

Bloc	Intraregional trade 2015	Variation intraregional trade 2015-1995	Size + MR + TC	FTA Effects direct and indirect	Tariffs MFN	Residual	Variation intraregional trade 2015-1995 (%)	Size + MR + TC	FTA Effects direct and indirect	Tariffs MFN	Residual
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Millions of USD							Share in trade variation 2015-1995 (%)			
Primary sector											
Mercosur	2,336	366	483	6	5	-129	18.6	132.2	1.7	1.5	-35.3
CAN	221	128	185	2	46	-105	137.7	144.9	1.2	36.0	-82.0
CACM	304	206	180	16	46	-37	208.1	87.7	8.0	22.2	-18.0
NAFTA	34,425	23,097	17,689	1,613	1,477	2,317	203.9	76.6	7.0	6.4	10.0
Asean+3	11,891	7,719	9,970	1,053	1,803	-5,107	185.0	129.2	13.6	23.4	-66.2
EU	83,879	40,484	3,761	16,533	16,345	3,845	93.3	9.3	40.8	40.4	9.5
Manufacturing sector											
Mercosur	29,153	16,512	14,065	742	-1,181	2,886	130.6	85.2	4.5	-7.1	17.5
CAN	6,598	5,173	3,672	167	1,094	240	362.9	71.0	3.2	21.1	4.6
CACM	8,292	6,779	4,132	712	1,048	887	447.8	61.0	10.5	15.5	13.1
NAFTA	921,462	643,677	340,514	48,171	117,089	137,903	231.7	52.9	7.5	18.2	21.4
Asean+3	665,581	586,676	555,014	34,249	68,904	-71,490	743.5	94.6	5.8	11.7	-12.2
EU	2,293,310	1,150,905	427,534	392,132	329,023	2,215	100.7	37.1	34.1	28.6	0.2

Notes: Trade decomposition is based on Bennet's method. ISIC Revision 3 is used for the primary sector (Sector AB) and manufacturing (Sector D). A list of the countries included in each group can be found in the Appendix (p. 108). MR stands for multilateral resistance and TC for trade complementarity.

Source: Authors based on Moncarz et al. (2021).

Trade policy was divided into two channels: preferential channel (FTA) and non-discriminatory (MFN). The effect of FTAs (see the absolute variation in Column 4 and their share in total variation in Column 9) adds the direct influence that the FTAs have, captured by the binary variables which indicates the existence of an FTA and its interaction with the preference margins, in addition to the interactions of these preferences with the number of agreements signed by the country of origin and the country of destination of exports, as well as the indirect influence, derived from the combined accumulation of FTAs. The FTA-related effects (see Column 9) played a dynamic role across the region in CACM's manufacturing trade (accounting for over 10% of the variation), and contributed very little to South America plurilateral trade agreements (CAN and Mercosur). Liberalization resulting from reducing MFN tariffs (Column 10) played a regressive role across Mercosur, whereas it had a positive impact on the two other Latin American agreements (CAN and CACM). Globally, all forms of trade liberalization accounted for one-fourth of the variation in manufacturing trade for CAN and CACM and had a negative impact on Mercosur (-2.6%).

These results indicate that trade liberalization was relevant to increasing trade in some of the regional spaces created in Latin America, but not in others. In CACM, which stands out for the considerable increase in manufacturing trade, which increased fivefold (Column 7), the preferential and non-discriminatory liberalization paths aligned; in CAN, the path to reduce MFN tariffs was active; and in Mercosur, the sum of both effects was almost nil.

Preferential and non-preferential openness contributed to the increase of intraregional trade in the Central American Common Market but not in Mercosur.

Trade liberalization was a dynamic driver for the rest of the plurilateral agreements studied. In general, there were positive effects of both the preferential and non-preferential mechanisms, although with heterogeneity in the relative intensities. While in NAFTA and Asean+3 multilateral non-discretionary openness played a slightly more relevant role in the growth of regional trade than preferential liberalization (Column 9); in the EU, the latter played a more notorious role than the former. It is noteworthy to find this evidence in the case of the EU, this being a pre-existing and relatively mature agreement at the beginning of the period considered. The results suggest that this fact has not prevented the EU from finding new ways to reduce internal trade barriers (including the expansion of the agreement itself to reach other countries on the continent). As a result, this liberalization channel explains 34% (Column 10) of the increase in trade during the period studied (the highest among the agreements analyzed).

Does Latin America trade little?

The final question posed at the beginning of the chapter was whether, given the time-varying factors that explain bilateral trade between countries (size and evolution of production and expenditure, trade policies, etc.), can it be said thattrade within Latin America is structurally low compared to other regions and blocks? If the answer is yes, this could be associated with permanent drivers that affect trade costs, which, in the estimation of the equation (2.2), were summarized in the country-pair fixed effect (μ_{ij}^{s}). Some of these costs are strictly associated with geography, which is effectively kept constant (e.g., distance), and others reflect structural variables (e.g., intraregional connectivity built over a certain geography), which have a slower pattern of change. Connectivity has physical aspects linked to infrastructure (e.g., roads), but there are also regulatory aspects related to trade facilitation variables, for example, which is an aspect that will be analyzed in more detail in Chapter 3.

Reducing these structural-type costs can generate increases in trade that then create incentives for reducing variable costs associated with trade policy (e.g., tariffs and non-tariff barriers). In fact, at the level of the world economy, regional integration is a result of this mechanism. Where costs are structurally lower, incentives to liberalize trade increase.

It is therefore of interest to be able to assess the extent to which these structural aspects that permanently affect trade costs are prevalent in the region.

In addition, they could explain why Latin America trades little, beyond what is explained by high tariffs and other non-tariff barriers in the region. To this end, a «second stage» estimate is proposed, where the bilateral fixed effect (μ_{ij}^{s}) estimated in the regression described in equation (2.2) is regressed with variables that are unchanged over time (at least during the period 1995-2015). These variables describe more directly aspects of geography, such as distance, adjacency (common border) or access to the sea, as well as other cultural aspects, which could also affect bilateral trade (e.g., same language) or institutional integration arrangements that precede the initial period under consideration (pre-1995). Box 2.1 elaborates on the methodological details of this estimate.

Box 2.1
Impact of structural drivers on bilateral trade

In order to assess the impact of time-invariant factors, like geography, on bilateral trade, the following equation using cross-sectional data (they only vary by pairs of countries), again estimated via Poisson's pseudo-maximal likelihood, is proposed:

$$e^{\widehat{\mu}_{ij}} = \exp\left(\vartheta_i + \psi_j + \gamma_1 sl_{ij} + \gamma_2 is_{ij} + \gamma_3 con_{ij} + \gamma_4 lc_{ij} + \gamma_5 ln(\mathrm{d}_{ij}) + \gamma_6 ln(FC_{ij})\right) \times \varepsilon_{ij} \quad (1)$$

where $\widehat{\mu}_{ij}$ are the fixed effects for each pair of countries, estimated in the first stage; ϑ_i is a fixed effect of origin (exporter); ψ_j is a fixed effect of destination (importer); sl_{ij} is a binary variable equal to 1 if one or both of the countries that make up the bilateral relationship *i*, *j* are landlocked; is_{ij} is a binary variable equal to 1 if one or both of the countries that make up the bilateral relationship *i*, *j* are islands; with con_{ij} being a binary variable equal to 1 if the countries *i* y *j* share a border; lc_{ij} is a binary variable equal to 1 if the countries *i* and *j* share the same language; and d_{ij} is a variable that measures distance[a] between countries *i* and *j*, and FC_{ij} is a variable that captures trade facilitation measures. The estimated coefficients associated to this variable are presented in Chapter 3.

To identify the peculiarity of these structural aspects of intraregional trade in Latin America, binary variables were constructed for each of the intraregional and interregional relations in a world divided into five macro-regions: Latin America (*AL*)[b]; North America (*AN*)[c]; Europe; East and Southeast Asia (*Asean+3*); and the rest of the world (*RdM*). These binary variables are interacted with the distance variable, one of the key geographic drivers of permanent trade costs. The objective is to assess whether the lower internal trade in Latin America is related to the fact that distance has a stronger (negative) impact on intraregional trade compared to other regions.

a. It corresponds to the distance, weighted by population, between the main cities of the pairs of countries (see Gurevich et al., 2018).

b. Latin America includes the countries of South America, Central America, and the Caribbean.

c. Mexico is included in North America, not Latin America.

The results of the regressions that analyze the permanent drivers of bilateral trade are presented in Table 2.7, for agriculture and manufacturing.

Distance has a greater impact on trade in Latin America, compared to other regions.

An initial conclusion, which reaffirms the good fit of the entire SGMT estimation exercise, is that the expected results are confirmed for the standard structure of the model, which explains the variation of bilateral trade in its structural components (Columns 1 and 3). Mediterranean countries trade less; sharing borders and the same language drives trade, while distance exerts a negative effect, with an elasticity close to -1. The magnitude of the coefficients, especially that relating to distance, is consistent with that obtained in the most recent literature (Yotov et al., 2016). There are differences between sectors, but these are adjusted to the different patterns, according to the type of product being analyzed.[35]

Table 2.7
Drivers of (permanent) structural bilateral trade, 1995-2015

Variables	(1)	(2)	(3)	(4)
	Primary sector	Primary sector	Manufacturing sector	Manufacturing sector
Landlocked (sl)	-0.665***	-0.656***	-0.082	-0.062
Island (is)	0.153	0.230	-0.209	-0.187
Common language (lc)	0.535***	0.481***	0.640***	0.631***
Contiguity (con)	0.174*	0.249***	0.292***	0.260***
Distance (lnD) a/	-0.984***	-0.876***	-1.089***	-1.069***
lnD*(AL,AL)		-0.198		-0.395***
lnD*(AN,AN)		-1.521***		-0.134
lnD*(Asean+3,Asean+3)		-0.213		0.115
Observations	10,506	10,506	10,506	10,506
R^2	0.699	0.755	0.684	0.700

Notes: All regressions include origin-time and destination-time fixed effects. They are also controlled by the procedural costs associated with the completion of customs formalities (see detail in Chapter 3). In addition, interactions between five macro-regions are included: Latin America (AL, includes Caribbean countries), North America (AN), Europe, Asean+3, and the rest of the world. Mexico is included in North America, not Latin America. ISIC Revision 3 is used for the primary sector (Sector AB) and manufacturing (Sector D). * indicates a 10% statistical significance, ** indicates a 5% statistical significance, and *** indicates a1% statistical significance. A list of the countries included in the analysis can be found in the Appendix (p. 111).

a/ Corresponds to the distance, weighted by population, between the main cities of the pairs of countries (see Gurevich et al., 2018).

Source: Authors based on Moncarz et al. (2021).

35. For example, the contiguity variable (common borders) is not relevant to explain agricultural trade and is relevant for manufactured goods. This is an expected result given that trade in the first type of product has a more global pattern, while the second arises in part from integration into global value chains which, as seen in Chapter 1, have an important regional component.

The interactions of the distance variable with the binary variables by region —*lnD*(AL,AL)*, *lnD*(AN,AN)* and *lnD*(Asean+3,Asean+3)*—, which describe possible differences in the effect of distance within blocks (Columns 2 and 4), are measured in relation to Europe, since the omitted category corresponds to the bloc's intraregional flows (Europa,Europa); therefore, the non-interaction distance effect (*lnD*) indicates the impact of this variable on bilateral trade for this region (Columns 2 and 4). The results show that, in the case of manufacturing, the effect of distance is significantly greater for intraregional trade in Latin America than for Europe: -1.069 versus -(1.069+0.395)=-1.454 (Column 4). Moreover, according to these results, the structural costs of intraregional trade in Latin America are negatively affected by distance more strongly than in other regions, such as North America and East and Southeast Asia. For these two blocs, the effects of distance on intraregional trade are not significantly different from those seen for Europe.

This final evidence aligns with the conjecture stated above: building infrastructure for connectivity within Latin America could potentially enable the region to achieve lower levels of structural trade costs and, therefore, increase trade. This is discussed in more detail in Chapter 4. This could, in turn, encourage changes in the more conventional trade policy variables, where, as seen above (Table 2.6), the region's performance has not driven international trade growth. This could generate a virtuous circle, where greater physical integration feeds back into incentives to reduce trade barriers and ultimately foster the long-awaited integration of Latin America.

Keys to understanding the impact of trade costs

1. The integration process worldwide has become very dynamic in recent decades, driven by both preferential and non-preferential trade. This development is evident in intraregional and extra-regional trade.

2. The structural gravity model of trade has become a powerful tool for analyzing evidence of trade drivers and evolution.

3. The fact that trade with and without preferences boosts the international exchange of goods and services suggests that open regionalism has conquered fears about the potential trade diversions that increased preferential trade could bring. Evidence in favor of this hypothesis is the positive sign associated with the variable measuring the effect of the FTA accumulation process in origin and destination countries in the SGMT regressions.

4. The decomposition of factors explaining the evolution of intraregional manufacturing trade shows that, as expected, a large part of this evolution in the region and in the world was due to the size and dynamics of economies. However, trade policy played an important role in most of the blocs studied, explaining 15% or more of the variation.

5. In the region, preferential and non-preferential trade policy accounts for approximately 25% of the variation in intraregional trade in manufactures in CAN and CACM. However, in Mercosur, this percentage is close to 0, as it increased slightly due to preferential policy, but fell due to non-preferential policy.

6. Distance negatively affects trade in all regions. However, this effect within Latin America appears to be much greater compared to Europe, North America or East and Southeast Asia. This suggests that there is room for improvement in transport infrastructure policies and trade facilitation measures that reduce effective distances.

Appendix

Theoretical model

The SGMT is specified in a system of three sets of equations, one for bilateral flows and two for multilateral resistors:

$$X_{ijt} = \frac{(Y_{it}E_{jt})}{Y_t}\left(\frac{c_{ijt}}{\Pi_{it}P_{jt}}\right)^{1-\sigma} \quad \text{(A 1.1)}$$

$$\Pi_{it}^{1-\sigma} = \sum_j \frac{E_{jt}}{Y_t}\left(\frac{c_{ijt}}{P_{jt}}\right)^{1-\sigma} \quad \text{(A 1.2)}$$

$$P_{jt}^{1-\sigma} = \sum_i \frac{Y_{it}}{Y_t}\left(\frac{c_{ijt}}{\Pi_{it}}\right)^{1-\sigma} \quad \text{(A 1.3)}$$

The SGMT considers the size of the economies in terms of supply (Y_{it}) and expenditures (E_{jt}), their multilateral location ($\Pi_{it}^{1-\sigma}$, $P_{jt}^{1-\sigma}$) and trade costs (c_{ijt}).

With this model, a bilateral trade cost estimate is obtained for each period (c_{ijt}), without requiring that a symmetry assumption is imposed, as was necessary in Novy's nonparametric methodology (2013). The particular geography of the countries is included in the form of multilateral resistances, as sellers ($\Pi_{it}^{1-\sigma}$,) and buyers ($P_{jt}^{1-\sigma}$). These resistances are weighted aggregations of the effect on trade of relative costs by selling $\left(\frac{c_{ijt}}{P_{jt}}\right)^{1-\sigma}$ and buying $\left(\frac{c_{ijt}}{\Pi_{it}}\right)^{1-\sigma}$. This effect, called market proximity, is inversely related to the relative costs of trading.

The multilateral resistance (RM for its abbreviation in Spanish) are derived from conditions associated with general equilibrium and hence the structural gravitational model designation. RMs comply with this form only if the total supply is the sum of the sales of i to all markets ($Y_{it} = \sum_j x_{ijt}$) and the expense is the sum of total purchases ($E_{jt} = \sum_i x_{ijt}$).

To identify the variables of trade costs, a distinction is made between permanent costs (cp_{ijt}) and those that change over time (cv_{ijt}).

$$c_{ijt} = cp_{ij}\, cv_{ijt} \quad \text{(A 1.4)}$$

The variable (cv_{ijt}) and permanent (cp_{ijt}) components are disaggregated into different explanatory variables in the empirical subsection of this paper. It is useful, for the purposes of parameter identification, to rewrite equation (A 1.1) as follows:

$$x_{ijt} = \frac{Y_{it}}{\Pi_{it}^{1-\sigma}\sqrt{Y_t}}\,\frac{E_{jt}}{P_{jt}^{1-\sigma}\sqrt{Y_t}}\,(cp_{ij})^{1-\sigma}(cv_{ijt})^{1-\sigma} \quad \text{(A 1.5)}$$

The empirical form derived from equation (A 1.5) is as follows:

$$x_{ijt} = \exp\,(\psi_{it} + n_{jt} + \mu_{ij} + \beta z_{ijt}) \times \varepsilon_{ijt} \quad \text{(A 1.6)}$$

where the coefficients of Equation (A 1.6) relate to the parameters of the theoretical model as follows:

$$\psi_{it} = \exp\left(\frac{Y_{it}}{\Pi_{it}^{1-\sigma}\sqrt{Y_t}}\right);\ n_{jt} = \exp\left(\frac{E_{jt}}{P_{jt}^{1-\sigma}\sqrt{Y_t}}\right);\ \mu_{ij} = (cp_{ij})^{1-\sigma};\ \beta z_{ijt} = (cv_{ijt})^{1-\sigma} \qquad \text{(A 1.7)}$$

Databases

The procedure carried out to construct the databases used is described here, paying special attention to the bilateral transactions database, which includes domestic trade flows, indispensable for the empirical analysis developed in this chapter.

Although there are some databases that include domestic trade, they have limited geographic coverage and information is not available for several Latin American countries.[36] Moreover, they raise questions as to their degree of sectoral coverage when working with a certain level of aggregation.[37]

This paper examined two aggregate sectors, taking the major sectors of ISIC, revision 3: the primary sector, which includes agriculture, livestock, hunting, and forestry, plus fishing (sector AB), and the manufacturing sector (sector D). The geographic coverage extends to those countries for which it was possible to obtain the information at the desired level or, alternatively, reconstruct the data using the procedures outlined below.

The database covers 112 countries, including most of the Latin American economies, for the period between 1995 and 2015. The countries included represent more than 90% of world trade in the primary sector and 94% of the manufacturing sector. The complete list is included in Table A 1.1 (p. 70).

Data sources used include the National Accounts - Analysis of Main Aggregates (AMA) database of the United Nations Statistics Division (UNDS), for production and value added data for the primary and manufacturing sectors;[38] the World Development Indicators (WDI) database of the World Bank, for value added data for the primary and manufacturing sectors;[39] the Input-Output Tables (IOT) of the OECD statistical database, for production, value added, gross and net exports data for the primary and manufacturing sectors;[40] and the BACI database of the Center for Prospective Studies and International Information (CEPII), for bilateral trade data at the six-digit level of the Harmonized System,

36. Arvis et al. (2015), and more recently the ITPD-E base, developed for the United States International Trade Commission (Borchert et al., 2021). See Gravity Portal at https://www.usitc.gov/data/gravity/itpde.htm.

37. On the one hand, the databases that report sectoral totals based on more disaggregated data do not specify in all cases whether these totals arise from considering all the subsectors or only those for which information could be obtained. On the other hand, data was not available for some subsectors; in those cases, the total for the sector was not reported.

38. Available at https://unstats.un.org/unsd/snaama/Index.

39. Available at https://databank.worldbank.org/source/world-development-indicators#.

40. Available at http://www.oecd.org/sti/ind/input-outputtables.htm.

in its 1992 version (HS-1992). [41]An advantage of the BACI database is that it reports statistics in which a harmonization process has been carried out between what is declared by the importing country and what is declared by the exporting country. The data are expressed in free on board values (FOB) and the original information source is the United Nations Statistical Database on International Trade (Comtrade).

To build the database of bilateral transactions, it was necessary to develop four databases (all in current dollars), which were then combined: production, total exports, domestic transactions, and bilateral trade flows.

The last step consisted of merging the database of bilateral trade flows, after the aforementioned corrections, and the database of domestic transactions, which results in a database covering the period 1995-2015 for a total of 112 economies, for the primary and manufacturing sectors.

In addition to the data corresponding to bilateral trade flows and domestic transactions, information was collected on the characteristic variables of the gravity model of trade. The two main sources are the Gravity database, developed by CEPII, and the Dynamic Gravity Dataset (DGD), developed for the United States International Trade Commission (USITC).[42]

A list of the assumptions and all the transformations performed can be found in Moncarz et al. (2021).

Calculation of MFN liberalization and preferential indicators

The MFN liberalization indicator ($rNMF_g^s$) for the sector (s) and the group (g) are obtained from the ratio of MFN tariffs for the period of analysis:

$$rNMF_g^s = \frac{(1 + NMF_{g15}^s)}{(1 + NMF_{g95}^s)}$$

where tariffs NMF_g^s are calculated as the simple average of the members of the group (*g*) for the year of interest. Therefore, MFN liberalization is observed when indicator $rNMF_g^s$ is less than one.

For the calculation of the preferential liberalization indicator, the trade preference margin (MP) for each sector (*s*) and bilateral relationship (*i, j*) is first calculated from the relationship between the MFN tariff and the preferential tariff applied (A):

$$(1 + MP_{ijt}^s) = \frac{(1 + NMF_{ijt}^s)}{(1 + A_{ijt}^s)}$$

41. Available at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=37.

42. See Gravity Portal at https://www.usitc.gov/data/gravity/dgd.htm.

The simple average of this margin is then calculated for each sector (*s*) and group (*g*). Once these simple averages have been calculated, the ratio for the period of analysis is calculated to obtain the preferential liberalization indicator:

$$rMP_g^s = \frac{(1 + MP_{g15}^s)}{(1 + MP_{g95}^s)}$$

In this case, if the indicator rMP_g^s is greater than 1, it indicates that the preferences increased, i.e., applied tariffs fell more than MFN tariffs.

List of countries included in tables

The following list breaks down the countries and territories included in each table:

Central America and the Caribbean:

- Central America: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.
- The Caribbean: Cuba, Dominican Republic, Haiti, and Jamaica.

North America: Canada, Mexico, and the United States.

South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela.

Europe: Austria, Azerbaijan, Belarus, Belgium-Luxembourg, Bosnia and Herzegovina, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Moldova, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom.

Pacific: Australia, Fiji, New Zealand, Samoa and Tonga.

Central and South Asia and Eurasia: Bangladesh, India, Kazakhstan, Kyrgyzstan, Maldives, Nepal, Pakistan, Russia, Turkmenistan, and Turkey.

East and Southeast Asia: China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

Africa: Angola, Benin, Burundi, Cameroon, Cape Verde, Côte d'Ivoire, Egypt, Ethiopia, Gambia, Guinea, Guinea-Bissau, Kenya, Madagascar, Malawi, Mauritania, Mauritius, Morocco, Nigeria, South Africa, Sudan, Tanzania, Tunisia, and Uganda.

Middle East: Iran, Israel, Jordan, Kuwait, Lebanon, Saudi Arabia, and Yemen.

In Table 2.7 the Latin America macro-region includes South America, Central America, and the Caribbean.

The following countries were included under each trade agreement:

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

CAN: Bolivia, Colombia, Ecuador, and Peru.

CACM: Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua.

NAFTA: Canada, Mexico, and the United States.

Asean+3: China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam.

EU+EEA Austria, Belgium-Luxembourg, Bosnia and Herzegovina, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Moldova, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

European Union: Austria, Belgium-Luxembourg, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

Trade facilitation in goods and services

3

Trade facilitation in goods and services[1]

International trade operates as an interconnected network enabling trade flows. Behind these trade flows, there is another network comprising rules, procedures, and regulations associated with different customs formalities, including the delivery of supporting documentation and information for operations, certifications of adherence to technical standards, physical examination and inspection of goods at the border, and permits to transport in-transit cargo, among others. Meeting these regulations is more cumbersome when they are not consistent across national jurisdictions. Lack of simplification and harmonization of these processes may translate into additional transaction costs and potentially reduce or even impede trade. The progressive and ongoing simplification, harmonization, and convergence of these rules is a token of the globalization process. This process is called trade facilitation (TF).

In the past decade, global, regional, and national discussions about ways to boost international trade attached more importance to and increased their focus on trade facilitation. The reason is that these procedures and regulations become more significant in the total cost of trade once tariffs and other non-tariff barriers decrease. While this impacts all firms and all types of products and services, it may have a greater incidence on small and medium-sized enterprises (SMEs) that are making their first incursion into international markets either exporting or importing small volumes of intermediate or final goods.

In general, liberalization measures related to trade facilitation are non-discriminatory, i.e. they impact all exports and imports equally, regardless of their origin or destination. This partly responds to the fact that these measures are adopted unilaterally by countries or in the context of multilateral agreements, such as the World Trade Organization (WTO) Trade Facilitation Agreement signed in 2017. However, these measures may also be adopted in the context of regional integration agreements under which economies may enjoy a certain degree of reciprocal counterparty behavior, driving the motivation for their implementation.

The purpose of this chapter is to compare the current situation across Latin America, using international databases that collect information about trade facilitation procedures and the time and costs involved in foreign trade operations. Policy experiences and country-specific interventions to reduce

1. This chapter was prepared by Marcel Vaillant, with research assistance by Ivana Benzaquen and Matías Italia.

these barriers will also be reviewed, along with their impact. In addition, it will address the role of multilateral and regional agreements in achieving liberalization goals. Finally, the chapter will outline a prospective vision of the challenges posed by current technological changes and their outcomes for the future of trade facilitation practices.

The chapter will show that, while progress has been achieved regarding different trade facilitation dimensions, most of Latin America's indicators continue to lag compared to more developed regions. At the same time, progress within the region is heterogenous at the levels of trade agreements and individual countries. As estimates based on the structural gravity model of trade have shown, higher costs in terms of time, documents, and procedures needed to carry out foreign trade activities translate into lower levels of trade.

Countries in the region have used different instruments to reduce these costs and improve trade facilitation, including single windows for foreign trade (SWFT) or programs to facilitate exports by small enterprises, like *Exporta Fácil*. They have helped decrease costs and increase exports and imports. Added to the digitalization of processes and the use of technology (e.g., data interchange, blockchain), these instruments may enable LAC countries to continue to close the gap in terms of trade costs with more developed countries and regions. Finally, while countries have unilaterally implemented many of these initiatives, existing trade agreements have accelerated trade openness and are expected to continue playing this role.

Trade facilitation and trade policy

Trade facilitation concepts and definitions

Trade barriers are heterogeneous and dynamic. Trade liberalization processes tend to impact the most visible elements first, e.g. those related to tariff policies or quantitative restrictions. When these barriers are removed, more subtle obstacles are unveiled. For example, the time and costs required to complete a foreign trade operation associated with all the applicable procedures. Regarding trade in services, regulatory harmonization is important because it is a critical enabler of international trade.

Mitigating these other obstacles is at the heart of the trade facilitation concept. It comprises the simplification, standardization, digitization, and harmonization of procedures, documents, the payment of fees, the certification of technical requirements, and the inspection of merchandise, among other mandatory formalities for the movement of goods, services, or productive factors between countries that impact the final cost for consumers (Maldonado and Pérez, 2020).

Trade facilitation comprises the simplification, modernization, and harmonization of import and export procedures.

Trade facilitation plays a very important role because the inevitable tax controls may hinder trade flow (Barbero, 2010) and highly increase time and monetary costs. In the international arena, recognizing this role has led to the establishment of multilateral organizations, such as the World Customs Organization (151 member states), to simplify customs procedures under agreements between partners. More recently, the WTO Trade Facilitation Agreement was signed and came into force in February 2017. Enforcement of this agreement is monitored by an annual survey conducted by UN regional agencies.[2]

Responsibility for trade facilitation measures lies basically with the public sector, the modernization of which has a high potential impact. The main problems with managing trade facilitation are encountered at ports, airports, and border zones, though some domestic operations are also involved. Along these lines, the most current vision of this issue encompasses trade facilitation across the full supply and distribution chain—without making any distinction between customs formalities, international transit or local transport to the borders—, where competitiveness largely depends on minimizing these costs (Staples, 2015). Box 3.1 presents some helpful definitions that describe different components of trade facilitation initiatives with more precision.

Best practices in the use of information technology for trade facilitation include SWFTs, electronic data transmission, and the use of devices such as quick response (QR) codes or labels to reduce the time required for certificate verification, among other applications for traceability and security of the supply chain (Maldonado and Pérez, 2020).[3]

Authorized economic operators (AEO) are border agencies' response to the increased number of fraud and security threats, introducing stricter border control measures (inspections). Given that these measures may create additional trade costs that could negatively impact firms, border agencies have also implemented multiple initiatives to facilitate lawful trade in this new context. For example, programs for «trustworthy firms, » aimed at increasing the security of supply chains, known as AEO programs, can be highlighted. Firms participating in these programs are certified by national customs administrations to show that they meet relevant security standards across their supply chain. The certification is based on a full and detailed analysis of the firms' facilities, as well as customs and tax behavior.

2. In the case of Latin America, ECLAC is the institution performing the survey (see ECLAC [2019]).

3. Subsection «The impact of technology on trade facilitation processes» below delves into new technological applications that could impact future trade facilitation processes.

Agreements for the movement of in-transit cargo between neighboring countries result from a vision of trade facilitation along the entire chain. Under this model, customs arrangements are conducted at facilities established within each country and do not require border stops. Bank guarantees are used to restrict risks. In South America, the transport truck is commonly used as a guarantee.

Box 3.1
Trade facilitation components

Single window for foreign trade: international trade and transport stakeholders use standardized documents and information at a single point of entry for exports, imports, or in-transit movement. Documentation includes customs declarations, permit import or export applications, along with other documents, such as certificates of origin and commercial invoices.

Joint processing at border crossings: joint border customs controls involve customs documentation review and the conduction of inspections at a single border site, where the customs clearance and inspection outcomes are mutually recognized by the associated customs office.

Authorized economic operator (AEO): some firms that conduct foreign trade operations on an ongoing basis will receive a certification endorsing their security practices and transparency. This will enable them to expedite customs processes.

Electronic data interchange (EDI): this structured data interchange between applications from different organizations largely simplifies communication between public and private sector trade and transport actors. UN EDIFACT—the abbreviation for «Electronic Data Interchange for Administration, Commerce and Transport»—is a global set of rules defined by the UN for the inter-company electronic data exchange between two or more business partners via EDI. It optimizes and standardizes the format of data flows between business partners, replacing incompatible older standards.

In-transit cargo movement: when two neighboring countries trade, in-transit movement means that the customs office of exit is located within the countries and not at the border. The risk of fraud is controlled using bank guarantees or even the carrier's truck.

Source: Authors based on FIEL (2021).

Usually, trade facilitation measures are adopted by countries on a unilateral basis or in the context of multilateral agreements, such as the WTO trade facilitation agreement. Therefore, they are similar to tariff reductions on a non-discriminatory basis. However, free trade agreements, especially in regional contexts, may include trade facilitation provisions that, when implemented, will not discriminate between the origin of imports or the destination of exports. This means that they are implemented under Most Favored Nation (MFN) standards. This ensures that all countries receive the same treatment as the country that is most favored by these commercial

rules. This is another case where the preferential pathway of regional integration complements the multilateral pathway; they reinforce each other (Baldwin and Low, 2009).

In spite of the above, in the context of preferential regional trade agreements, trade facilitation programs may enable reciprocal counterpart behavior. In turn, this may stimulate the implementation of these measures. Moreover, while their application is non-discriminatory in practice, these policies may have a stronger impact on trade between regional partners, given that harmonization would face fewer difficulties.

Trade facilitation measures are similar to non-discriminatory tariff reductions; however, free trade agreements may include trade facilitation provisions that will not discriminate based on origin.

Actions required to conduct foreign trade operations involve costs that are not incurred in the case of domestic transactions. However, as stated above, these costs will apply to all international product origins or destinations. In this regard, they are similar to import tariffs or export duties.[4] Therefore, it is always possible to find an equivalent tariff that makes foreign trade operations more expensive compared to domestic trade. Facilitation instruments will reduce this equivalent tariff, thus decreasing the border effect of each national jurisdiction. Trade facilitation initiatives can fail or be influenced by a trend observed with other trade liberalization measures, such as the more traditional non-tariff barriers (e.g., anti-dumping). As tariffs decrease, incentives for protectionism increase and other instruments are used, such as cumbersome customs formalities.

To counteract these trends, trade facilitation offers innovative instruments associated with the use of technology to conduct foreign trade operations efficiently and at a low cost, i.e. business transactions between residents and non-residents. As stated earlier, these transactions have their own specificities in terms of information management and the mandatory certification of the fulfillment of a multiple set of requirements. Trade facilitation assessment tends to boil down to the time, quantity, and cost of procedures needed to complete an export or import operation.

While time and costs impact all goods and services trade flows, their impact may be even greater in the case of regional or global value chains where the production of goods is performed at different facilities located in different countries, driving trade in parts (components or pieces) and intermediate goods. The capacity for dynamic participation in this process is contingent upon the efficiency to carry out the tasks required by an international trade operation, among other factors. For exports and imports alike, border costs, time, and delivery certainty to meet demand are increasingly important requirements that determine the ability of firms to participate in these trade flows of supplies and intermediate goods (Volpe Martincus, 2017).

4. While import tariffs or export duties, if taken as trading costs, may be equivalent, from the point of view of the state they represent tax income. On the contrary, trade facilitation measures do not have a similar direct impact on fiscal revenue.

Trade facilitation may be particularly significant to achieving a firm's insertion in global value chains.

Trade based on global value chains needs to be supported by precise information on the transit and traceability of shipments, which is favored by technological change and process digitalization. However, as will be discussed below, this type of information is nowhere close to being used to its full potential to improve the performance of border interventions. The second section of this chapter includes some illustrative examples.

Trade facilitation indicators associated with trade in goods

A comparative analysis of the Latin American situation

The Organisation for Economic Cooperation and Development (OECD, 2019) has implemented a system to collect and process trade facilitation indicators (TFI).[5] This system has 11 relevant dimensions to assess these policies which use the methodology laid down under the WTO Trade Facilitation Agreement.[6] This information system enables monitoring of the progress achieved by countries, particularly developing economies, which can introduce the provisions set forth by the agreement in stages. Graph 3.1 describes the different dimensions. These cover a wide range of topics, from technical issues on procedures, documents, and automation to more institutional topics, like governance and impartiality, availability of information, cooperation with border agencies, appeal procedures, and advanced rulings, among others. The graph shows information for 2019; countries are grouped based on their participation in regional plurilateral trade agreements or other benchmark blocs (Table A 1.1 on page 70 shows member states of each agreement or group). The indicator for each dimension ranges from 0 to 2 and increases with the implementation of best practices for each item.

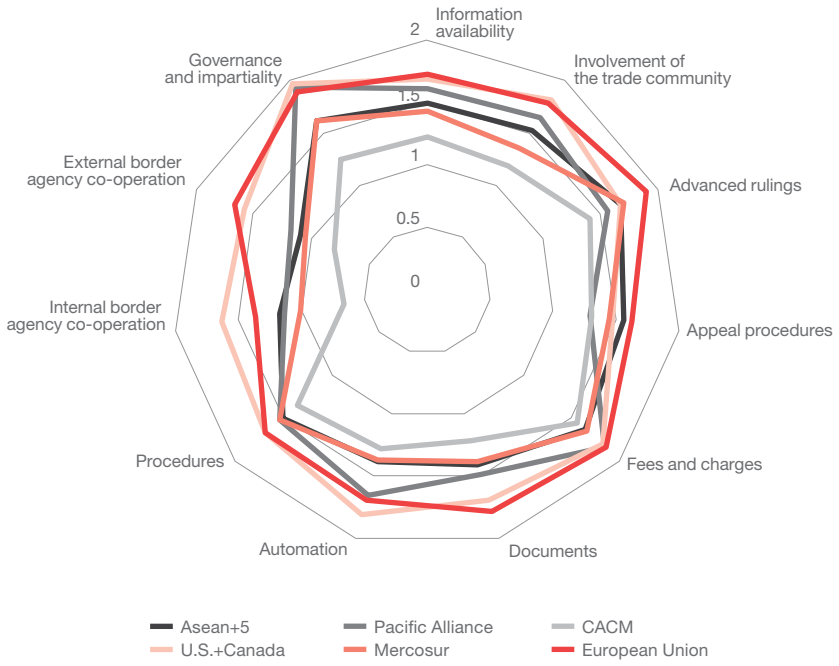
The information to construct the indicator value is based on forms filled in by different types of actors in each country. Therefore, results for comparative exercises should be used with caution.[7]

5. Available on OECD's website: http://www.oecd.org/trade/facilitation/indicators.htm

6. According to the OECD (2018), TFIs are based on a questionnaire that can be compared over time and among different jurisdictions. Data are drawn from three sources: a) public information available on the website of customs and other border government agencies; b) data sent by countries' administrations; and c) information received from the private sector. The construction mechanism involves a full process of primary data review and adjustment that is performed by OECD's technical services.

7. Each dimension is broken down into more specific aspects, scored at three levels: 0 means that the answer is negative or that the discipline does not exist; 1 means that the discipline exists; and 2 means that the discipline is completely fulfilled. The result for each dimension is reached by summarizing the results of these questions for each dimension. The form comprises 133 questions: on average, there are more than 13 questions by dimension. The indicator for each dimension ranges from 0 to 1, a higher score reflecting a better performance of trade facilitation in each dimension.

Graph 3.1
OECD's Trade Facilitation Index Dimensions



Notes: Simple averages in each group of countries for each of the OECD's 11 trade facilitation indicators in 2019 are shown. The indicator values range from 0 to 2, where 2 is the best performance attained. See the Appendix for details about the countries included in each group (p. 155).

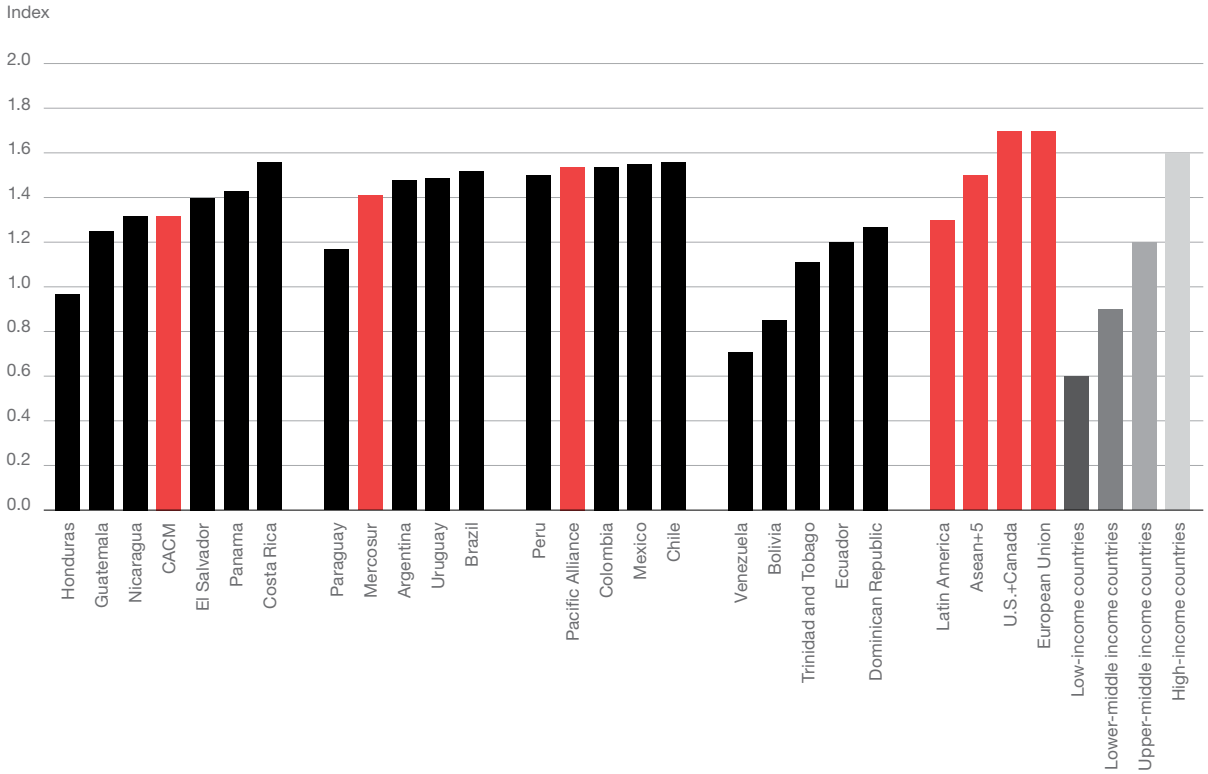
Source: Authors based on Trade Facilitation Indicators data (OECD, 2019).

As the graph shows, the U.S.+Canada and European Union (EU) countries record the highest indicators on average across all dimensions. While internal cooperation mechanisms with government agencies stand out in the U.S.+Canada, the European Union's best practice is the advanced rulings dimension. Central American Common Market (CACM) countries rank the lowest in most dimensions. The Southern Common Market (Mercosur) and the Association of Southeast Asian Nations (Asean)+5[8] countries rank at comparable intermediate levels. The position of the Pacific Alliance countries is slightly better than Mercosur's but lower than the best standard observed. Overall, the average value for the region's plurilateral trade agreements shows that these sub-regional blocs lag in terms of the institutional dimensions associated with governance and impartiality, border agency cooperation, and availability of information. Table A 3.1 in the Appendix (p. 153) shows results by country.

8. Japan, China, South Korea, New Zealand, and Australia have joined the Asean group of nations to form the Asean+5 group.

In a complementary manner, Graph 3.2 shows the average value for the 11 dimensions, with countries grouped once more by bloc and income level. Indicators are shown for each Latin American country.

Graph 3.2
OECD's Trade Facilitation Index



Notes: Each bar represents the average of the OECD's trade facilitation 11 indicators for 2019. The indicator values range from 0 to 2, where 2 is the best performance attained. Simple averages are shown for each country group. The values for Latin America correspond to the simple average of the countries presented in the graph. See the Appendix for details about the countries included in each group (p.156).

Source: Authors based on Trade Facilitation Indicators data (OECD, 2019).

Bars on the right side of the graph show the simple average for Asean+5, U.S.+Canada, the European Union, and Latin American countries, along with four groups of countries according to their level of income in line with the World Bank's country classification by income level (2021e).[9] Latin America's average is clearly below the other world regions used as benchmarks and slightly above upper-middle-income countries. The Pacific Alliance has the

9. Calculations based on the level of income do not include Latin American countries. See the Appendix for details about the countries included in each group (p. 155).

best standard in the region. Member parties Chile, Mexico, and Colombia stand out, with values close to the EU and U.S.+Canada. While the CACM lags behind, Costa Rica stands out in the group, with high values in terms of the implementation of trade facilitation measures that are very close to the most advanced regions. Finally, some Caribbean countries, like the Dominican Republic and Trinidad and Tobago, plus some Andean countries, like Ecuador and Bolivia, rank among the worst performing countries considered on average across the 11 dimensions.

The region's average trade facilitation index is lower than high-income countries and comparable to upper-middle-income countries. Chile, Costa Rica, and Mexico are the best performers.

Other sources of information have also developed trade facilitation indicators. The World Bank's cross-border trade indicators produced for the «Doing Business» report are an excellent example. Based on information collected from surveys of local freight forwarders, customs agents, port authorities, and international traders, these indicators reflect the time and monetary costs of exporting and importing associated with a given foreign trade operation.

In line with the methodology introduced in 2016, different standardized types of cargo are considered for import and export operations. In the case of imports, the operation for each country is based on 15 tons of auto parts imported by its main import partner for the product. For exports, the operation is based on exporting the product having the largest comparative edge over the main export partner for the product.[10]

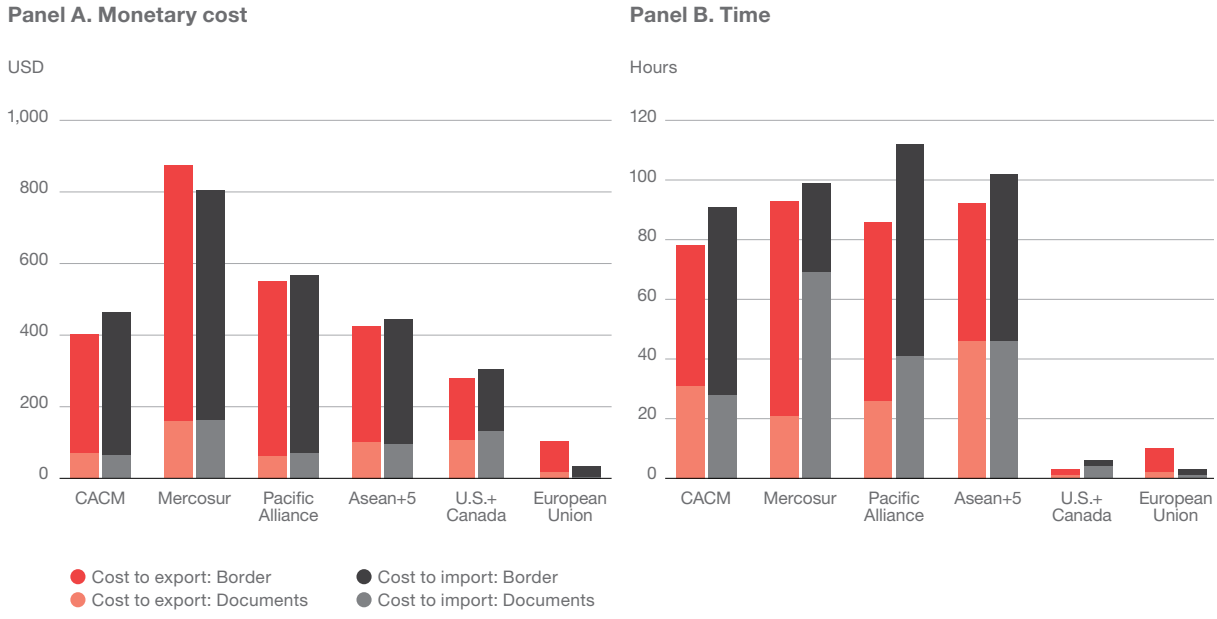
Cross-border trade indicators, in turn, collect information on the time and cost (excluding tariffs) of procedures associated with documentary and border compliance in the export or import process. Compliance with document requirements will measure the time and cost involved in preparing the set of documents that will enable completion of the foreign trade operation. It includes the time and cost required to obtain, prepare, process, and submit or send the documents. On the other hand, compliance with cross-border requirements reflects the time and cost necessary to obtain, prepare, and submit documents at ports or borders, in addition to customs clearance and inspection procedures (World Bank, 2020c).

With this in mind, time and cost indicators help conduct benchmarking exercises to find the region's most restrictive aspects in relative terms. Results are shown in Graph 3.3. While they confirm the above trends, they are far more effective in showing Latin American countries' lagging in relation to the European Union and U.S.+Canada. In particular, monetary costs associated with foreign trade (Panel A) are lower in U.S.+Canada and the EU, although Latin America is heterogeneous in this regard. Mercosur's fees for border formalities are the highest. One step below, the Pacific Alliance charges slightly more than CACM and Asean+5. On the other hand, the poor performance under most plurilateral trade agreements in Latin America compared with the U.S.+Canada and the EU stands out regarding the time required for the completion of operations (Panel B). Border formalities in

10. For more details on the methodology and assumptions associated with each operation, see the World Bank's page https://espanol.doingbusiness.org/es/methodology/trading-across-borders (retrieved May 12, 2021).

Latin American countries demand 80 to 100 hours (similar to Asia), whereas the U.S.+Canada and the EU require less than 10 hours.

Graph 3.3
Cost and time of a standard foreign trade operation



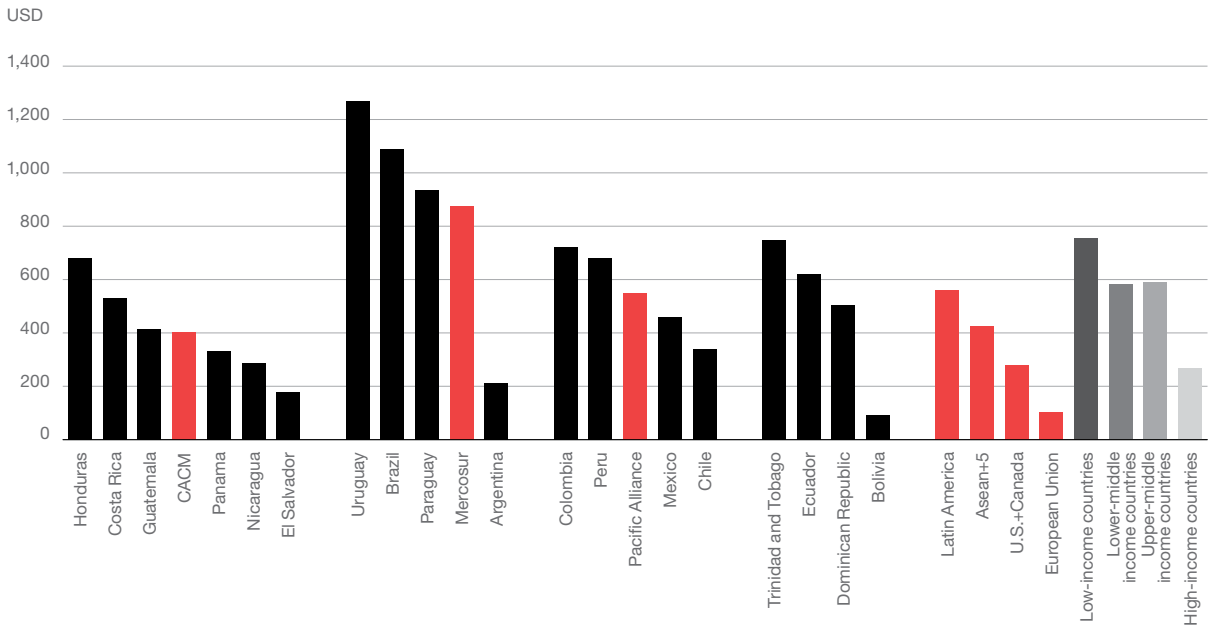
Notes: In the case of imports, the operation is based on 15 tons of auto parts imported by the main trade partner of the sector. For exports, the operation is based on exporting the product having the largest comparative edge to the main trade partner of the sector. Simple averages are shown for each country group. See the Appendix for details about the countries included in each group (p. 156).

Source: Authors based on data from Doing Business (World Bank, 2020b).

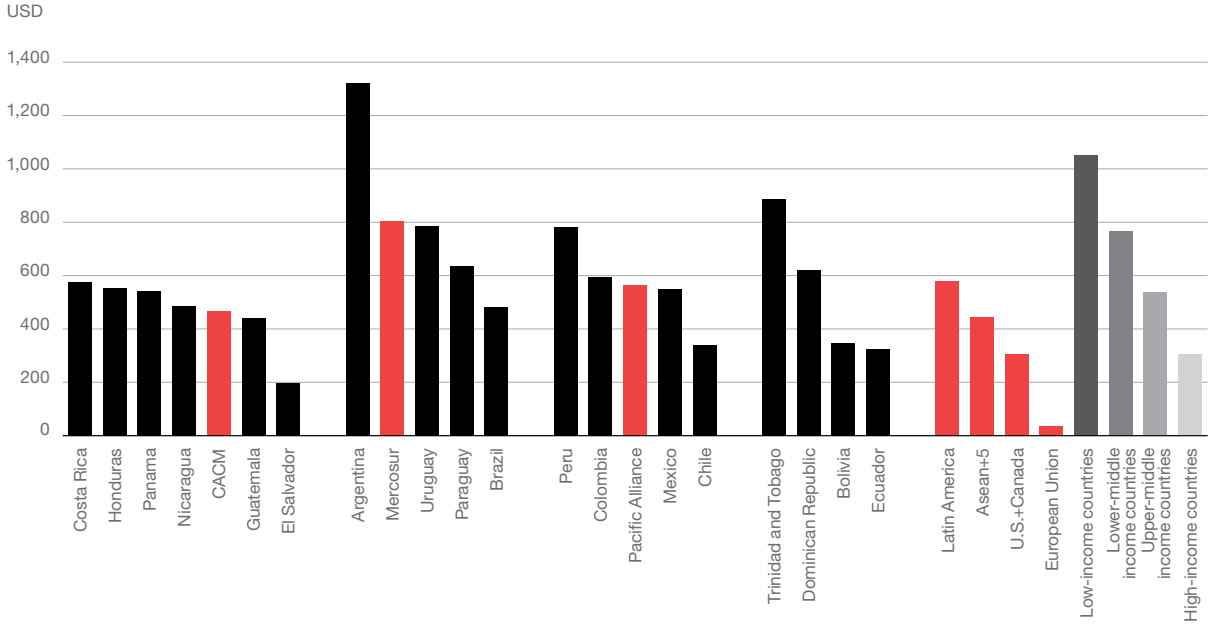
Graph 3.4 complements the above analysis showing these indicators by country, the average for Latin America, and the average for low-income, lower-middle-income, upper-middle-income, and high-income countries according to the World Bank's classification. Time and cost for importing and exporting are presented, now including border and document formalities.

Graph 3.4
Costs and time for international trade by country groups broken down for Latin America

Panel A. Cost to export



Panel B. Cost to import



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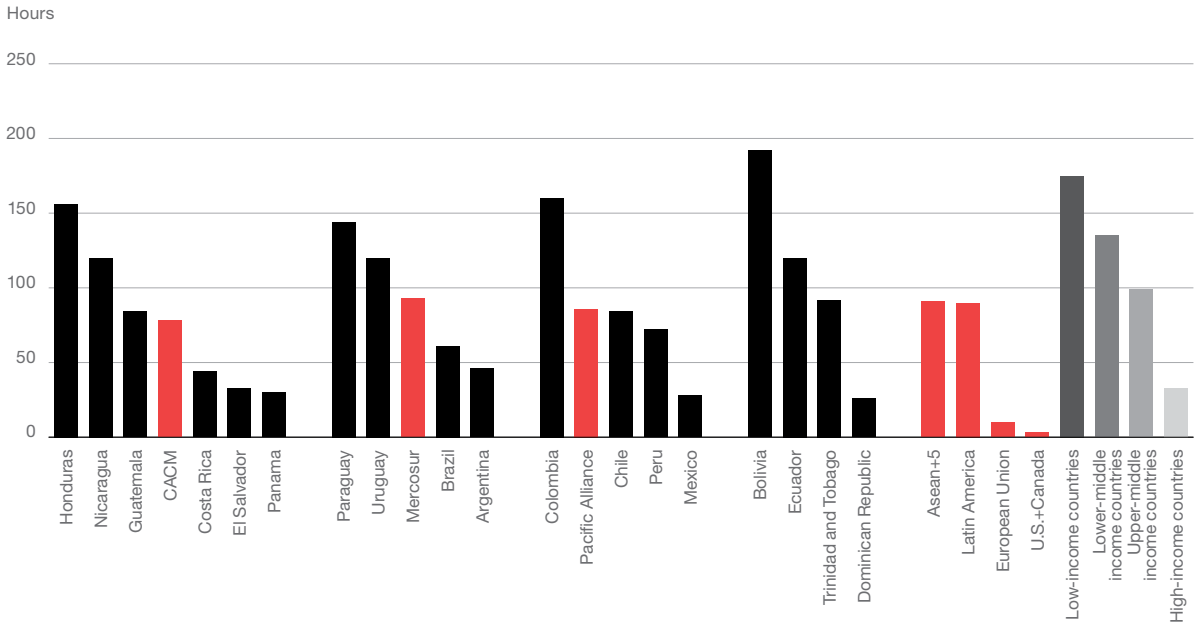
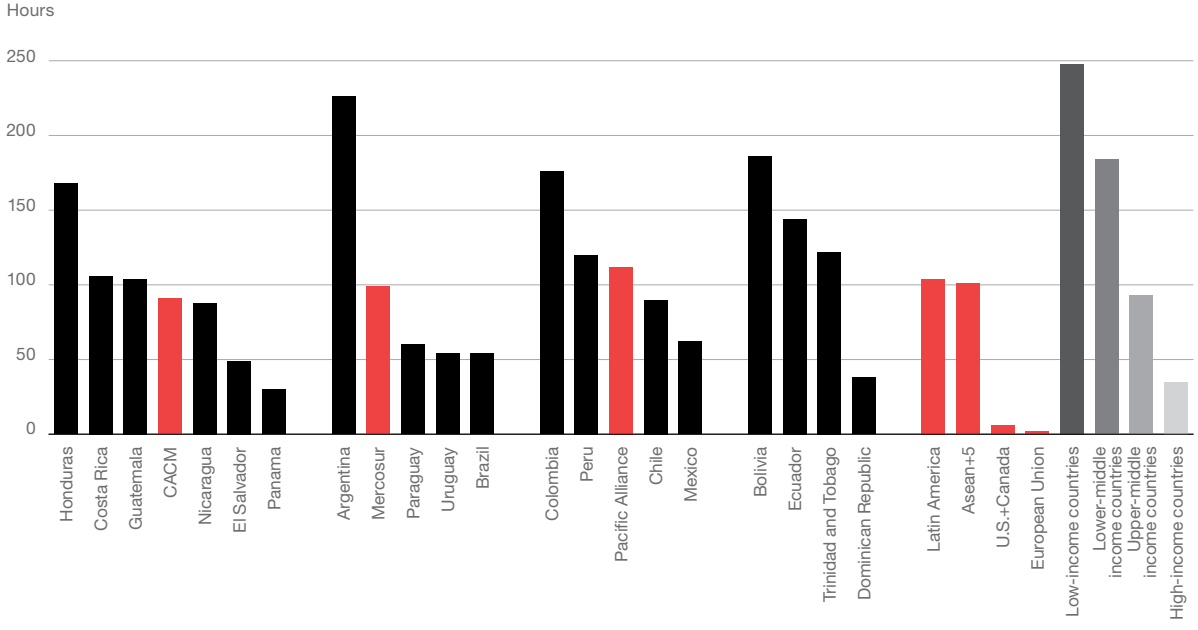
Panel C. Time to export



Panel D. Time to import



Notes: In the case of imports, the transaction is based on 15 tons of auto parts imported by the main trade partner of the sector. For exports, the transaction is based on exporting the product with the largest comparative edge to the main trade partner of the sector. Document and border time and costs are grouped. Simple averages are shown for each country group. The values for Latin America correspond to the simple average of the countries presented in the graph. See the Appendix for a list of the countries included in each group (p. 156).

Source: Authors based on data from Doing Business (World Bank, 2020b).

The Latin American average shows no significant differences regarding the time required to complete import and export formalities (Panels C and D), which is about 100 hours. However, striking differences can be seen between countries. For example, Argentina is one of the slowest countries in the region to complete import formalities (above 200 hours), but the time to finalize export operations is significantly lower (less than 50 hours). Mexico, Panama, the Dominican Republic, and El Salvador are among the best performers for imports and exports alike, coming close to high-income countries.

With differences between countries, Latin America's time and costs for importing and exporting are comparable to upper-middle-income countries but significantly greater than high-income countries.

Regarding payment of fees and duties required for border formalities (Panels A and B), Latin America's performance on average is comparable to upper-middle-income economies. More specifically, the region's cost to export is 5% lower than upper-middle-income countries and the cost to import is 8% higher. The gap is much deeper vis-à-vis high-income economies (210% to export and 190% to import). Bolivia, Chile, Ecuador, and El Salvador are among the best import performers in the region, while Chile, Panama, Argentina, Bolivia, and El Salvador are among the countries with the best export performance.[11]

In most countries, the value of these indicators has remained unchanged over time. There have been some exceptions in recent years, notably, Argentina and Brazil recorded improved indicators. The implemented reforms that may be linked to these changes include the removal of non-automatic licensing requirements (although these were reintroduced in 2020) and the licensing system for importing in Argentina, and the SISCOMEX electronic portal and electronic import systems in Brazil.

Impact of trade facilitation variables on bilateral trade flows

How do the outcomes of the structural gravity trade model (SGTM)[12] developed in Chapter 2 integrate with the comparative analysis of trade facilitation indicators described above? To answer this, the following analysis undertakes an extension of the estimate of the second stage of the SGTM that helps explain the role of the most permanent components of bilateral trade drivers, such as geography (e.g., distance). This extension includes a measure of trade facilitation costs associated with export/import operations of the *i, j* country pair (FC_{ij}). The equation is the following:

$$e^{\widehat{\mu}_{ij}} = \exp\left(\vartheta_i + \psi_j + \gamma_1 sl_{ij} + \gamma_2 is_{ij} + \gamma_3 con_{ij} + \gamma_4 lc_{ij} + \gamma_5 ln(\mathrm{d}_{ij}) + \gamma_6 ln(FC_{ij})\right) \times \varepsilon_{ij} \qquad (3.1)$$

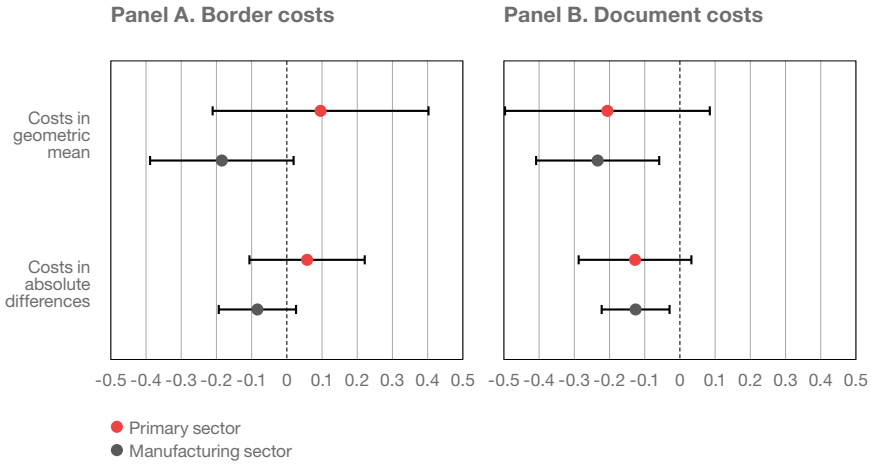
11. Table A 3.2 in the Appendix shows a more detailed perspective (p. 154)

12. Traditionally, this model predicts bilateral trade flows based on the size of the economy and the distance between countries. The model suggests that trade between two countries is proportional to the size of each country's economy and inversely proportional to the distance that separates them (larger distances make trade less attractive).

This equation matches equation (1) in Box 2.1 of Chapter 2.[13] The trade facilitation indicators measured correspond to the average for the 2009-2015 period.[14] Two World Bank (2020b) indicators were used for the costs of procedures associated with the fulfillment of the above-described mandatory foreign trade document and border requirements. The value of these indicators is defined by country (either as exporters or importers) and is calculated as the result of the geometric mean between *i* and *j* (the export indicator for *i* and the value as importer for *j*). Alternatively, the absolute difference between the index value for country *i* as an exporter and country *j* as an importer can be used. In both cases, lower costs, along with a narrower difference between exporter and importer costs, reflect a larger volume of bilateral trade. Graph 3.5 shows the ratios for the above trade facilitation variables included in the second stage of the SGTM used in Chapter 2 (Table 2.7, p. 105). The resulting estimates are as expected, especially in the manufacturing sector: the lower the costs of border and document formalities, the larger the volume of bilateral trade.

Graph 3.5

Trade facilitation as a driver of structural bilateral trade



Notes: Ratios estimated under Poisson pseudo-maximum likelihood model (PPML) and confidence intervals (95%) are shown. Trade facilitation indicators are measured for the average of the 2009-2015 period. All regressions include the fixed effects of origin, destination, and traditional controls (one or both countries in the bilateral relationship are landlocked, one or both countries are an island, they share a common border or language, the distance between the countries). In addition, interactions between five macroregions were included: Latin America, North America, Europe, East and Southeast Asia, and the Rest of the World. The International Standard Industrial Classification (ISIC, Revision 3) was used for the primary sector (sector AB) and the manufacturing sector (sector D).

Source: Authors based on Moncarz et al. (2021).

13. See Box 2.1 (p. 104) for more details on the estimation.

14. Information on these indicators is not available for previous years.

Evidence suggests that trade increases when trade facilitation measures are in place.

It is helpful to compare these results with other studies that also used the trade gravity model to evaluate the effect of trade facilitation measures. Martínez-Zarzoso and Chelala (2020) included the SWFT variable for a sample of 176 countries for the period 1995-2017. Their goal was to determine the impact of SWFTs on trade as an answer to the following question: how much will the implementation of these trade facilitation instruments increase trade? The calculation used a two-stage procedure (Head and Mayer, 2014). The first stage includes the fixed effects of origin-time (*it*), destination-time (*jt*), and origin-destination (*ij*), and retrieves the fixed effects of country-time. These are used as dependent variables in the second stage, where the trade facilitation variables (SWFT) are introduced as *it* and *jt* variables. As a result, total trade between two countries that have implemented SWFTs is found to increase 37% on average.[15]

Two other studies, Moïsé et al. (2011) and Moïsé and Sorescu (2013), used a database with variables related to different trade facilitation dimensions. In the first study, the analysis used 12 trade facilitation dimensions and was restricted to a set of OECD countries. The second study covered 16 dimensions and included developing countries.[16] From the point of view of results, Moïsé et al. (2011) found that trade costs for OECD countries would decrease by 10% if measures for the 12 trade facilitation dimensions were implemented at the same time. In addition, the dimensions that seem to have the strongest impact are anticipated rulings, availability of information, formalities and procedures, and cooperation between agencies. On the other hand, Moïsé and Sorescu (2013) concluded that trade costs would decrease by 14.5% for low-income countries, 15.5% for middle-income countries, and 13.2% for high-income countries if there was an improvement in the 16 trade facilitation dimensions.[17]

Services and regulatory divergence

When it comes to services, trade facilitation focuses on economic regulation instead of border issues. Economic regulation sets up a framework of rules for states to develop and implement instruments aimed at attaining public policy goals. Regulatory frameworks impact their regulated activity and, therefore, the economy as a whole. Levels of market competition, the cost of the economic activity, and the productivity of firms are some core dimensions that reflect

15. In addition, as a robustness exercise, the authors used the PPML method instead of log-linear regressions. While the result continues to be positive and significant, the magnitude is much smaller (1%). In addition, it is worthwhile noting that this estimate does not include information about domestic trade, so it has not captured the substitution between domestic and international trade that could originate from trade facilitation.

16. The 12 indicators associated with trade facilitation measures analyzed by Moïsé et al. (2011) are: information availability, involvement of the trade community, advanced rulings, appeal procedures, fees and charges, formalities–documents, formalities–automation, formalities–procedures; border agency co-operation–internal, border agency co-operation–external, consularization, and governance and impartiality. Moïsé and Sorescu (2013) further introduced transit fees and charges, transit formalities, transit guarantees, and transit agreements and cooperation.

17. The study did not include domestic trade either, so it will not be possible to capture the impact of trade facilitation on the substitution between domestic and international trade.

these impacts. Periodically evaluating and reviewing regulatory instruments and entities is a critical government activity.

In the context of a global economic activity that expands coverage to service sectors in addition to goods, regulatory framework divergence becomes an obstacle to internationalization. The increase in global economic integration, particularly the development of global value chains (see Chapter 6), raises the issue of bilateral regulatory compatibility. Not only should rules be helpful for the domestic economy but they must also be able to function harmoniously with the rules established in other economies with which trade and investment relations are established. These rules of interaction will condition the capacity of national jurisdictions to integrate and, in this regard, function as a determinant of a country's competitiveness.

Preferential trade agreements, both regional and extra-regional, moved in the direction of regulatory harmonization at the same time as progress was made in liberalizing the services sector in international transactions. As highlighted in Chapter 2, economic integration agreements (EIAs), which go beyond free trade agreements in terms of trade liberalization, have become a predominant modality since 2000. In this context, regional plurilateral trade agreements took a big step forward. As this process gained momentum, there was a growing demand for service trade regulations to be harmonized in economic integration agreements.

The limited availability of information, especially data that cover a broad range of Latin American countries, makes it difficult to assess this matter. The goal is to compare countries and create indicators that can measure the degree of compatibility between divergent national regulations.

The OECD Services Trade Restrictiveness Database is a helpful source of information that covers some of the region's countries.[18] The OECD calculates the service trade restrictiveness indices (STRI) for 22 sectors in member states, in addition to Brazil, China, Costa Rica, India, Indonesia, Kazakhstan, Malaysia, Peru, Russia, South Africa, and Thailand.[19] This database created in 2014 includes over 40 countries and covers more than 80% of trade in services globally. It is part of a broader program that not only develops indices but is also an information and tool application system to analyze regulatory harmonization processes that facilitate trade in services.

Using these data, the comparative situation of some Latin American countries can be described (Brazil, Chile, Colombia, Costa Rica, Mexico, and Peru).

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18. See the OECD's website: https://www.oecd.org/trade/topics/services-trade/

19. It would be helpful to make an effort and enlarge the coverage of these indicators to include the other countries in the region: they may represent a critical input for the design and improvement of regulations in these fields.

For each sector, STRIs reflect five types of regulatory restrictiveness that impact either trade or productive integration between countries: a) restrictions on the entry of foreign firms (limited stock ownership; nationality or residency requirements for firm's managers; restrictiveness to foreign investments both for purchasing, and mergers and acquisitions, along with equity control and special sectoral measures); b) restrictions on the movement of natural persons (quotas by country, labor market assessments, length of stay for foreign individuals who provide internal services to a firm, temporal outsourced services); c) other discriminatory measures (against foreign service suppliers; taxes and duties, subsidies, access to procurement; national standards different from international standards); d) barriers to competition (competition policies; state-owned firms, and relevant preferences; special regulations governing competition in public service networks); and e) regulatory transparency (availability of information, processes for inquiries before regulatory amendments are introduced; administrative procedures regarding the establishment of a firm and visa requirements).

Regulatory trade restrictiveness indicators are grouped into five dimensions: entry of foreign firms, movement of natural persons, barriers to competition, regulatory transparency, and other discriminatory measures.

For each of these dimensions, a range is defined. Then, dimensions are weighted to create compound indices with values from 0 to 1, where 1 is the most restrictive.

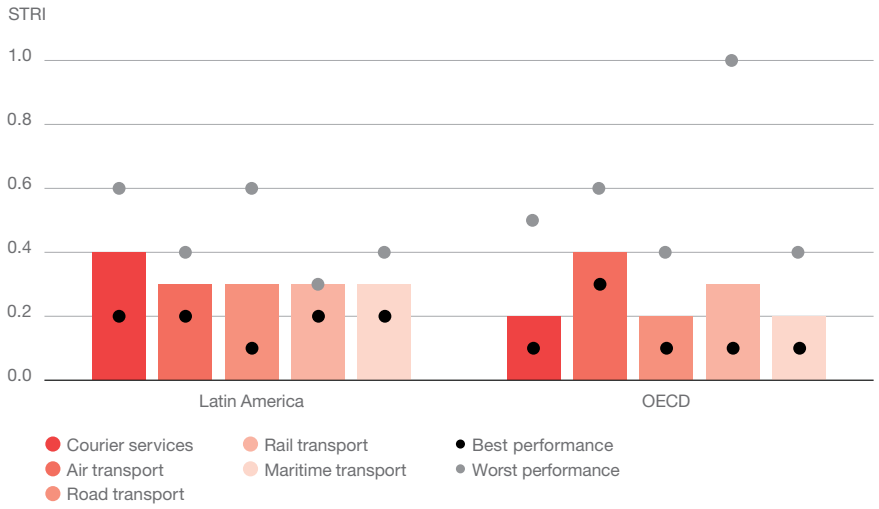
Two groups of sectors were selected: on the one hand, transport (air, maritime, road, and rail) and courier services, and, on the other, logistic services (cargo handling, warehousing and storage, freight transport, and customs service). These services play a key role in the internationalization of economic activity. Moreover, they are associated with the costs of trade facilitation in goods and merchandise that have already been discussed.

Transport

Graph 3.6 presents the STRI for Latin America and the OECD transport service subsectors. The six Latin American countries for which information is available show higher restrictiveness indices than the average in OECD countries. This applies to all cases, except for air transport, where the OECD average is more restrictive. Comparatively, the most restrictive subsectors in Latin America are road transport and courier services.

The STRI database covers the different regulatory dimensions that have been mentioned above (OECD, 2020). The air subsector shows large regulatory harmonization across the regions, with small gaps between values. However, the highest restrictiveness indicator in the OECD applies to the entry of foreign companies. In Latin America, Peru and Mexico also show the main deviations (upwards) in this dimension.

Graph 3.6
Transport and courier services trade restrictiveness, 2020



Notes: The Service Trade Restrictiveness Index (STRI) with values from 0 to 1, where 1 is the most restrictive, is reported. The simple average for Latin America and the OECD is presented, along with values for the worst and best performances. The OECD region excludes Latin American countries. See the Appendix for details about the countries included in each group (p. 157).

Source: Authors based on industry and service data by OECD.Stat (OECD, 2020).

Countries in the region are more restrictive than OECD countries in transport service subsectors, except for air transport.

Courier services show a more heterogeneous outlook. The OECD is the best performer, with Costa Rica, Colombia, and Peru following closely behind. The most restrictive countries in this sector are Brazil, Chile, and Mexico, in three dimensions: restrictiveness to the entry of foreign firms, regulatory transparency, and barriers to competition. Again, the first one of these dimensions shows the largest deviation.

In terms of maritime transport, Chile is the most open country, i.e. with fewer restrictions in place. Colombia ranks almost level with the OECD. Costa Rica and Mexico follow closely, very near the second tier of openness in sea transport. Brazil and Peru are the most closed countries, in which the most significant deviation is the restriction on the entry of foreign companies.

The performance of the rail transport indicator is heterogeneous, with lower levels across the board. In addition, the range of variation is smaller than in the other subsectors. Upward deviations in restrictiveness regarding the entry of foreign firms in Mexico and Brazil stand out. The barriers to competition indicator is higher in Costa Rica compared with the rest of the countries in the region. The other LA countries and the OECD show low restrictiveness in all dimensions, except for South Korea and Israel, the worst performing OECD countries in the rail transport subsector.

In road transport, Mexico shows the largest deviation and the highest STRI level in all dimensions, especially the entry of foreign firms. Similarly, but to a lesser degree, Costa Rica and Brazil stand out. Chile is the most open country followed by Colombia. Both countries are less restrictive than the OECD average.

Logistic services

As with the transport sector, the OECD's STRIs are used to analyze the performance of logistic services in Latin America. In general, this sector shows better openness indicators than transport, although Latin America's average level of restrictiveness is higher than the OECD's.

On average, Latin America's logistic services face a higher level of restrictiveness than in the OECD. Only Chile's levels are similar to the OECD average.

Graph 3.7 shows the simple average for both groups of countries, including the worst and best STRI practices of each logistics service subsector. On average, Latin America always presents a higher level of restrictiveness than the OECD in the four subsectors, being the best practice in the region comparable to the OECD average. In the customs clearance sector, the region's average is even more restrictive than the worst OECD practice,[20] while the homogeneity of STRI indicators in the other three subsectors (cargo handling, transport, and storage) should be highlighted.

Graph 3.7
Logistic services trade restrictiveness, 2020

Notes: The Service Trade Restrictiveness Index (STRI) is reported, with values from 0 to 1, where 1 is the most restrictive. The simple average is presented for Latin America and the OECD, along with values for the worst and best performances. See the Appendix for details about the countries included in each group (p. 157).

Source: Authors based on industry and service data by OECD.Stat (OECD, 2020).

20. The customs clearance subsector tends to be more dependent on the state's activity and presents more idiosyncratic cases.

Again, performance is analyzed at each dimension (barriers to competition, other discriminatory measures, restrictiveness to the movement of natural persons, restrictiveness to the entry of foreign firms, and regulatory transparency) of the STRIs for each logistic service subsector (OECD, 2020).

The OECD average for the customs clearance subsector is low across all dimensions, while the performance of most Latin American countries considered is slightly more restrictive but very close to the OECD. Mexico is the only country that stands out, with the highest restrictiveness levels across all dimensions. Peru also shows a high level of restrictiveness in terms of regulatory transparency.

Regarding the cargo handling, transport, and storage and warehouse subsectors, the region's countries perform similarly when the different regulatory dimensions are analyzed. Again, OECD countries have the most open standard and Chile is the Latin American country that ranks closer to the OECD (it is even more open in some dimensions of the cargo transport and storage and warehouse subsectors). However, the region's countries are characterized by high restrictiveness in regulatory transparency with Peru and Mexico ranking as the most restrictive. In addition, Brazil is the most closed country in terms of restrictions on the entry of foreign firms in the three subsectors.

Trade facilitation initiatives: cases and impacts

Instruments and cases

Trade facilitation instruments may be developed on a unilateral basis. These are national programs implemented to decrease administrative costs and the time to complete operations. For example, the number of procedures, how easy they can be performed, the uniformity of procedures across countries, and many other questions. It is helpful to review some regional cases of development of these instruments and assess their results.

These instruments may be oriented to simplifying the participation of certain types of firms in export activities. A typical obstacle is high fixed export costs, a barrier for micro, small, and medium-sized enterprises (MSMEs). This problem is even more serious in developing economies with less efficient foreign-trade-related activities. There may be opportunities in international markets for these firms, but they may not be able to leverage them because of the scale of operations, which then becomes a barrier to entry.

To overcome this obstacle, the *Exporta Fácil* program was implemented, one of the trade facilitation instruments supported by the WTO-led Aid-for-Trade initiative.[21] It is aimed at expanding the participation of MSMEs in international trade by introducing simplified postal services. This program attracted the interest of different multilateral agencies that provided funding and technical support for the development of these initiatives.

The goal of *Exporta Fácil* is to expand the participation of MSMEs in exports by introducing simplified postal services.

Exporta Fácil was first introduced in Brazil (OECD and WTO, 2010). It initially aimed to improve the competitiveness of Brazilian MSMEs by simplifying their access to international trade. Under this program, the Brazilian postal service offered its broad network of 8,000 sale points to export goods at a much lower cost than competitors. Thanks to the cooperation between the government, the postal service, and customs, *Exporta Fácil* helped reduce the number of forms required to ship packages under 30 kg with a value of less than USD 10,000. This threshold was later raised to USD 50,000. In addition, exporters did not need to engage with other authorities involved in the export process, such as customs and sanitary, environment and export agencies. As a result, MSMEs increased their share of export activities, and a broader range of Brazilian products could be exported to more destinations.[22]

The program in Brazil was then replicated in other Latin American countries after being included among the priority projects of the Initiative for the Integration of the Regional Infrastructure of South America (*Iniciativa para la Integración de Infraestructura Regional en Sudamérica*, IIRSA). Peru launched a similar project in 2008, followed by Colombia and Uruguay in 2009, Ecuador in 2011, Chile in 2015, and Argentina in 2017, among others.[23] This instrument helped reaffirm that postal services can play a critical role in the social and economic development of countries. In addition, it highlights the significance of developing and strengthening postal infrastructure in South America so that governments can support regional integration and the implementation of an inclusive approach to public policies. Along these lines, the sector is already part of IIRSA infrastructure projects.

Single windows for foreign trade are another common instrument for implementing trade facilitation policies. Moreover, they can be especially beneficial to MSMEs. Some of the difficulties MSMEs face in their international expansion are the lack of access to specific trade information and specific knowledge needed for a foreign trade operation; missing institutional mechanisms for inquiries, and non-conformity to international standards (ESCAP, 2016). In this context, SWFTs are a key trade facilitation measure to meet these challenges.

21. The Aid-for-Trade initiative was launched at the WTO Ministerial Conference held in Hong Kong in 2005. It is aimed at providing market access support to developing countries in articulating, communicating, and integrating their trade-related goals, and having donors aligned.

22. With Exporta Fácil, the volume of exports rose from USD 0.19 million in 1999 to USD 254 million in 2010 (OECD and WTO, 2010).

23. The program was expanded to other countries, such as Venezuela, but the date of implementation is not available. However, there is no complete list of the countries where it was implemented.

Costa Rica's SWFT is a very interesting example for its positive impact on exports, particularly international sales by SMEs (see Box 3.2).

Box 3.2
Costa Rica's SWFT: a good example of an expedited operation that reduced time and costs

Costa Rica's SWFT was introduced by Law 7638 in November 1996. It operates electronically for imports and exports based on two modules: an external module for the exporter, the importer, and customs agencies; and an internal module, where authorities and public entities interact. Before the SWFT, due to its size, Costa Rica had an export-import process in place that involved 22 entities, including relevant forms and the traditional duplication of information. All formalities were concentrated in the capital city, and the public and private sectors were not coordinated. The SWFT helped modernize the state and make it attractive for investments, production, and exports. The different public entities that issue sanitary authorizations and certificates, certificates of origin, and others were successfully integrated into the system.

In particular, the private sector plays a critical role in Costa Rica's SWFT, given its direct involvement in the strategic conception and management of the instrument. This ensures fast adaptability where necessary, along with more stability and sustainability from the administrative and financial side. In addition, it favors a service payment model that secures resources for the SWFT operation, while imposing an obligation to maintain a high level of quality. For example, the SWFT quickly introduced technological improvements, such as the SWFT integrated system (*Sistema Integrado de Ventanilla Única de Comercio Exterior*, SIVU-CE), a tool designed to reduce the cost of export intermediaries (especially for SMEs) and expedite operations. The SWFT integrated system was developed gradually and had a positive impact on exports. It was particularly beneficial for firms coordinating their activity with many agencies located in other regions (Elorza, 2012).

In 2011, the Costa Rica branch of the Georgia Institute of Technology (Georgia Tech) Trade, Innovation, and Productivity Center conducted a study to estimate the potential savings that this system could generate in terms of costs, time, and environmental impact. The study findings revealed that the new SWFT system could help save, on average, 79% of the total time and 78% of the total cost required to complete export and import permit formalities, while helping decrease an average of 96% of CO2 emissions and 66% of paper use (Thorrens, 2020).

In March 2014 the SWFT 2.0 was implemented, an automated interoperable system that interchanges information to facilitate compliance with international regulations and treaties. System achievements include more expedited permit and certification procedures, reducing waiting time and costs; 24x7x365 service availability of all border institutions; digital signature use across the whole process, enhancing security; electronic payment for all transactions; traceability of all processes performed on the system; less paper use to achieve fully automated and electronic operation (IDB-INTAL, 2018).

As of 2017, 14 LAC countries had received investment loans to implement SWFTs.

Investment projects have also been implemented in other countries across the region to set up and improve SWFT.[24] As of 2017, 14 LAC countries had received investment loans focused solely on SWFTs or including a component for the establishment, implementation, update, or interoperability of this instrument (OECD and WTO, 2017b). These are minor investments intended to reduce trade costs. In the case of Peru, the results of these initiatives are very positive because the SWFT expanded its operations thanks to the investments made, becoming a world-class single window. Results attained by 2020 included the involvement of 27 institutions (17 from the public sector, 9 business associations, and 1 port administrator); a 25% decrease in the time required to complete formalities, and a 5% foreign trade cost reduction (ECLAC, 2020). More recent SWFT reforms in Peru show other significant improvements. The platform covers more than B2G customs formalities. It includes market advisory services, access to funding, and other B2B instruments (Thorrens, 2020).[25]

Argentina also carried out reforms in terms of trade facilitation initiatives. In 2018, a public-private dialogue was conducted (*Mesa Exportadora*, Export Round Table). The goal was to put in place specific interventions materialized in special projects under an Export Development Plan (Argentina's Ministry of Production and Labor, 2019). It is worthwhile noting that the government interacted not only with the private sector but also with multilateral agencies. The mission of the World Customs Organization (WCO) to provide recommendations on the implementation of the WTO Trade Facilitation Agreement is particularly noteworthy.

A set of projects that were carried out with different degrees of progress resulted from this exchange. First, a series of actions to improve SWFTs: expanded coverage, including all government formalities; online integration of operations with the customs on the SWFT portal; improved search engine of the foreign trade information center (*Central de Información de Comercio Exterior*, CICE) for required formalities; enhanced digitalization at the cargo terminal.

The *Exporta Simple* program was also improved: more logistic operators were authorized to provide services under the program; simplified billing system for expedite operation; removal of weight limits. The expansion of the maximum value for exports under the messenger regime was an associated resolution of a more general impact. Intraregional trade highlights the implementation of digital certificates of origin for transactions with Brazil and Uruguay.

Moreover, since 2017, Argentina has had an authorized economic operator program in place. Firms that meet the applicable requirements can access benefits to enhance the efficiency of their foreign trade operations in terms of customs formalities. Program coverage was expanded to include

24. For more information on the current status of SWFTs in the region, see ECLAC's briefing note [in Spanish], availble on https://www.cepal.org/es/notas/america-latina-caribe-paises-seleccionados-interoperabilidad-vuce-pcs-existentes-1

25. Uruguay shows the same trend.

small and medium-sized enterprises (SMEs) by reducing the required shareholders' equity; a WCO recommendation. It should be noted that the work methodology is based on a mechanism to follow up on the progress achieved by all identified projects.

The International Transit of Goods (*Tránsito Internacional de Mercanc'as*, TIM) in Central America (OECD and WTO, 2017a)[26] is another interesting trade facilitation initiative implementation experience. The goal was to simplify documents and procedures. TIM is an online system to handle and control the transit of goods, including the establishment of unified border control; the implementation of technology to interconnect entities involved in the customs tracking of goods in transit; system modernization, replacing the different forms used with a single form that contains the information from multiple agencies (including customs, migration and sanitary records); and stronger cooperation between related national agencies.

The first assessment conducted in El Salvador showed that the cost to deliver the goods had decreased by 27%, which helped increase exports to USD 5.1 billion in 2013. The destination of 45% of these exports was LAC (OECD and WTO, 2017a). In addition, exports that used TIM grew 2.7% more than exports using standard transit processes. In 2013, about 2,300 exporters shipped over 400,000 orders selling 3,277 products to almost 9,300 buyers. Another TIM achievement is the single transport document (*Documento Único de Transporte*, DUT), enabling the submission of a single electronic document to the closest customs office.

The simplification and automation of the sanitary registration of food products in Central America is another interesting experience (OECD and WTO, 2017c). Firms wishing to sell foods and beverages in this subregion should meet sanitary registration procedures. While Central American countries are required to accept other Central American countries' records under existing regulations, traders still need to travel to each country to submit the required documentation, which slows down the pace of operations and increases the cost of regional trade. In response to this problem, Central America piloted a project to simplify and automate the sanitary registration of food and beverages processed in the region. In 2016, an online regional system was launched to facilitate acceptance of these records. The project has already improved across five processes and reduced the time required for registration from five to three days. It is further expected to decrease the time, cost, and the number of required sanitary registration documents, which will contribute to economic integration across the region and boost growth.

26. This new transit trade system was implemented at the beginning of the past decade. It applies to road transit trade between Central American countries (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama). This transit regime was introduced progressively in the region's trade corridors.

Impact evaluations and lessons from case studies

The large menu of available reforms described above warrants a review of the micro-level evidence of the impact these have had using methodologies that can isolate the effect of trade facilitation policies from any other factor that may affect the results. In other words, the goal is to find an indication of the causal effect of these reforms.

In Peru, *Exporta Fácil* showed more experimentation, innovation, and diversification of exports, with spillover effects even for non-participating firms.

A study by *Unión Postal Universal* (UPU) reveals that from 2002 to 2008, almost 10,000 firms that had never exported could access foreign markets using the *Exporta Fácil* service in Brazil (Caron and Ansón, 2008). The study also shows that one out of ten Brazilian exporters in 2005 could not have shipped their products abroad without this service. UPU, the program sponsor, pointed out in the concluding remarks that the significant increase in the volume of exports through postal channels did raise the share of Brazilian firms in regional and international trade.

Carballo et al. (2016) also assessed *Exporta Fácil* in Peru. This export mechanism using postal channels simplifies both export procedures and the provision of intermediary services. The study used a single dataset comprising the whole universe of export transactions in Peru for the period 1999-2014, including regular and postal shipping. The authors concluded that the new mode of exporting is associated with increased and more diversified regional exports, higher entry and exit rates, and more export experimentation and learning, both within and between firms. The instrument helps firms launch new products or enter new markets at a low cost. In addition, there are dynamic effects in the sense that firms that enter markets using this postal modality show successful expansion trajectories later. There are also spillover effects, even for firms that do not use this instrument.

The study by Volpe Martincus et al. (2015) delves into customs procedures in Uruguay, where a control system randomly selects either a green or a red channel for inspections. The study reviews the potential effects of this procedure in terms of delays at customs and the resulting impact on exports. A very broad dataset was used, comprising the universe of export operations in Uruguay for the period 2002-2011, including precise information about how long it took to complete the customs inspection process for each operation. The authors concluded that delays caused by customs procedures have a negative and significant impact on exporting firms. In particular, a 10% increase in customs delays leads to a 3.8% drop in exports. This results from higher costs for exporters, which then decrease their sales abroad, and from buyers, who seem to reduce their exposure to firms that are subject to these changes in delivering their products.

Laajaj et al. (2019) analyzed the effects of the digitalization of customs information based on different variables associated with the production of Colombian firms. The reform took place in stages across the different customs offices from 2000 to 2005. This enabled the use of a triple difference strategy that compared the changes in outcome variables between firms that were and were not importers before reform implementation. The same applies to the post-reform period. Then, the difference between these comparisons was

Digitalizing imports increased value added, employment, and productivity for Colombian importers. Reduced corruption, less uncertainty, and shorter customs clearance procedures partly accounted for these improvements.

computed. According to the study, digitalizing imports increased the firms' value added by 6%. In turn, employment, productivity, and the collection of customs duties also rose. As a result, there were winners (importing firms) and losers (non-importing firms). In addition, an examination of these mechanisms revealed that legal actions due to corruption decreased in the reviewed customs, along with the time required to complete customs clearance procedures and their unpredictability.

With regard to the assessment of the TIM experience in Central America, the available information varies at the level of export firm, product, destination, and year, based on the routes used by firms to deliver certain products to certain destinations. Carballo et al. (2018) used this rich source of information combined with detailed export data from El Salvador to examine the impact of this new transit trade regime on the transport sector. In particular, the impact on total freight and insurance charges was explored, and also these charges by exported value, weight, and number of shipments. According to the authors, introducing a new trade transit policy for exports originating in El Salvador that are then shipped to other Central American countries will increase exports and, similarly, drive demand for transport and freight services. As a result, there may not be a decline in freight and transport costs. Findings seem to confirm this assumption. While some components of the new transit trade policy will reduce transport costs—such as faster delivery and a more reliable border crossing, which should have positive effects on equipment idle time, driving hours, and planning—, no systematic effects were found for the trade sector in terms of lower freight costs. In most cases, TIM did not impact ad valorem rates and shipping charges, or, if anything, the impact was slightly positive. However, these effects may not be estimated with precision based on the available data.

Table 3.1 summarizes the trade facilitation policy implementation experiences analyzed in this section. The following lessons can be highlighted. A recurrent problem across the region is that many of these initiatives are not continued. Changes in government, whether keeping the same orientation or not, impact the continuity of programs that require time to mature to reach their full potential. Maintaining initiatives over time, generating information systems to assess them, and changing the initiatives based on the results of evaluations is a simple rule. However, it is not the management standard for most trade facilitation programs. While several evaluations are available, some of which have already been described, many are far from a government decision system that generates a positive feedback loop to optimize trade facilitation management. The aim is that controls associated with trade facilitation instruments are managed in a context where they can be performed fast and do not increase foreign trade operation costs.

Table 3.1
Trade facilitation in Latin America: selected experiences

Program	Country	Start	Coverage	Instrument	Local executing agency	Sponsor multilateral agency	Financier	Source
Exporta Fácil (Easy Export)	Brazil	2001	National coverage for MSMEs	Exports through postal channels regime involving simplification of export procedures and the provision of intermediary services	Brazil Ministry of Communications	Unión Postal Universal (UPU) and Initiative for the Integration of the Regional Infrastructure of South America (IIRSA)	IDB, CAF and FONPLATA	OECD and WTO (2017b), and Caron and Ansón (2008)
	Peru	2007			Prom Perú, SUNAT, and Serpost[/a]		IDB, CAF, FONPLATA, and the World Bank	OECD and WTO (2017b), and Carballo et al. (2016)
	Ecuador	2011			Ministry of Production, Foreign Trade, Investments and Fisheries, and others[/b]		IDB, CAF, and FONPLATA	Carballo et al. (2016)
	Colombia	2011			Ministry of Trade, Industry and Tourism, and others[/c]			OECD and WTO (2017b)
	Uruguay	2009			Ministry of Economy and Finance, Uruguay Postal Service, National Customs Authority, and others[/d]			
	Argentina (called *Exporta Simple*)	2017			Ministry of Production and Federal Administration of Public Revenue		Investment and Foreign Trade Bank BICE (*Banco de Inversión y Comercio Exterior*), and the Bank of the Argentine Nation BNA (*Banco de la Nación Argentina*)	Palmieri (2018)
Construcción de la política nacional logística (PNL) (Logistics National Policy Development)	Ecuador	2010	National	SWFT, National System of Non-Intrusive Inspections, Strategic Road Transport Development Plan, and implementation of port and airport policies	Production, Employment, and Competitiveness Coordination Ministry	IDB	CAF and IDB	OECD and WTO (2017), and Montanez et al. (2015)
Tránsito y transporte (Transit and Transport)	Central America	2011-2013	Regional	TIM for export document and procedure simplification	Central America Economic Integration Secretariat SIECA (*Secretaría de Integración Económica Centroamericana*), and special national authorities	SIECA	IDB	OECD and WTO (2017a), and Carballo et al. (2018)
Alimentos Centroamérica (Food in Central America)	Central America	2016	Regional	Data automation to improve sanitary records and drive regional trade	Special national authorities	SIECA	World Bank Group, USAID, and FIAS[/e]	OECD and WTO (2017a)
SWFT	Peru	2015	National	SWFT improvements	Ministry of Foreign Trade and Tourism	IDB[/f]	IDB	OECD and WTO (2017b)
Mesa Exportadora (Export Round Table)	Argentina	2017-2018	National	SWFT improvements and *Exporta Simple*	Ministry of Production and Labor	World Customs Organization	National government	Argentina's Ministry of Production and Labor (2019)
Apoyo pymes (Support to SMEs)	Colombia	2017	National (SMEs)	Support for SMEs exporting flowers. TFF Project[/g]	Public sector	CBI[/h]	TFF project SMEs	OECD and WTO (2017)

Notes: The programs *Exporta Fácil* in Brazil and Peru, Transit and transport in Central America, and SWFTs in Peru have been subject to technical evaluation.

a/Peru Export and Tourism Promotion Committee (*Comisión de Promoción del Perú para la Exportación y el Turismo*, Prom Perú), National Superintendency of Customs and Tax Administration (*Superintendencia Nacional de Aduanas y de Administración Tributaria*, SUNAT), and Peru Postal Services (*Servicios Postales del Perú*, Serpost).
b/ National Ecuador Customs Service, Ecuador Postal Services.
c/ Ministry of Information and Communications Technologies, National Department of Planning, Postal services, Tax and National Customs Directorate.
d/ Ministry of Industry, Energy and Mining, and Uruguay XXI (investment and export promotion).
e/ United States Agency for International Development (USAID) and the Foreign Investment Advisory Service (FIAS).
f/ In the context of a program for several Latin American countries.
g/ Tropical Flowers, Foliage and Hydrangeas (TFF).
h/ Centre for the Promotion of Imports from developing countries (CBI).

Source: Authors based on the documents in the last column.

Trade facilitation systems are information-intensive. Therefore, it is critical to have support systems that can improve efficiency regarding information. The economy may benefit enormously from the digitalization of customs procedures. In addition, there is growing evidence that the appropriate use of information technologies may have a strong potential impact to improve efficiency and fight corruption in public administration.

SWFTs are at the heart of trade facilitation initiatives and most countries in the region have already implemented them. However, the design and operation of most SWFTs in Latin America are restricted to foreign trade formalities and procedures. While this has successfully reduced time and costs for firms, the direct contribution of SWFTs to the internationalization of SMEs is still limited. At the same time, the B2G approach has been highly positive so far (simplification of procedures). However, SWFTs need a deep conceptual change to become actual building blocks in the internationalization of SMEs. As has already been discussed, SWFTs are becoming platforms that go beyond customs formalities in some countries, offering market counseling services, access to funding, and other B2B instruments.

Trade facilitation reforms introduced in broader programs that include the transport and logistics sectors are more fruitful and generate greater impact because they leverage the full potential of trade facilitation policies.[27] Despite this, designing these programs is more complex because it requires a more detailed analysis of the multiple interconnections that are established.

The role of agreements

The Aid-for-Trade initiative can be a very helpful tool for the implementation of trade facilitation measures in the region's countries.

Trade facilitation measures are applied on non-discriminatory bases. Most of the experiences reviewed at the start of this chapter describe the implementation of new instruments that were initiatives unilaterally adopted by countries. This means that these reforms and changes were promoted by an incumbent government, without any reciprocal counterpart behavior by a trade partner. However, trade agreements played a critical role in driving this process. First, the WTO Trade Facilitation Agreement (TFA) established a standardized framework to develop initiatives in the 11 referred dimensions (see the subsection «A comparative analysis of the Latin American situation»).[28] According to the WTO (2015b), estimates show that the full implementation of the TFA could reduce trade costs by 14.3% on average, along with driving global trade by up to USD 1 trillion per year, with the highest revenues in the poorest countries. The WTO TFA covers disciplines and provisions associated with multiple dimensions:

27. See Moïsé and Sorescu (2013).

28. At the Ministerial Conference held in Bali in 2013, WTO member states concluded the negotiations on the significant TFA that came into force on February 22, 2017, after ratification by two thirds of the signatories. See https://www.wto.org/spanish/tratop_s/tradfa_s/tradfa_s.htm.

- Expediting the movement, release, and clearance of goods.
- Effective cooperation between customs and other trade facilitation competent authorities with a view to simplifying and digitalizing formalities.
- Completion of customs procedures.
- Technical assistance and capacity-building in trade facilitation.

Regarding technical assistance and capacity-building, the Aid-for-Trade initiative was promoted in developing countries. The goal of this initiative is to provide market access support to these states in articulating, communicating, and integrating their trade-related goals, and having donors aligned. Based on the TFA, one of the main lines of action driving the program was to support the financing of projects fostering trade facilitation in line with the directives under the treaty. This instrument is highly recommended for the countries of the region, softening budget restrictions to introduce innovations, while enabling access to technical assistance in support of improvement and reform processes.

The WTO uses a more restrictive definition of trade facilitation, understood as trade cost reductions associated with the simplification of border procedures. Despite this, the other components related to the disciplines covering the classic domains of non-tariff barriers (NTBs), such as non-automatic import licensing, quotas, and anti-dumping, remain in place and predominate in more protectionist national and regional environments. In this regard, much work remains to be done. This helps increase trade policy transparency and remove opaque obstacles to trade.

The national jurisdictions that consolidated a political economy equilibrium in favor of trade openness adopted a stricter stance in relation to trade facilitation. This is defined by the improvement of border management technology, with the objective of reducing time and costs.

Table 3.2 summarizes some of the main plurilateral trade agreements that include references to trade facilitation. The list covers agreements between Latin American countries along with plurilateral trade agreements (more than two members) with non-regional third parties. The WTO TFA was also included in the list. After the TFA was signed, trade facilitation chapters were more frequently included in plurilateral trade agreements. This is another example of complementarity between regionalism and multilateralism.

Table 3.2
Preferential multilateral and plurilateral trade agreements including Latin American countries

Agreement	Members	Date	Name	Articles	Authorized economic operator (AEO)	SWFT	Interoperability
CAFTA-DR	Central America, United States, and the Dominican Republic	Signed: 2004 Entry into force: 2006	Customs administration and trade facilitation (CAFTA-DR chapter 5)	12	NO	NO	NO
Comunidad Andina (Andean Community)	Bolivia, Colombia, Ecuador, and Peru	Signed: 2012 Entry into force: 2012	Resolution 1467, Andean Community Strategic Customs Trade Facilitation Plan	4	Implements	Implements	Promotes
Agreement for an Economic Alliance between Central America and the European Union, (AACUE)	EU members and Central America (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama)	Signed: 2012 Entry into force: 2013	Customs and trade facilitation (chapter 3)	8	NO	NO	NO
WTO	127 members. List of countries in «WTO-TF.»	Signed: 2014 Entry into force: 2017	Trade Facilitation Agreement	24	Promotes	Promotes	NO
Pacific Alliance	Chile, Colombia, Mexico, and Peru	Signed: 2014 Entry into force: 2016	Trade facilitation and customs cooperation (chapter 5 PA)	24	Implements	Implements	Implements
Trans-Pacific Partnership (TPP11)	Australia, Brunei, Darussalam, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, and Vietnam	Signed: 2018 Entry into force: 2018	Customs administration and trade facilitation (chapter 5)	12	NO	NO	NO
USMCA	Canada, the United States, and Mexico	Signed: 2018 Entry into force: 2020	Customs administration and trade facilitation (chapter 7)	24	Implements	Implements	Promotes
Mercosur	Argentina, Brazil, Paraguay, and Uruguay	Signed: 2019 Entry into force: pending	Mercosur Trade Facilitation Agreement	21	Promotes	Promotes	Promotes

Source: Authors based on trade agreement information collected by the OAS Foreign Trade Information System (2021).

Trade agreements can favor the implementation of certain trade facilitation measures, such as the interoperability between customs records and SWFTs.

Trade facilitation agreements highlight three instruments: AEOs, SWFTs, and regional interoperability between customs records databases and the SWFT. While the first two of these elements are applicable nationwide and ultimately refer to the unilateral capability to create them, the last one necessarily has to be part of a broader agreement. It is original in the sense that it requires reciprocal counterpart behavior and has an effect that moves away from the MFN basis and implies trade facilitation measures that reduce costs, particularly under preferential trade agreements. The only reviewed case where the interoperability of SWFTs was implemented is the Pacific Alliance. USMCA and Mercosur stated the goal to promote this instrument but did not make any explicit commitment to implementation. Mercosur discussed traditional trade facilitation aspects, along with including as a discipline the most conventional non-tariff barriers, with the aim to enhance trade policy transparency. In the above example, this was materialized as the removal of consular fees in Uruguay and the statistical fee in Argentina, which actually act as import duties.

Finally, regional trade facilitation projects have some peculiar features that need to be taken into account when assessing implementation and prospects of success: i) review and coordination between countries is time-consuming, so the appropriate time should be allocated for these activities; ii) likewise, when regional systems are set up, unexpected expenses should be factored in to cover the additional time needed for the countries to conclude negotiations; iii) public announcements speed up reforms and force public agencies to commit to the process; iv) private sector involvement helps secure political commitments.

The impact of technology on trade facilitation processes

Digitalizing documents is the first step of a process that is reshaping trade facilitation based on data openness and use, in addition to new information and communication technologies (ICT). The increased utilization of ICTs and the growing digitalization of procedures, combined with the enforcement of regulations, pose at least two challenges:

1. Ensuring consistency across regulatory frameworks that have overlapped through the years. Frequently, frameworks are not consistent worldwide as each regulation was typically developed in isolation.

2. Ensuring compatibility of the processes. Before starting digitalization, the simplification of formalities should be reviewed, along with the adherence of formalities to their intended goals. Cohesion, harmonization, and redundancy should be taken into consideration, i.e. a process reengineering strategy should be carried out.

Because information flows become more rigorous thanks to digitalization, it will improve the efficiency of formalities. Another advantage is that it will minimize errors originating in document handling.

The above will particularly impact trade facilitation and the regulatory harmonization of services associated with international trade, which demands intensive information use and processing. The required time and the obstacles to be overcome are contingent upon the efficiency of information management. If information management is more efficient, not only will trade costs improve but also better decisions will be made at a public and private level. Appropriate information management systems should contain mechanisms for the enhancement and continuous improvement of procedures and formalities.

In a recent study of a group of Southern Cone countries, qualitative and quantitative information was collected about the operating conditions of export infrastructure (ports, airports, and border crossings), along with trade facilitation conditions at these nodal points. The latter involved evaluating the performance of customs agencies and other control areas. This study conducted a survey of 105 export firms and 14 logistics operators and experts across five countries (Argentina, Brazil, Chile, Paraguay, and Uruguay). Their responses revealed positive progress in the simplification of trade formalities. However, respondents pointed out a need to incorporate technological

solutions that facilitate paperless trade, such as the cross-border electronic interchange of certificates of origin, sanitary and phytosanitary certificates, and the electronic request for customs refunds. These improvements would enhance the transparency of operations (FIEL, 2021).

In the context of trade associated with global chains and the fragmentation of production, information technology could solve some of the major challenges faced by this type of productive strategy:

1. Time required from the placement of a purchase order (signing the contract) to order completion, including product delivery (contract performance).

2. Imperfect enforcement of international contracts involving multiple national jurisdictions.

3. Risk and mutual dependence between suppliers and potential buyers.

All these aspects boil down to a need for trustworthy and timely access to information. One way to deal with these difficulties is through a firm's control and ownership across value chain segments. In other words, a firm's organization of a value chain defines how decisions over control are made, how much is outsourced to a supplier, and how many segments will be owned within a single firm's organization (Antràs and Chor, 2013).

Digital transformation (data + technology) plays a critical role in removing the potential hurdle of meeting the new and strict requirements that will need to be fulfilled. Improving interoperability between national and international regulatory agencies is a growing need posed by new trade relationships. Interoperability has several national-international and public-private dimensions. Technological changes have led to digital processing and communication levels that can cover and manage all these dimensions simultaneously. This improves compliance with the new requirements arising from trade relationships.

One step forward is to digitalize all SWFT procedures. This is easier when digitalization has already impacted other parts of the process. The process is enhanced if regulatory segments that are early adopters move forward from a modular perspective. There is a generalized use of single window instruments across the region to concentrate and complete formalities in certain areas. The interoperability between these windows across the borders is less frequent. Regarding trade matters, the potential for interoperability between single windows for foreign trade (SWFT), electronic trade (e-trade), the port community information system (Port Community System, PCS), the maritime single window (Maritime SW), and air cargo transport (e-freight) stands out. This is a highlight in Recommendation No. 36 by the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT, 2017).[29]

29. CEFACT is a subsidiary body of the Economic Commission for Europe (UNECE) responsible for trade facilitation recommendations and electronic business standards. It has global membership and its members are experts from intergovernmental organizations, individual countries' authorities and also from the business community. So far, it has produced 43 recommendations on how to conduct the digital transformation process in the trade facilitation field. See https://unece.org/trade/uncefact/tf_recommendations

The above provides ample grounds for the use of new disruptive technologies in information management, the enforcement of regulations, and public and private decision-making. For example, among distributed ledger technologies (DLT), the most popular at present is blockchain, but there are other applications associated with productive chains and trade, transport, and logistics.[30]

Chang et al. (2020) present several examples of blockchain uses. On the one hand, the management of sectoral supply chains for food, pharmaceutical, and electronic products can be mentioned. Then, there are uses associated with trade, transport, and logistics, summarized in Box 3.3.

In general, digital platforms enable multiple trade stakeholders and partners to share information securely and collaborate through a single shared transaction view, without putting information, privacy, or confidentiality at risk. Several parties may interact and have real-time access to shipping data and documents. Multiple international firms offer services to build transport, logistics, and trade facilitation platforms and interconnect them over a network. Not all of them use blockchain technology; there are many other options out there, and firms in the market that offer different products.

This ongoing technological change impacts the fundamentals of global value chain development based on the trust and security resulting from the exchange of information, one of the major components of these structures according to Antràs and Chor (2013).

As described in the subsections above, some progress has been achieved in the field of digitalization and interoperability platform building in Latin America. SWFTs have moved ahead across the region, even heading for interoperability in a few cases (Pacific Alliance). Some multinational platforms exist, such as TIM in Central America, but similar developments to those reviewed from other parts of the world were not found in LAC. It is a very recent phenomenon that will have an impact in the future. The capacity of countries to attract stages of currently fragmented productive processes, i.e., to increase their participation in global value chains, will also be contingent upon the pace of the region to develop or adopt these new connectivity and information management technologies associated with trade, transport, and logistics.

30. As stated by Ganne (2018), «a blockchain is a decentralized, distributed record or 'ledger' of transactions in which the transactions are stored in a permanent and near inalterable way using cryptographic techniques. Unlike traditional databases, which are administered by a central entity, blockchains rely on a peer-to-peer network that no single party can control. Authentication of transactions is achieved through cryptographic means and a mathematical 'consensus protocol' that determines the rules by which the ledger is updated, which allows participants with no particular trust in each other to collaborate without having to rely on a single trusted third party.»

Box 3.3
Blockchain solutions in trade, transport, and logistics

The port of Antwerp, in collaboration with a private firm that specializes in the application of blockchain technologies to port management (T-Mining),[a] developed a platform that improves the security and efficiency of two major functions: container release and document flow.

In the arena of international transport, Maersk, the container shipping company, developed the TradeLens platform[b] in partnership with IBM. This technology has been used since 2018 in maritime transport and across supply chains, from end to end.

Associated with logistics and freight services, a group of manufacturing, consultancy, transportation, and transport logistics private firms (AB InBev, Accenture, APL, Kuehne, and Nagel) is working with a European customs authority to test a new blockchain solution.[c]

In addition, Blockchain in Transport Alliance (BiTA) is a group of transport and logistics firms that produces standards and promotes the adoption of blockchain technology in this field.[d] It has open membership and its members are the main industry firms in the world.

Finally, UPS has applied for a patent that uses a blockchain solution to optimize the shipping of parcels through an international courier network including several operators.[e]

a. See https://t-mining.be/
b. See https://www.tradelens.com/c
c. See https://www.accenture.com/us-en/insights/blockchain-index
d. See https://www.bita.studio/
e. In line with the description by Chang et al. (2020), the designed system can automatically determine a route on the basis of the service offerings available on a network of suppliers, after the parcel is scanned at a packaging station. As the parcel is shipped to its destination, the blockchain solution records full shipping information and checks fulfillment by every service supplier of the obligations under their respective service offerings. In addition, the system uses smart contracts to pay multiple parties on a postal service network after obligations are discharged.

Keys to promote trade facilitation across Latin America

1. When tariffs and other non-tariff barriers are reduced, customs formalities and border regulations start to account for a significant portion of total trade costs, which makes trade facilitation more relevant and central to trade policies.

2. In general, liberalization measures related to trade facilitation are non-discriminatory, i.e. they impact all exports and imports equally, regardless of their origin or destination.

3. Trade facilitation measures are crucial for firms to deepen their participation in global and regional value chains. The required trade flows demand not only a reduction of costs associated with customs formalities and requirements but also more certainty on merchandise delivery times. As mostly inputs are traded, associated with the different stages of the productive process, not only should quality standards be high, but they must also be timely.

4. Trade facilitation offers innovative technological and digitalization instruments to conduct foreign trade operations efficiently at a low cost, such as single windows for foreign trade (SWFT) and electronic data interchange (EDI) (e.g., mutually accepting digital certificates of compliance with phytosanitary requirements).

5. Most of Latin America's trade facilitation indicators are still lagging compared to more developed regions. At the same time, even within the region, progress is uneven across existing trade agreements and countries.

6. According to the OECD's Trade Facilitation Index, Latin America's plurilateral trade agreements—i.e., the Central American Common Market, the Pacific Alliance, and the Southern Common Market—perform poorly on average. This lag is most noticeable in the institutional dimensions of governance and impartiality, border agency cooperation, and availability of information.

7. Border costs and times in LAC highlight the performance gap between plurilateral trade agreements in the region and those in other parts of the world, such as the European Union. For example, border formalities require 7 to 9 times more hours in Latin America than in Europe. That said, the region is heterogeneous in this regard. Countries such as El Salvador, Mexico, Panama or the Dominican Republic perform well, while Argentina, Bolivia or Colombia show significant delays.

8. Empirical evidence from the estimation of quantitative models on the drivers of bilateral trade confirms the negative impact of the lack of trade facilitation efforts (e.g., the cost of documentation required in foreign trade operations).

9 Trade facilitation also impacts trade in services, but, in this case, regulatory instruments are used. The levels of restrictiveness across the region on trade in services regarding transport and courier services are higher than the OECD's average. In terms of logistics services, however, restrictiveness levels are lower but still lag slightly compared to the OECD. More efforts to collect information from all Latin American countries would provide critical input for the design and improvement of relevant regulations.

10 Different countries across the region have implemented trade facilitation instruments. The Exporta Fácil program was used in Brazil, Colombia, Uruguay, Ecuador, Chile, Argentina, and Venezuela, among others. Single windows for foreign trade (SWFTs) have been implemented in most of the region's countries, with exemplary initiatives in Costa Rica and Peru. Finally, the International Transit of Goods has been used in Central America. These instruments have helped decrease costs and increase export and import volumes.

11 While countries have unilaterally implemented many trade facilitation initiatives, existing trade agreements are driving trade openness and can continue to do so on a sustained basis. The Pacific Alliance's SWFT interoperability is one of the best examples illustrating this type of collaboration.

12 Support for international cooperation under the WTO-led Aid-for-Trade program may be a very helpful tool during both the design and implementation stages of trade facilitation measures. These WTO-led programs may be introduced in interventions addressing transport, logistic, and customs and border formalities. This systemic approach should be structured on modular building blocks to enable sequenced development.

Appendix

Table A 3.1
OECD's Trade Facilitation Index Dimensions

	Information availability	Involvement of the trade community	Advanced rulings	Appeal procedures	Fees and charges	Documents	Automation	Procedures	Internal border agency cooperation	External border agency cooperation	Governance and impartiality
Costa Rica	1.60	1.57	2.00	1.67	1.71	1.33	1.85	1.57	1.09	1.36	1.44
El Salvador	1.48	1.25	1.50	1.11	1.92	1.13	1.80	1.67	1.00	0.91	1.67
Guatemala	1.25	1.25	1.57	1.56	1.62	1.44	0.92	1.58	0.46	0.64	1.44
Honduras	0.86	0.43	1.67	1.56	1.23	0.88	1.30	0.96	0.36	0.55	0.83
Nicaragua	1.10	1.83	2.00	1.56	1.75	1.13	1.33	1.41	0.55	0.73	1.13
Panama	1.70	1.29	1.14	1.22	1.77	1.75	1.42	1.69	0.82	1.09	1.89
CACM	**1.33**	**1.27**	**1.65**	**1.45**	**1.67**	**1.28**	**1.44**	**1.48**	**0.71**	**0.88**	**1.40**
Argentina	1.43	1.43	1.71	1.63	1.77	1.13	1.46	1.65	1.30	1.18	1.56
Brazil	1.57	1.38	1.64	1.50	1.85	1.78	1.46	1.61	0.91	1.09	1.89
Paraguay	0.91	0.86	2.00	1.44	1.00	1.25	0.85	1.46	0.91	0.82	1.33
Uruguay	1.81	1.71	1.46	1.22	2.00	1.38	1.69	1.43	0.91	1.09	1.67
Mercosur	**1.43**	**1.35**	**1.70**	**1.45**	**1.66**	**1.39**	**1.37**	**1.54**	**1.01**	**1.05**	**1.61**
Chile	1.70	1.63	1.36	1.39	1.93	1.38	1.77	1.70	0.91	1.36	2.00
Colombia	1.75	1.71	1.67	1.44	1.85	1.38	1.77	1.33	1.18	1.00	1.89
Mexico	1.24	1.63	1.50	1.00	1.77	1.50	1.92	1.60	1.46	1.55	1.89
Peru	1.76	1.57	1.71	1.38	1.85	1.75	1.23	1.52	1.00	0.82	1.89
Pacific Alliance	**1.61**	**1.64**	**1.56**	**1.30**	**1.85**	**1.50**	**1.67**	**1.54**	**1.14**	**1.18**	**1.92**
Asean+5	**1.49**	**1.52**	**1.67**	**1.57**	**1.65**	**1.41**	**1.39**	**1.51**	**1.17**	**1.10**	**1.61**
U.S.+Canada	**1.68**	**1.80**	**1.67**	**1.47**	**1.83**	**1.71**	**1.82**	**1.68**	**1.64**	**1.58**	**1.96**
European Union	**1.72**	**1.77**	**1.90**	**1.63**	**1.86**	**1.80**	**1.71**	**1.68**	**1.37**	**1.67**	**1.88**

Notes: The values in each group of countries and for each Latin American agreement, for each of the OECD's 11 trade facilitation indicators in 2019 are shown. The indicator values range from 0 to 2, where 2 is the best performance attained. See the Appendix for details about the countries included in Asean+5 and the European Union (p. 155).

Source: Authors based on Trade Facilitation Indicators data (OECD, 2019).

Table A 3.2
Foreign trade operation time and costs

	Time to export: Documents (hours)	Time to import: Documents (hours)	Time to export: Border (hours)	Time to import: Border (hours)	Cost to export: Documents (USD)	Cost to import: Documents (USD)	Cost to export: Border (USD)	Cost to import: Border (USD)
Costa Rica	24	26	20	80	80	75	450	500
El Salvador	9	13	24	36	50	67	128	128
Guatemala	48	32	36	72	105	37	310	405
Honduras	48	72	108	96	80	70	601	483
Nicaragua	48	16	72	72	47	86	240	400
Panama	6	6	24	24	60	50	270	490
CACM	**31**	**28**	**47**	**63**	**70**	**64**	**333**	**401**
Argentina	25	166	21	60	60	120	150	1,200
Brazil	12	24	49	30	226	107	862	375
Paraguay	24	36	120	24	120	135	815	500
Uruguay	24	48	96	6	231	285	1,038	500
Mercosur	**21**	**69**	**72**	**30**	**159**	**162**	**716**	**644**
Chile	24	36	60	54	50	50	290	290
Colombia	48	64	112	112	90	50	630	545
Mexico	8	18	20	44	60	100	400	450
Peru	24	48	48	72	50	80	630	700
Pacific Alliance	**26**	**41**	**60**	**71**	**63**	**70**	**488**	**496**
Asean+5	**46**	**46**	**46**	**56**	**102**	**96**	**322**	**347**
U.S.+Canada	**1**	**4**	**2**	**2**	**108**	**131**	**171**	**173**
European Union	**2**	**1**	**8**	**2**	**17**	**4**	**87**	**29**

Notes: The time and costs of a standard import and export foreign trade operation in each group of countries for each Latin American agreement are shown. In the case of imports, the transaction is based on 15 tons of auto parts imported by the main trade partner of the sector. For exports, the transaction is based on exporting the product with the largest comparative advantage to the main trade partner of the sector. See the Appendix for details about the countries included in Asean+5 and the European Union (p. 156).

Source: Authors based on data from Doing Business (World Bank, 2020b).

Graphs 3.1, 3.2, and Table A 3.1 Clarifications

Information about the OECD's Trade Facilitation Index for 2019 corresponds to the countries and territories below:

Asean+5: Australia, Myanmar/Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, New Zealand, the Philippines, Singapore, South Korea, Thailand, and Vietnam.

Pacific Alliance: Chile, Colombia, Mexico, and Peru.

CACM: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

Latin America: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

In addition, countries and territories were ranked according to their level of income in line with the World Bank's country classification by income level (2021e):

Low income: Burundi, Burkina Faso, the Central African Republic, Chad, the Democratic Republic of the Congo, Ethiopia, Gambia, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Rwanda, Sudan, Sierra Leone, Tajikistan, Togo, Uganda, and Yemen.

Lower-middle income: Argelia, Angola, Benin, Bangladesh, Bhutan, Myanmar/Burma, Cambodia, Côte d'Ivoire, Cameroon, Comoros, the Democratic Republic of the Congo, Djibouti, Egypt, Eswatini, the Philippines, Ghana, India, Solomon Islands, Kenya, Kyrgyzstan, Kiribati, Laos, Lesotho, Morocco, Micronesia, Moldova, Mongolia, Nepal, Nigeria, Pakistan, Papua New Guinea, Senegal, Sri Lanka, Tanzania, Tunisia, Ukraine. Upper-middle income: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Botswana, Bulgaria, China, Fiji, Gabon, Georgia, Indonesia, Jordan, Kazakhstan, Lebanon, Malaysia, Maldives, Montenegro, Namibia, North Macedonia, Russia, Samoa, Serbia, South Africa, Thailand, Tonga, and Turkey.

High income: Australia, Austria, Bahrain, Belgium, Brunei Darussalam, Canada, Croatia, Cyprus, Czech Republic, Denmark, United Arab Emirates, United States, Estonia, Finland, France, Germany, Greece, Hong Kong (China), Hungary, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Latvia, Lithuania, Luxembourg, Malta, Mauritius, New Zealand, Norway, the Netherlands, Oman, Palau, Poland, Portugal, Qatar, Saudi Arabia, Singapore, Slovenia, South Korea, Spain, Sweden, Switzerland, Taiwan (China), the United Kingdom.

Averages are calculated as simple averages between countries.

Graphs 3.3, 3.4, and Table A 3.2 Clarifications

Information about the Doing Business database for 2020 corresponds to the countries and territories below:

Asean+5: Australia, Myanmar/Burma, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, New Zealand, the Philippines, Singapore, South Korea, Thailand, and Vietnam.

Pacific Alliance: Chile, Colombia, Mexico, and Peru.

CACM: Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

Mercosur: Argentina, Brazil, Paraguay, and Uruguay.

Latin America: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, and Uruguay.

European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

In addition, countries and territories were ranked according to their level of income in line with the World Bank's country classification by income level (2021e):

Low income: Afghanistan, Burkina Faso, Burundi, the Central African Republic, Chad, the Democratic Republic of the Congo, Eritrea, Ethiopia, the Gambia, Guinea, Guinea-Bissau, Haiti, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Rwanda, Sierra Leone, Syria, Somalia, Sudan, South Sudan, Tajikistan, Togo, Uganda, and Yemen.

Lower-middle income: Algeria, Angola, Bangladesh, Benin, Bhutan, Burma, Cape Verde, Cambodia, Cameroon, Comoros, Ivory Coast, Djibouti, Egypt, Eswatini, Philippines, Gaza and West Bank, Ghana, India, Solomon Islands, Kenya, Kyrgyzstan, Kiribati, Laos, Lesotho, Morocco, Mauritania, Micronesia, Moldova, Mongolia, Nepal, Nigeria, Pakistan, Papua New Guinea, Republic of Congo, Sao Tome and Principe, Senegal, Solomon Islands, Sri Lanka, Tanzania, Timor-Leste, Tunisia, Ukraine, Uzbekistan, Vanuatu, Vietnam, Zambia, and Zimbabwe.

Upper-middle income: Albania, Armenia, Azerbaijan, Belarus, Belize, Bosnia and Herzegovina, Botswana, Bulgaria, China, Dominica, Fiji, Equatorial Guinea, Gabon, Georgia, Grenada, Guyana, Indonesia, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Kosovo, Lebanon, Libya, Malaysia, Maldives, Marshall Islands, Montenegro, Namibia, North Macedonia, Russia, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Serbia, South Africa, Suriname, Thailand, Tonga, and Turkey.

High income: Antigua and Barbuda, Australia, Austria, Bahamas, Bahrain, Barbados, Belgium, Brunei Darussalam, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong (China), Hungary, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Oman, Palau, Poland, Portugal, Puerto Rico, Qatar, St. Kitts and Nevis, San Marino, Seychelles, Singapore, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Taiwan (China), United Arab Emirates, United Kingdom, United States.

Averages are calculated as simple averages between countries.

Notes to Graphs 3.6 and 3.7

Information about the OECD's Services Trade Restrictiveness Index for 2020 corresponds to the countries and territories below:

Latin America: Brazil, Chile, Colombia, Costa Rica, Mexico, and Peru.

OECD: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, New Zealand, Poland, Portugal, Slovakia, Slovenia, Spain, South Korea, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

The role of transport infrastructure

4

The role of transport infrastructure[1]

Intraregional trade is low in Latin America compared to other regions of the world, partly as a result of the prevalence of high trade costs. A critical component in these costs is the cost of transporting goods. In turn, physical distance, geographical features, and the efficiency of the available means of transport to overcome them influence this cost. The estimate provided in Chapter 2 of this report shows that the impact of these transport costs—represented by the elasticity of trade to distance—is higher in Latin America than in other regions of the world. Moreover, these costs may explain, in part, the low level of intra-bloc trade observed in the region.

This chapter focuses on the study of infrastructure as a fundamental determinant of transport and logistics costs. Within a region, physical proximity among countries makes these costs substantially lower than for extra-regional trade, naturally driving trade between neighboring countries, and originates integration processes that progressively eliminate other trade barriers such as tariffs, technical obstacles, customs procedures, regulations on trade in services, etc. This further strengthens the exchange of goods and services, driving productive integration among economies through the establishment of regional value chains, thereby reinforcing the increase in trade, in this case, of intermediate goods.

However, leveraging the advantage of physical proximity requires interventions and investments in the multiple transport infrastructure components that affect costs. The first of these components is the set of linear infrastructures for land transport—roads and railways—connecting the productive zones within the country of origin between the production sites and the borders, and in the country of destination from the border to the consumer markets. The second is the infrastructure at border crossings, i.e., bridges, tunnels, scales, and integrated customs infrastructure, to enable the passage of cargo and completion of customs procedures. The third component is land connectivity to ports and airports including the loading, unloading, and storage infrastructure at these hubs.

The advantage of physical proximity between neighboring countries needs to be leveraged through investments in transport infrastructure.

1. This chapter was prepared by Lian Allub and Federico Juncosa, with research assistance from Augusto Caro and Matías Italia.

In addition to being affected by the available stock of transport infrastructure and the investments made in improving it, transport costs are also largely determined by how the transport and logistics market works. The productivity of transport and logistics companies is influenced by the economy as a whole. The availability and costs of access to quality inputs, the level of competition in the transport and logistic sector or the effectiveness of market regulations for monopolistic markets, the functioning of the labor market, and access to financing are all factors that influence productivity (CAF, 2018).

This chapter begins with a conceptual discussion of the role of transport infrastructure in the development of Latin America. It highlights its impact on trade and productive integration, emphasizing the complexity involved in analyzing transport. This complexity is owed firstly to the network structure of transport, which implies the presence of substantial indirect effects, and secondly to the spatial dimension of the issue, which involves ubiquitous positive and negative externalities.

The next section in the chapter makes a diagnosis of transport infrastructure in the region, with special emphasis on evaluating the extent to which it enables market access for firms and consumers. This analysis finds that the costs of transport are high in Latin America compared to other regions, particularly for intraregional trade. There is high dependence on maritime transport compared to other modes. Finally, available data on infrastructure stock and the metrics of market access show that this is due to deficient infrastructure, particularly for land transport.

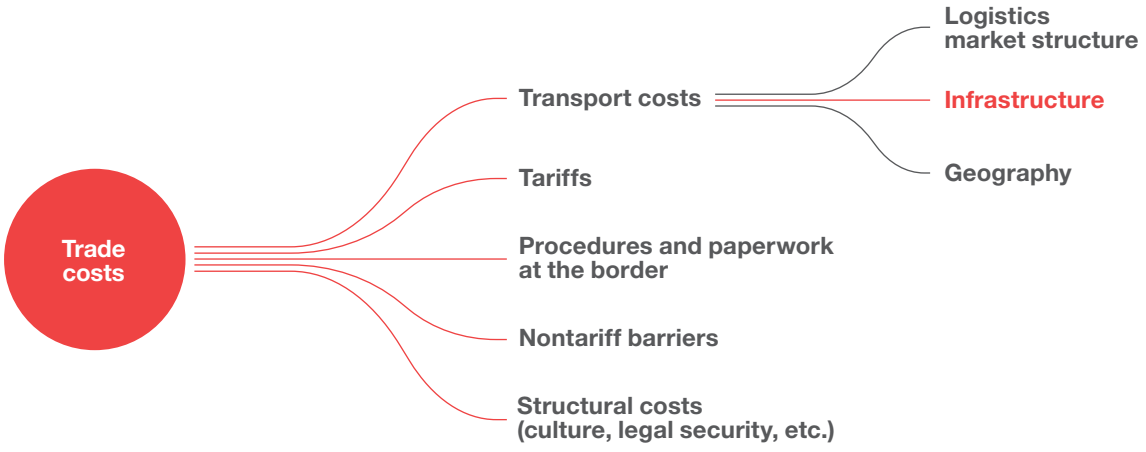
Next, the chapter discusses the main problems involved in measuring the impacts of infrastructure projects. It also presents a set of recent developments in the field of spatial economics to overcome many of these barriers. To illustrate the potential of these tools to inform decision-making processes, a quantitative spatial economics model is applied to two road corridor projects: one in Bolivia and one in Argentina.

The chapter concludes with a section on policies. It highlights important aspects for implementing decisions regarding investment in transport infrastructure in Latin America. It discusses three key instruments for maximizing the impact of investments in the sector: a) the importance of balancing the budget among new infrastructure projects, infrastructure rehabilitation, and infrastructure maintenance; b) the relevance of logistics corridors as policy objectives, focusing on providing support to value chains from beginning to end; and c) the role of supranational organizations and multilateral trade agreements in Latin America in solving the coordination problems in order to improve connectivity among countries in the region.

Conceptual framework

Trade costs in an economy are determined by many variables, including tariffs on imported products, costs associated with customs and other procedures required for foreign trade, nontariff barriers (e.g., phytosanitary regulations), and transport and logistics costs (see Figure 4.1). This chapter examines the role of transport costs in determining trade costs, focusing on the role of the different components of transport infrastructure associated with international trade flows, such as roads, ports, and airports.

Figure 4.1
Composition of trade costs



Source: Authors.

Trade costs and transport infrastructure

As described in the previous chapters in this report, trade policy and trade facilitation play an essential role in determining trade levels between countries. States can also have a great influence on transport costs, another essential element of trade activity. Transport costs depend on (a) transport infrastructure and geography and (b) the operation of the transport and logistics service market.

The modal composition of transport infrastructure affects the sectorial structure of the economy.

Transport infrastructure involves three main characteristics. First, its network structure implies complex interrelations among all the locations it connects within and outside the country. Thus, for example, building a highway to link two cities may have implications on the operation of other links or distant cities, whether due to rerouting of flows of goods and persons, new shipments of goods, or relocation of companies and families. It is therefore essential to consider the direct and indirect effects of these kinds of interventions.

Second, transport infrastructure comprises different modes, whose availability, quality, and relative costs are relevant to the sectorial composition of the economy. The specific features of each mode determine its suitability to the type of goods to be shipped, shipment frequency, and distances. For instance, road transport is more flexible to changes in the flow of goods. It has more granular and independent access than other modes, which may suit a company whose cargo shipments on a given route are not recurrent and do not have scheduled services. Rail transport may be best, for example, for companies that make frequent, large shipments in bulk to a specialized port (e.g., coal shipments by rail to Puerto Bolívar in Colombia), with final destinations outside the region. Air transport (which provides the most agile performance) is usually needed for seasonal or perishable produce such as flowers exported from the Bogotá savanna to Europe.

The third main characteristic pertains to distribution hubs (ports, airports, and border checkpoints). They are a central component of transport infrastructure because these are the places where bottlenecks tend to occur, largely conditioning the performance of transport services. An efficient, predictable cargo transport process requires good access to those hubs; infrastructure for loading, unloading, and storing merchandise; and ease of complying with bureaucratic procedures. Border checkpoint operation is particularly relevant for landlocked countries like Bolivia and Paraguay because their extra-regional maritime trade requires passing through transit countries.

Transport infrastructure impacts pecuniary costs, like shipping rates, and non-pecuniary costs of transport associated with the travel times, safety, quality, and reliability of transport services. The distinction between monetary costs and time costs is relevant because their relative valuation depends strongly on the sector or type of goods considered. Thus, for non-perishable goods that do not involve storage difficulties (which may be a problem with fragile products), the exporter's willingness to pay for expedited shipment, e.g., one day's travel time, will generally depend on the financial cost involved in that additional day as a result of capital tied up in the value of the goods. For perishable goods, such as seafood or fresh fruit, travel time is of the essence. Locations far from consumption centers or ports may not be able to trade a certain good if the costs in terms of time are too high (Hummels, 2007).

In addition, the variability or uncertainty of travel times is highly relevant, posing special challenges to industries for which the storage costs are high. For example, for a volatile liquid fuel, an unexpected delay in shipping may cause costly interruptions in a productive process that uses it as input, while storage of a volatile substance to prevent interruptions may be expensive. Moreover, integrated value chains, whether regional or global, often require the timely availability of inputs. Proper planning of transit times and costs is therefore essential to productive integration.

The distinction between the monetary costs and time costs of transport is relevant because their relative valuation depends strongly on the sector.

The operation of the transport and logistics market also plays a central role in determining transport costs. Routes connecting sources and destinations with high levels of trade will be more attractive to transport service providers, while remote locations with low levels of production or demand will be unattractive, and therefore have lower availability of transport services. Thus, the quantity and quality of available transport and logistics services depend on the potential for trade in the locations connected, which in turn will determine the available freight volume and freight rate.

Lastly, different means of transport have different market structures. Railways tend to be natural monopolies, while land, air, or maritime transport enable more competitive settings. The role of the State in each of these cases is to ensure high-quality services at competitive prices. Sometimes, certain routes may not be served by providers at market prices. In such situations, the State can subsidize providers if it considers these routes to be strategic for trade, economic, or social policies. Although this chapter does not discuss this aspect of the transport and logistics market, the regulatory framework is key for determining transport costs.

Transport infrastructure, trade, and development

Transport infrastructure contributes to commercial and productive integration, and ultimately, to economic development and welfare. The channels and mechanisms through which these impacts occur have been thoroughly studied and identified in the literature on international trade and economic geography. On the one hand, the consumption channel refers to the availability of goods of greater variety and quality at lower prices. On the other, the production channel pertains to producers' greater market access, which allows them to leverage comparative advantages, achieve greater economies of scale, deepen productive specialization, and accelerate technology adoption. Transport infrastructure also encourages reallocation of resources from less productive companies to more productive companies. Some of these channels through which transport infrastructure can affect the productivity and welfare of localities and regions are discussed in greater detail below.

Reductions in transport costs enable companies for which it was not profitable to produce (or export) to enter the market, affecting labor demand, prices, and production locally and at the aggregate level. Further, they enable more productive firms to increase their scale of production to satisfy the greater demand for goods from the new or larger markets (Melitz, 2003). This expansion of production translates into increased demand for inputs and productive

factors, leading to an increase in their price, a rise in salaries and the return on capital. Meanwhile, the supply of goods increases in the destination economy. Better market access also benefits the destination markets of firms' products because the set of available goods, both final and intermediate, increases for their consumers and producers.

Reductions in transport costs may lead to major aggregate benefits and, at the same time, have adverse effects on some regions.

Due to these effects, improving a connection has direct and indirect benefits. Likewise, some parties may be adversely affected. Reducing transport costs in a group of locations leads to higher purchasing power of salaries in these locations because fewer resources are needed to transfer goods. However, it also drives demand for labor (and other productive factors) for firms in those locations, which compete for workers by increasing salaries. This is bad news for locations that are only marginally benefited by the reduction in transport costs because the increase in salaries in neighboring localities creates higher production costs, leading to higher prices of imported goods (Asturias et al., 2018).

At the same time, the transport network may affect a country's productive structure. Transport costs are a major part of the total cost of some goods, e.g., due to the low value of the good relative to its weight or volume, or specific transport difficulties like in the case of fragile goods. As a result, they tend to be produced in well-connected regions. Their production in regions where transport costs are high is discouraged, even if such regions have a comparative advantage in that sector. Reducing transport costs leads economies to exploit their comparative advantages in the production of goods, i.e., to concentrate production on the activities for which they are the most productive. This leads to a reallocation of resources from activities that lose share in this new context to more competitive activities that gain market share. The same kind of reallocation also occurs within each sector, from less productive firms to more productive ones. (Eaton and Kortum, 2002; Fajgelbaum and Redding, 2021). Ultimately, the benefits associated with reduced transport costs extend beyond firms and consumers affected directly through the input-output relationships (Baldomero Quintana, 2021).

Again, the reorganization of production and reallocation of productive factors among regions and sectors due to reductions in transport costs may have positive aggregate benefits but with heterogeneous effects per region. The improvements in the transportation network can lead to an increase in the production of the goods sold thanks to an increase in productivity as a result of greater specialization and better access to inputs. However, it can also reinforce competition because producers further away can now sell in local markets, which lowers the price of traded goods. Thus, this improvement would imply heterogeneous gains among locations and sectors within a single location, depending on the balance among these two forces (Sotelo, 2020).

Finally, many of the effects described above are related to the fact that improved infrastructure increases market access for both firms and consumers. Here, there are agglomeration forces like economies of scale or knowledge spillover effects that increase the benefit of the more populated locations. In addition, dispersion forces such as the presence of fixed production factors (e.g., land) or high costs of congestion may increase the costs of locating in more populated cities. Thus, depending on which of these forces prevails, infrastructure improvements may lead to a higher or lower concentration of production and population (Redding and Rossi-Hansberg, 2017).

Diagnosis and characterization

This section aims to provide a diagnosis of the transport infrastructure that supports international trade and how it compares to that in other regions. To do so, it first discusses the importance of the different modes of transport in both global and regional trade flows. It highlights the fact that Latin America disproportionally depends on maritime transport for international trade compared to other regions. This may be a sign of a low level of transport infrastructure for other modes, particularly land transport modes. Secondly, it evaluates the perceptions in the private sector regarding the functioning and quality of these infrastructures. Thirdly, it documents the costs of international transport faced by Latin America in relation to other more developed regions, through indirect measurement of transport costs by means of CIF-FOB[2] margins. Finally, it presents evidence of the stock of cargo transport infrastructure, including hubs (maritime and aerial transport) and linear infrastructure (land transport). This information provides input for estimating market access indicators, which provide a more precise description of the extent to which these road networks provide services to firms, enabling them to reach locations and markets in their countries as well as neighboring ones.

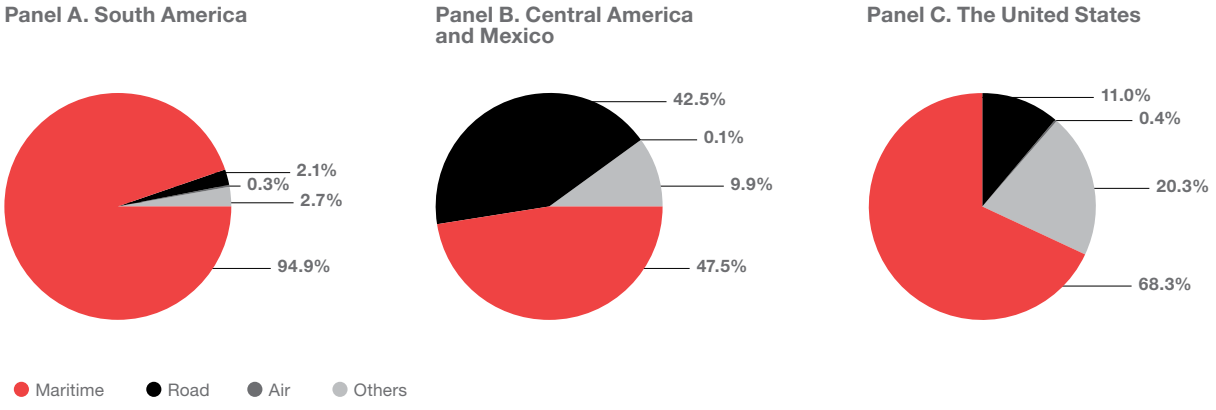
Latin America disproportionally depends on maritime transport for international trade compared to other regions, which may be a sign of a lower level of transport infrastructure for other modes, particularly land transport modes.

Transport infrastructure and global and regional trade flows in Latin America

Analysis of the modal composition of international trade in different subregions and countries in the Americas (Graph 4.1) shows that maritime transport has a very high share in South America. In Central America and Mexico, or the United States, maritime is also the main mode of transport but road transport has a large share too. The higher share of land transport in international trade for the U.S., Central America, and Mexico is partly due to the higher volume of intraregional trade, which uses land transport intensively (Graph 4.2).

2. CIF is Cost, Insurance and Freight. FOB is Free on Board.

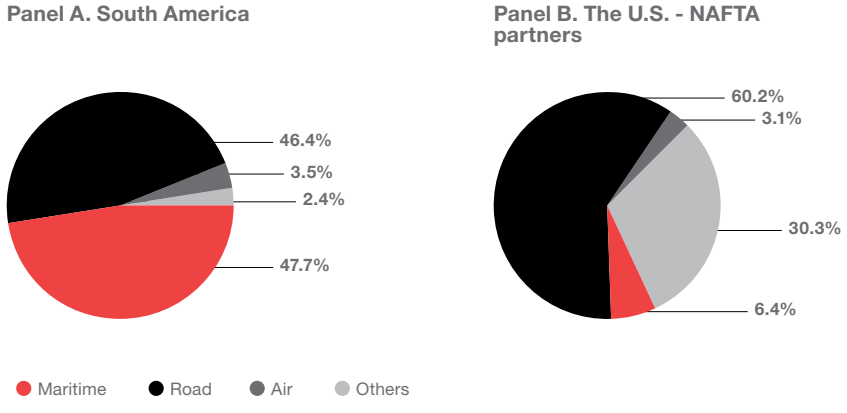
Graph 4.1
Modal composition in international trade, 2017



Notes: The values reported correspond to the share of each mode of transport in the exports of each country or region, according to the transported weight. Details on the countries in each region are provided in the Appendix (p. 218).

Source: Authors based on data from ECLAC (2019a) and BTS (2021).

Graph 4.2
Modal composition in intraregional trade, 2017



Notes: The values reported correspond to the share of each mode of transport in the exports of each region, according to the transported weight. The countries included in each region are listed in the Appendix (p. 219).

Source: Authors based on data from ECLAC (2019a) and BTS (2021).

For example, two-thirds of the trade between the U.S. and its USMCA partners (formerly NAFTA) is done by land transport. In South America, the proportion of land transport used in intraregional trade also ascends to 46.4% but, given the lower trade within the region, this share is small relative to total trade. In addition, maritime trade in South America still has significant weight (47.7%) in intra-zone trade, while it only accounts for 6.4% between the U.S. and its neighbors.

Of course, both globally and regionally, how much each mode of transport is used depends not only on the location of the different markets (regional vs. extra-regional) but also on the type of product traded. The prevalence of marine transport in South America can partly be explained by the increase in the proportion of agricultural and mining goods in total trade in recent years. In general, these goods require port infrastructure for bulk cargo.

Broadly speaking, the composition of international trade by sector, by trade partner, and by mode of transport is determined jointly. For example, those Latin American economies that are organized around the production and export of primary products to distant extra-regional destinations, like Europe or China, generate demand for infrastructure development to connect productive regions with ports and call for increased port capacity. However, the available transport infrastructure conditions the development of new trade relations, favoring those for which the current infrastructure does provide adequate support. Thus, deficient land connectivity between countries that share borders may result in a major barrier to regional trade and, in particular, to productive integration and the establishment of regional value chains.[3]

Business perception of transport infrastructure

A first step in evaluating the quality and availability of transport infrastructure for trade is to resort to the perceptions held by firms and relevant actors. In the framework of this report, logistics operators and companies operating in Argentina, Brazil, Chile, Colombia, Paraguay, and Uruguay were interviewed and surveyed. The objective was to gather their perspectives on the operation of border checkpoints, ports, and airports, as well as transport infrastructure in general (Consejo Nacional de Consultoría, 2021a; FIEL, 2021).

Box 4.1 discusses the outcomes of both studies. In short, analyses show that there is room for improvement, mainly in border checkpoint operation and road conditions. In addition, the supply of land freight transport faces underinvestment in several countries in the region, especially in the railway sector. Port infrastructure fared better than land transport, generally assessed as being of higher quality even though there is room for improvement in terms of scheduling, digitalization, and transparency. Finally, companies say that airports in the region are more efficient than other hubs. However, due to high prices, air transport is only used for specific goods that make it worthwhile because of their monetary value, seasonality, or perishability.

3. For example, Baldomero Quintana (2021) shows how transport infrastructure, as a fundamental determinant of transport and trade costs, shapes the comparative advantages (and thereby the trade) of a country.

Box 4.1
Firms weigh in on trade logistics and infrastructure in Latin America

Within the framework of this report, two studies were conducted to compile the opinions of firms in the region regarding border checkpoints, ports, and airports. The objective was to identify progress and obstacles affecting infrastructure and the mechanisms for facilitating international and regional trade in Latin America.

The first study surveyed private firms. Quantitative and qualitative information was gathered on the operational conditions of ports, airports, and border checkpoints in Argentina, Brazil, Chile, Paraguay, and Uruguay. One hundred and five exporting companies and 14 logistics operators and industry experts were surveyed. The second study focused on Colombia. Fifteen in-depth interviews were conducted with experts, local authorities, and academics. In addition, 381 firms (importers, exporters, and logistics agents) were surveyed to inquire into the dynamics in Colombian ports and border checkpoints, in order to identify progress and obstacles involved in the export process.

The analyses found that border checkpoint infrastructure efficiency is average or fair, and generally perceived as less efficient than hubs (ports and airports). Although there have been major investments and improvements in coordination through binational integration at some border checkpoints, others operate under great obstacles, which is why companies consider that there is still much room for improvement. Among the negative aspects, they mentioned interruptions of border checkpoints due to weather problems and the high variability in services from one location to another.

Regarding ports, firms in the region perceive better infrastructure availability than at border checkpoints. Among areas for improvement, they highlighted delays in the systems for scheduling turns, lack of digitalization, duplication of paperwork, high cost of services, and lack of transparency.

Finally, airports are perceived as being relatively more efficient. Almost half the firms that use airports say that airport infrastructure quality and efficiency is high or average. However, airport share is very low compared to other modes. Moreover, air transport is usually used for shipping high-value manufactured or perishable products.

In Colombia, the analysis reveals that firms assigned the highest scores to airport services, highlighting their streamlined paperwork and procedures. Colombian companies positively assess airport, port, and land border checkpoint infrastructure, with 77%, 64%, and 27%, respectively.

Finally, companies from all six countries—Argentina, Brazil, Colombia, Chile, Paraguay, and Uruguay—highlighted the high operational costs of freight transport as being the main barrier to their operations, followed by transport times.

Source: Based on the survey commissioned to FIEL (2021) and Consejo Nacional de Consultoría (2021a).

Other surveys are available on transport infrastructure quality and its impact on foreign trade operations. The World Bank Enterprise Surveys (WBES) include a useful indicator: whether firms consider transport to be a major barrier to their operations. The survey distinguishes between exporting and non-exporting firms, noting that in Bolivia, Costa Rica, Paraguay, and Uruguay, 45% or more

of exporters respond affirmatively. Bolivia is especially outstanding because 80% of the exporting firms report that transport infrastructure is a major barrier to their activity. This is partly because of Bolivia's landlocked condition; land transport infrastructure is critical for its access to foreign markets. Moreover, as mentioned previously, firms generally rate these services as worse quality than maritime or aerial transport. The opposite occurs in Panama, where companies do not identify transport infrastructure as a barrier to their operations. This is related to the large investments in logistics services for maritime (and aerial) connections in relation to the Panama Canal.

Another widely used indicator is the World Economic Forum (WEF) Logistics Performance Index (LPI), which gathers opinions from package delivery companies and freight forwarding agents.[4] Two of the components in this index are particularly relevant to the discussion in this section: the logistics service quality and appropriateness indicator, and the transport and trade infrastructure quality indicator. A comparison of data for countries in the region shows a similar pattern to the one observed in the World Bank indicator: Chile and Panama have the best performances, while Bolivia, Guatemala, and Venezuela are the countries with the lowest values (see Graph A 4.3 in the Appendix).[5]

The high costs of intraregional transport

The central stylized fact that motivates this report on integration in Latin America is the high cost of regional trade compared to other regions in the world. The cost of freight transport activities needed for integration plays a major role in this regard. For example, for maritime freight, the costs per ton-kilometer in the region are almost twice as high as the costs paid in the U.S. for freight to China (UNCTAD, 2021a).

Even though data on transport costs around the world for exports and imports are central to economic integration, there is a lack of systematic data measuring them directly. An indirect way of measuring costs, which has the advantage of being comprehensive across countries in all regions and across categories of goods, is to use administrative data based on foreign trade. The analysis that follows is based on CIF-FOB margins, i.e. the differences in CIF and FOB prices of traded goods, reported as a proportion of the FOB value.

Graph 4.3 shows transport costs based on the difference between CIF-FOB margins for different regions, as a percentage increase on the average values observed for economies of the European Union (EU), controlling for the different composition of the export basket (i.e., with fixed effects of goods). Panel A shows the value for intraregional trade, and Panel B shows the value for extra-regional trade. This reveals that transport costs for exports are 15% higher in South America than in the EU for intraregional trade.

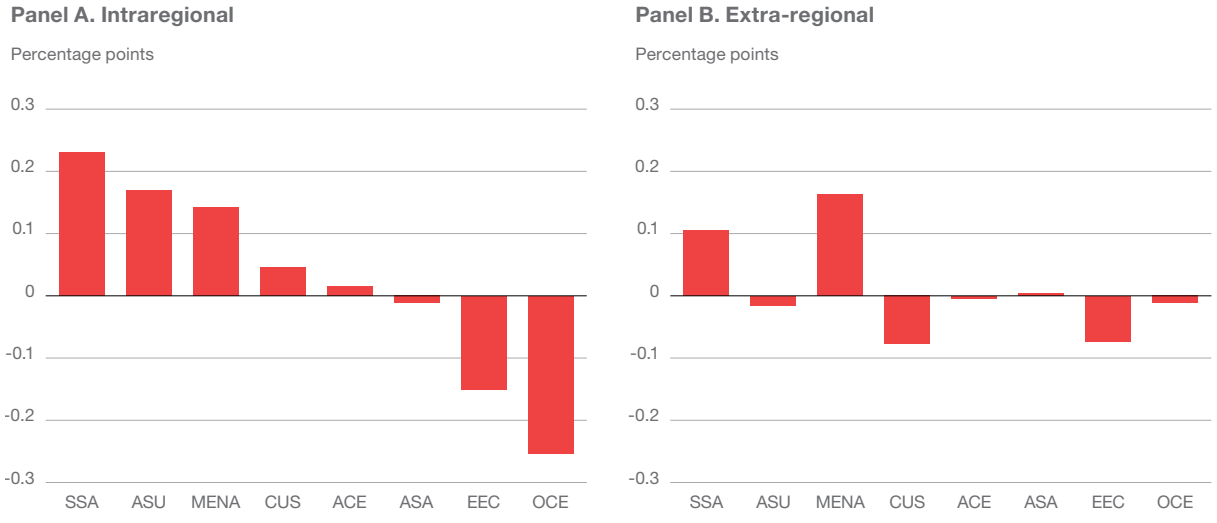
In South America, transport costs for exports are 15% higher than the costs in the European Union for intraregional trade, though similar for extra-regional trade.

4. The LPI considers the following dimensions: i) customs clearance efficiency; ii) trade and transport infrastructure quality; iii) ease of arranging competitively priced shipments; iv) logistics services quality; v) ability to track and trace consignments; and vi) timeliness of shipments in reaching the destination within the scheduled delivery time. See details in the Appendix (page 219).

5. Graph A 4.3 (page 221) provides further details on compared performance for the countries in the region.

Analysis of extra-regional trade shows that the performances of South America and Central America are similar to that of EU countries. This evidence is consistent with the information provided in Chapters 1 and 2, showing that in the region, particularly in South America, openness to extra-regional trade was more significant than to intraregional flows in the trade openness process discussed. In addition, there is evidence that within Latin America, distance seems to have a more limiting effect on trade flows than they do in Asia, Europe, and North America.

Graph 4.3
Transport costs relative to the European Union for intraregional and extra-regional exports, 2016



Notes: Bars indicate the extra cost of transport for intraregional exports (Panel A) and extra-regional exports (Panel B) for each region compared to the European Union. These extra costs correspond to the coefficients of the regression of the logarithm of the CIF-FOB margin given by the fixed effects of regions and control additionally for categories of exported goods. The regions included are Sub-Saharan Africa (SSA), South America (ASU), North Africa and the Middle East (MENA), Canada and the U.S. (CUS), Mexico, Central America and the Caribbean (ACE), Asia minor and Southeast Asia (ASA), Eastern Europe (EEC) and Oceania (OCE). Details on the countries included in each region are provided in the Appendix (p. 219).

Source: Authors based on data from United Nations (2021).

Ports and airports: regional and global integration hubs

Air transport

Airport infrastructure is key to the integration of economies. Adequate airport service quality results in lower operating costs, which in turn attract new companies and new routes. As is usual in transport sectors, these phenomena are mutually reinforcing because higher passenger and cargo demand for air transport services at a given terminal creates incentives for the establishment of air carriers and connected services such as freight agents and road transfer services to and from the terminal.

The opening of new air routes and the establishment of new scheduled services on existing routes are usually driven globally by increasing demand for passenger transport (Planzer and Pérez, 2019). This offers opportunities for shipping cargo by air because passenger flights typically have excess cargo hold capacity. As a result, shipping small-scale cargo that would not be profitable to transport using dedicated air services often becomes viable. Scheduled air services, in turn, provide important advantages due to their predictability compared to charter services, as does the speed of air transport compared to alternative modes. Indeed, in 2019, half the air freight in the world was carried in passenger plane cargo holds, which have much greater route coverage, while the rest was carried in cargo aircraft, with fewer available routes.

The increasing demand for passenger air transport offers opportunities for shipping cargo. Indeed, in 2019, half the air freight worldwide was carried in passenger planes.

To quantify the connectivity available to countries at any given time, the International Air Transport Association (IATA) prepares and publishes the Air Connectivity Index (ACI), calculated as the sum of the number of available annual seats to each destination weighted by the destination airport. The weighting for each destination indicates its relative importance in terms of the number of connections it can provide. Thus, a weighting of 1 is given to the airport with the highest annual flow of passengers (Beijing International Airport) and the weighting of other airports is calculated according to their passenger flow with respect to Beijing (IATA, 2020).

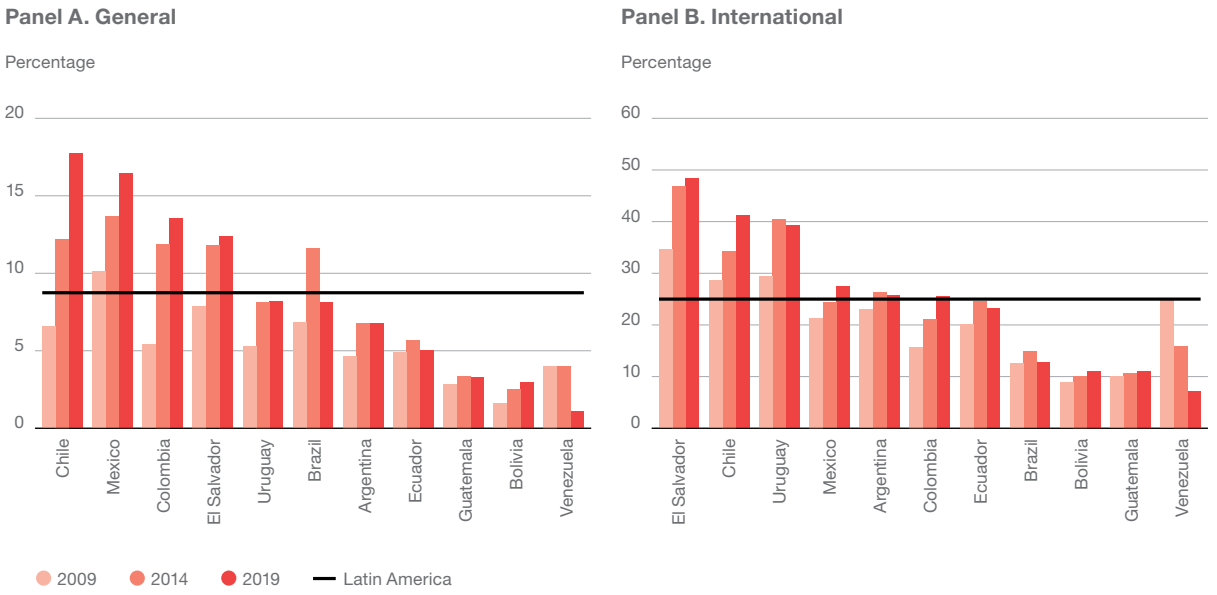
Graph 4.4 shows the evolution of the ACI in Latin American countries in per capita terms relative to the value for the U.S. for three years: 2009, 2014, and 2019. For the period shown, the baseline indicator increased by 57% for the U.S., leading to two main observations. First, air connectivity relative to population in the region is lagging with respect to the U.S., with average ACI being 8.7% of that reported for the U.S. in 2019. That said, there is some convergence over time in most countries, given that the differences decrease. The international component of the ACI is closer to the one observed for the U.S., though still markedly lower, with an average value of 25% in 2019. Second, there are major disparities in the region, which have increased over time and do not seem to be explained only by geographic advantages. In 2019, El Salvador, Chile, and Uruguay had the highest ACIs, with 48%, 41%, and 39%, respectively, in relation to the U.S., followed by Mexico and Colombia, with 27% and 26%, respectively. While these five countries showed strong convergence toward the connectivity value of the U.S., values remained stagnant for Argentina, Brazil, Ecuador, and Guatemala. In Venezuela, there was noticeable deterioration.

Although the ACI is not specific to cargo transport, it is key to trade due to the complementarity between cargo and passenger transport.

In Latin America, the volume of air freight grew more than the global average, increasing by 90.5% from 2009 to 2018 (Sanchez and Weikert, 2020). According to the Latin American Air Transport Association (ALTA, for its acronym in Spanish), one-third of the region's air transport—measured in tons per kilometer (t/km)—corresponds to intraregional traffic, and two-thirds correspond to extra-regional traffic, of which nearly 80% corresponds to trade between the region and Canada and the U.S. South American countries are the origin or destination for the majority of movements (65%), particularly Brazil, Chile, and Colombia. A relevant portion of cargo is carried in passenger

plane cargo holds (and occupies up to 40% of these units). Another portion—involving large volumes—is carried by dedicated cargo planes. Dedicated cargo aircraft are operated by mixed air carriers (passengers and cargo), dedicated air freight carriers, and integrated express service operators.

Graph 4.4
Air connectivity per capita as a proportion of U.S. connectivity



Note: The Air Connectivity Index (ACI) is an aggregate indicator of the performance of air transfer services at the national level. Panel A shows general performance, which applies to both domestic and international flight services (Panel B only shows international). The values for each country are presented as a proportion of the value in the U.S. for each year. The horizontal lines indicate the simple average for Latin American countries (included in the graph) for 2019.

Source: Authors based on data from IATA (2020).

Globally, air freight concentrates on certain items, particularly foreign trade of products with higher monetary value relative to weight (medicines and medical supplies; cash, securities, credit cards, precious metals and jewels; spare parts and industrial parts; fresh food; flowers; live animals; electronic products and explosives). Thus, as structural change in the region intensifies and economies turn toward products with higher added value, demand for air freight is expected to increase in the region. This will result in a higher share of air transport of cargo over total transport (Planzer and Pérez, 2019).

To conclude, the development of infrastructure for air transport in Latin America has led to the demand for passenger transport to slowly converge toward the observed demand in developed economies such as the U.S. This growth and the consequent opening of new services and new routes offer major opportunities for air freight. However, to take full advantage of this opportunity, first, investments in airport infrastructure should consider the development of specific infrastructure

for cargo transport. This includes roads to provide smooth access for trucks; storage facilities; loading and unloading equipment; and cold storage facilities when necessary for transporting fresh food, flowers, or medicines, among others. Second, it is essential to accompany physical infrastructure development with initiatives to facilitate trade by simplifying processes and improving coordination among the agents involved in foreign trade operations (FIEL, 2021).

Maritime transport

As described above, maritime transport is the main mode for international trade of goods by a wide margin, covering more than 90% of the trade in countries in the region. This is because the cost per ton-kilometer in maritime transport is low for medium and long distances, thus offsetting port management costs.

Maritime transport costs arise from three main sources: insurance for port handling and transport, cost of port handling, and freight cost. In addition to these pecuniary costs, there are additional costs in time, including both transport times and waiting times at origin, transshipment, and destination. Transit times between origin and destination depend on the distance and the number of ports of call (with or without transshipments) needed to reach the final destination. Finally, waiting times depend on the efficiency of port operation and availability of vessels covering the required route.

Maritime transport costs are associated with port connectivity and the availability and quality of foreign trade services at the port.

Thus, a country's port connectivity is important in determining the total cost of transport of goods. This concept is associated with the following four dimensions. First, a larger number of firms operating in a port can lead to lower costs as competition for freight between them increases. Second, a higher number of scheduled transport services usually means shorter waiting times to find services that cover a particular route. Third, the more direct-route port calls that are available, and the greater the importance of the destinations served, the lower will be the average number of transshipments needed to cover the required routes. Fourth, high port capacity is typically linked to greater availability of foreign trade services, including land connectivity to the port; transport, logistics, and freight forwarding providers, and more efficient customs services.

Maritime freight flow is currently concentrated in very few ports per country. They operate as distribution network hubs. In container transport, containerships have increased significantly in size, and the number of ports of call has been reduced to ports with large docking capacity and adequate transshipping equipment. This has led to lower costs, given the flow of containers along the transoceanic routes. In this context, there is a hierarchy of ports, where some ports operate as regional hubs, receiving and consolidating freight from smaller ports.

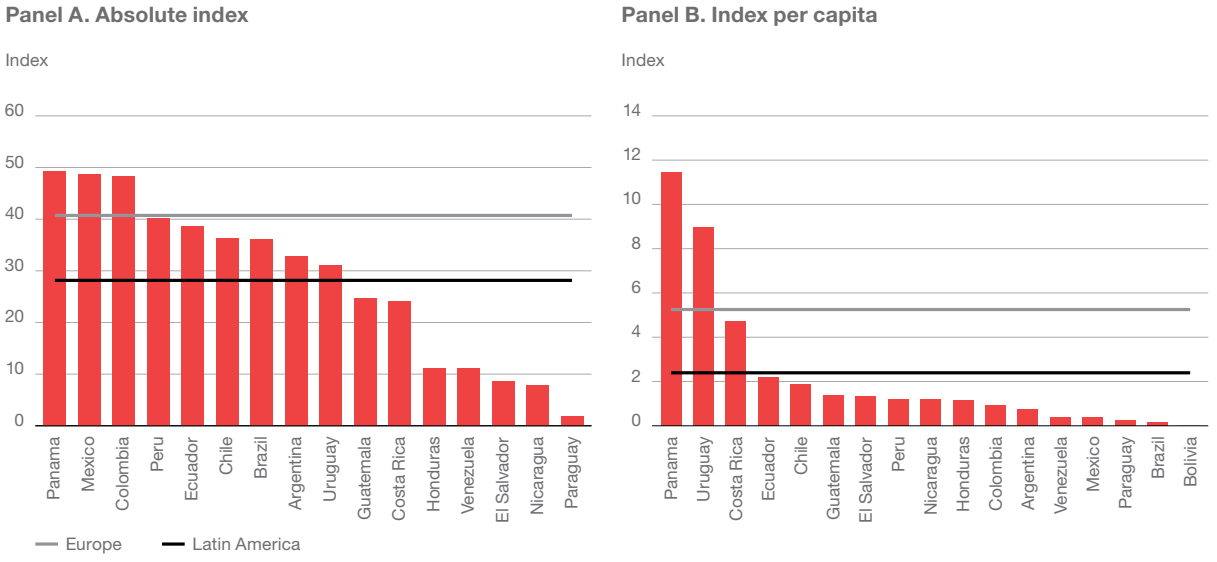
This model is known as a *hub and spoke* distribution system.[6] Large containerships covering long-distance connections dock at hub ports, from which freight is transshipped to feeder vessels that serve regional routes. Feeder vessels have a

6. For a port to have maritime container «hub status,» traffic must be higher than 1,000,000 TEU/year (TEU stands for twenty-foot equivalent unit, which is the usual measurement unit for containers).

smaller capacity, operate in shallower ports, and usually have their own means of loading and unloading containers. Because of the advantages of having direct connectivity to multiple distant destinations, countries try to ensure that their ports are regional nodes, which improves the competitiveness of their own trade.

The United Nations Conference on Trade and Development (UNCTAD) prepares and publishes an indicator for general use to quantify the maritime connectivity of countries, called the Liner Shipping Connectivity Index. It consists of six indicators that correspond to three dimensions of analysis: number of services scheduled, port capacity, and number of services available to each destination. Graph 4.5 shows the values of the index for countries in Latin America, together with the regional average and the average for EU countries. The indicator takes 100 as a basis, which is the value for China in 2006 when the index was first published. Although Paraguay is a landlocked country, its index is also provided because it has maritime connectivity via the Parana River (UNCTAD, 2017).

Graph 4.5
Liner Shipping Connectivity Index



Notes: The Liner Shipping Connectivity Index (LSCI) quantifies each country's level of integration in the global maritime logistics market, with higher values indicating greater integration. The index is calculated based on 100, which was the value for China during the first third of 2006. Panel A shows index values per country, while Panel B deflates them based on the population in each country, using World Bank data (2021b). The horizontal lines indicate the simple average for countries in Latin America (included in the graph) and Europe. Details on the countries included in Europe are provided in the Appendix (p. 220).

Source: Authors based on data from UNCTAD (2021b) and World Bank (2021b).

The graph shows that average connectivity in Europe is 45% higher than the average in Latin America, while in per capita terms, the gap is 119%. There is also significant heterogeneity in the region: Panama leads the classification, with an aggregate index near 50, consistently with the fact that it concentrates

a large flow of ships through the Panama Canal, while the value for Venezuela is comparable to those for small Central American economies, with an index of approximately 10 points. It is worth highlighting that Costa Rica and Uruguay—thanks to their privileged geographic position—have high connectivity in relation to the size of their economies. The fact that Costa Rica is near Panama provides good connectivity through feeder services that use Panama as a hub from which there are direct connections to numerous destinations. Uruguay benefits from its intermediate position between Argentina and Brazil, serving as an accessible port of call and transshipping point for services originating in its two large neighbors (UNCTAD, 2017).

The average port connectivity gap in Latin America compared to Europe is 119%, although there is great heterogeneity in the region.

Better port infrastructure—consisting of land connectivity for shipping freight to these hubs, storage warehouses, infrastructure for port handling and container stowage, and efficient port operation systems—leads to lower operation costs, encouraging the establishment of service providers. Moreover, improvements in efficiency and operation cost reductions in the port promote rerouting of land freight toward the most efficient port, while the increasing demand for transport at the port fosters the establishment of new services and routes.[7]

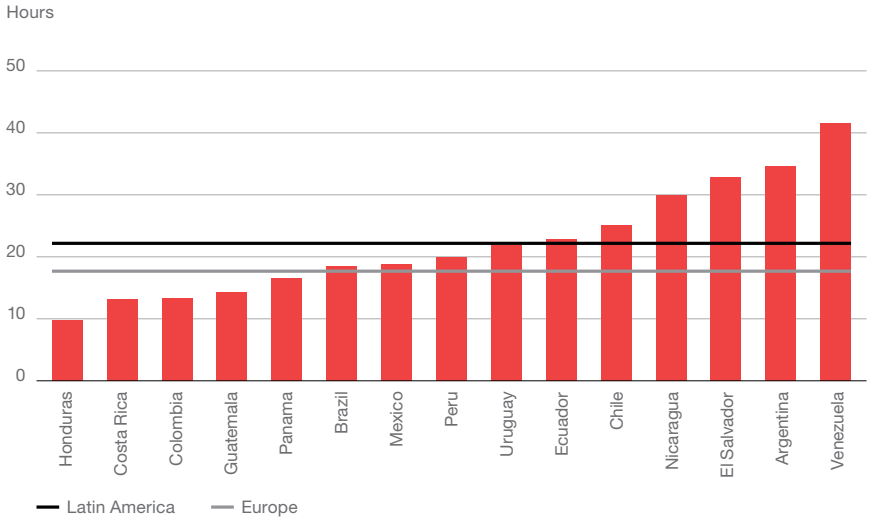
A major barrier to this virtuous circle is the need for complementarity of improvements in the infrastructure of ports that belong to the same route. This effect is particularly relevant to feeder ports. For example, isolated improvements in one port to enable the operation of ships with greater drafts may provide no benefit if the ports usually included on the same route do not have the same capacity.

One metric for evaluating port infrastructure operational efficiency is the median vessel waiting time in port. Graph 4.6 shows this metric published by UNCTAD (2021b). It shows lower average efficiency of the economies in Latin America, with a median port waiting time that is 25% higher than in the EU. It also shows high variability within the region, with Honduras leading the indicator with median times of 10 hours, followed by Costa Rica, Colombia, and Guatemala, with about 14 hours. Venezuela has the worst performance, with over 41 hours, followed by Argentina, El Salvador, and Nicaragua, with 35, 33, and 30 hours, respectively.

Reports from firms with foreign trade activities reinforce the findings of the data presented herein, highlighting Latin American ports as the area with the greatest potential contribution to regional competitiveness (Consejo Nacional de Consultoría, 2021a). Reducing the time vessels spend in port is key to improving port efficiency. This can be achieved by improving the planning of port calls in a coordinated manner with cargo availability; ensuring instruments for facilitating trade so that tasks do not depend on the time required for bureaucratic procedures, and strengthening port operation through investments in infrastructure, technology, and human capital.

7. Clark et al. (2004) find that improvements in a proxy measurement of port efficiency equivalent to going from the first quartile to the last quartile in efficiency reduce shipping costs by 12%.

Graph 4.6
Vessel time in ports, 2020



Notes: The graph shows the median in hours of vessel delay in port per country. Horizontal lines show the simple average of countries in Latin America (included in the graph) and Europe. Details of the countries included in Europe are provided in the Appendix (p. 220).

Source: Authors based on UNCTAD (2021b).

The challenge of digitalizing logistics procedures is being led by the main shipping companies, especially for maritime transport of containers, in turn driving the digitalization of the ports where they operate.[8]

Land transport infrastructure and market access

Descriptive analysis of road and rail networks

The main role of transport infrastructure is to connect locations allowing the flow of goods and people. The dimensions used to analyze land transport infrastructure service provision include coverage, quality, and intermodal distribution (road and rail).

Coverage is usually analyzed using measurements that consider the total length of the road or rail network as a proportion of the country's surface area or as a proportion of the number of inhabitants it reaches. The density in the region is very low, with less than 200 km of roads per 1,000 sq. km., whereas the average in OECD countries is 1,400 km of roads per 1,000 sq. km. Even in

8. In the region, the Port of San Antonio (Chile) expects to complete its digitalization initiative in 2021. In Argentina, Grupo ITL, a holding that belongs the port group PSA Group and operates the Exolgan container terminal, launched the solution ITL Track, a tool that provides real-time monitoring of the location and status of import and export cargos at that terminal.

large countries like the U.S., road network density is 3 to 4 times higher. The low density in the region is corroborated by indicators such as kilometers of road per 1,000 inhabitants, which is 1.2 for the region. It is more than 4 in North America and more than 6 in Western Europe (AC&A et al., 2020).[9]

Road transport quality is often measured based on the proportion of paved roads in the network because they enable greater speed and safety, as well as reduce maintenance costs for the vehicles that use them. Panama and Uruguay have the highest percentages of paved primary and secondary roads, with over 90%, whereas Bolivia and Colombia only have about 20%.

Indicators can also be built to measure both coverage and quality of the infrastructure.[10] For such purpose, Panel A in Graph 4.7 shows the paved road network (primary and secondary) both per 100,000 inhabitants and per square kilometers. Uruguay, Argentina, and Panama have higher coverage per capita, with values of 232 km, 189 km, and 172 km per 100,000 inhabitants, respectively. Panama, Mexico, and Ecuador have greater coverage in relation to the surface area, in line with their higher population densities. This highlights a difficulty in the use of this type of indicator: the values largely depend on the country's geography.

Uruguay, Argentina, and Panama have the highest coverage of paved roads per capita, with 232 km, 189 km, and 172 km, respectively, per 100,000 inhabitants.

Regarding rail transport, Latin America began to develop its network in the late 19th century. Local rail networks expanded greatly in the early 20th century, reaching a length of 130,000 km at their peak. However, since its introduction, the share of road freight has been increasing to the detriment of railways. Currently, the rail network extends approximately 85,000 km. An additional challenge for trade by rail in the region is that the networks use different track gauges. Argentina operates three different track gauges; Brazil, Chile, Mexico, and Peru use two. This increases transport costs because there is not a direct connection between networks, and freight must be transshipped.

Intermodality can be analyzed by using road and rail share in freight transport as an indicator. As shown in Panel B of Graph 4.7, rail freight in the different countries is practically null except in Brazil, Bolivia, Mexico, Panama, and Colombia. This low share of rail transport may show that countries in the region are not leveraging the competitive advantages of the different means of land transport. These advantages aim to minimize the cost of transport involved in domestic and international trade activities.

Considering these dimensions and the indicators presented so far, infrastructure stock measurements show that land transport infrastructure performance is in line with the findings in the previous section, which used indicators based on the perception of agents regarding infrastructure. Mexico and Panama are among the countries with the best performance, while Bolivia, Colombia, and Peru are among the worst.

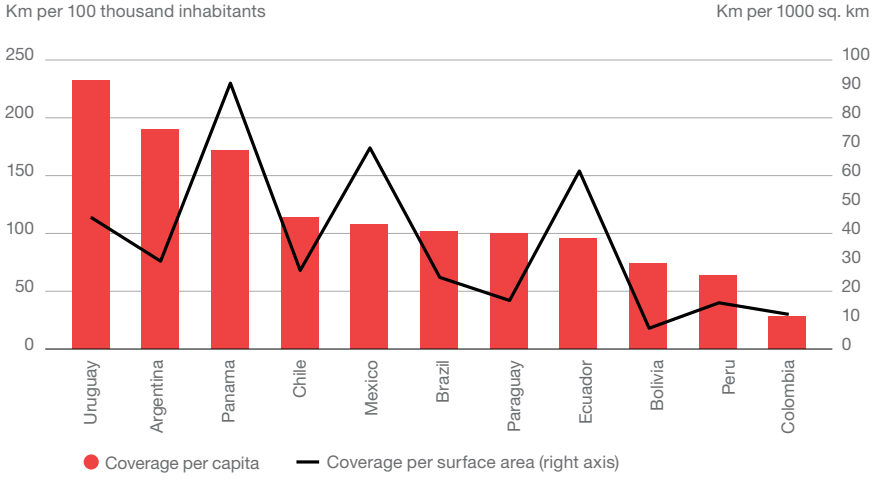
9. This value for Western Europe considers the members of the ex-European Economic Community.

10. There are some barriers to comparing road infrastructure stock due to the difference criteria used for recording information and the lack of updated data. Roads in a network are usually classified as primary, secondary and tertiary according to the government level responsible for maintenance, rather than according to a criterion which is objective and even for all countries. In addition, some countries report total length of roads including urban sections. Finally, information on roads managed by the national government usually is subject to less under-reporting and is updated more frequently than secondary and tertiary roads.

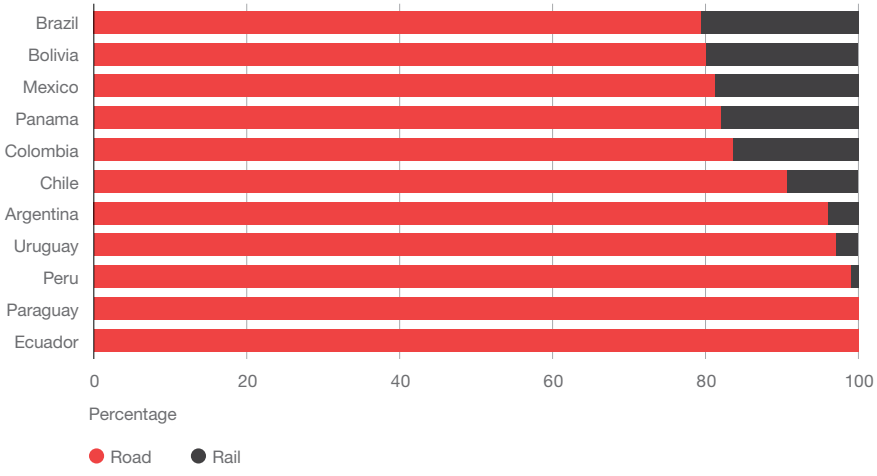
Graph 4.7

Coverage, quality, and intermodality indicators for transport infrastructure, 2019

Panel A. Paved road coverage



Panel B. Intermodality of freight transport



Notes: Panel A shows kilometers of paved roads according to population and surface area of each country (primary and secondary axis, respectively). Panel B shows the proportion of freight, measured in millions of tons per kilometer, transported by road and rail.

Source: Authors based on data by AC&A et al. (2020).

At the same time, as shown by the above analysis, the services provided by land transport infrastructure include many dimensions that need to be studied, and there is no single indicator to summarize them. To summarize and systematize a set of relevant indicators, AC&A et al. (2020) suggest analyzing infrastructure services in six dimensions, which are discussed in Box 4.2.

These efforts to systematize information are very valuable for analyzing the infrastructure needs in the different countries and may become a fundamental complementary tool for prioritizing interventions.

Box 4.2
CAF land transport indicator system

AC&A et al. (2020) developed a system that groups 18 traditional indicators into six dimensions: coverage; quality and safety; productivity and operative costs; modal balance for logistics optimization; environmental and social sustainability; and institutional framework and public-private partnerships. These indicators were calculated for 11 countries in the region: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Panama, Paraguay, Peru, and Uruguay. A specification of each dimension is provided below.

- **Coverage.** Reflects the extent to which the population has access to transport infrastructure by considering the indicators for total network kilometers per sq. km, total network kilometers per population, total paved network kilometers per sq. km, and percentage of rural population in the country with access to passable roads.

- **Quality and safety.** Measures whether infrastructure quality is sufficient for safe travel. Includes perception of the road and rail network, percentage paved of the primary network, percentage of highways over the primary network, and total accidents (injuries and deaths) with respect to the total number of vehicles.

- **Productivity and operation costs.** Includes indicators that provide a measure of the services provided by the infrastructure for companies, including kilometers per hour between hub points, and the infrastructure quality component related to trade and transport of the logistics performance index.

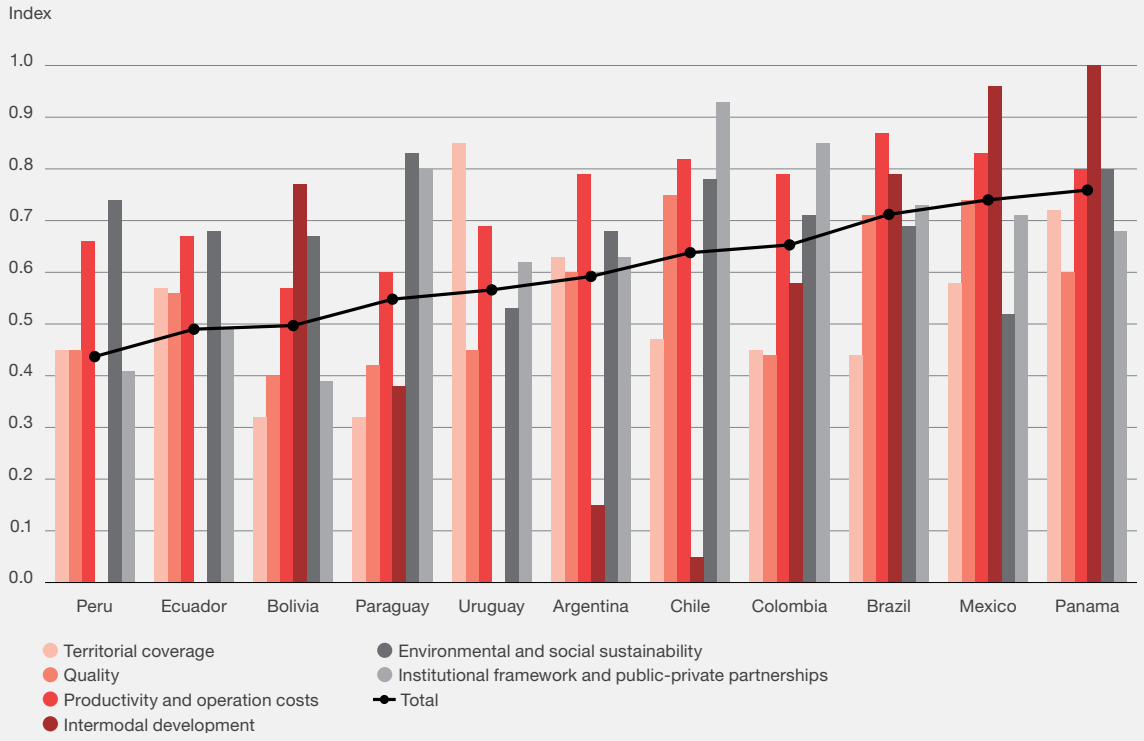
- **Modal balance for logistics optimization.** Includes participation of rail in freight transport and use of rail networks, seeking to capture the availability of the different means of land transport and the degree to which they complement each other in order to provide better transport service.

- **Environmental and social sustainability.** Includes indicators that measure the impact of transport on the environment and the reach of the network to the least favored areas. It includes the average age of vehicles in the country, CO_2 emissions per 1000 inhabitants, and percentage of the network in less favored regions.

- **Institutional framework and public-private partnerships.** Measures the degree to which the private sector is involved in investments in transport infrastructure, and government performance in its management. Includes percentage of the network under concession, evaluation of performance in public-private partnerships (PPP), and perception of government effectiveness.

Graph 1 shows the individual performance of countries in the different dimensions analyzed, and in the indicator summarizing overall performance. The general conclusion of this analysis is in line with what the perception indicators suggest: Mexico and Panama have the highest indicators, while Bolivia, Ecuador, and Peru have the lowest. However, even among countries with good performance, there are potential areas of improvement, such as environmental and social sustainability in Mexico or intermodal development in Argentina, Chile, and Uruguay.

Graph 1
Land transport indicator system



Notes: The graph presents six indicators that measure the situation of land transport infrastructure. The scale for each indicator is 0 to 1, with 1 being the highest possible score for each one. The Total indicator measures the general status of service provided and corresponds to the weighted average of the six indicators.

Source: Authors based on data by AC&A et al. (2020).

Road networks and market access

The previous subsection presented a series of indicators for measuring the services provided by land transport infrastructure. Complementary to that approach, this section presents a set of indicators, not of the stock of infrastructure itself, but rather, of the scope of the services provided by said infrastructure, focusing on market access. These measurements consider the differences in population distribution and geographical features, thereby enabling a more precise approximation of the services provided by the transport infrastructure, and the potential gains that improvement would bring about. This enables comparison among countries with dissimilar geographic features.

This section measures market access using an indicator that summarizes the markets that can be reached by a firm from a given location, based on certain assumptions of travel times and routes used. For instance, at zero hours of travel time, a firm could only trade with the population in its own location, while at one hour, it could trade with everyone living in locations less than one hour away, and so on. Box 4.3 describes this methodology in greater detail.

Box 4.3
Measuring market access

The time that it takes businesses to reach their customers or suppliers—just as the time it takes consumers to get to their jobs or the stores where they buy goods—is an important feature of an economy.

It is possible to compute the time and distance required to link the different localities where population and production are concentrated and to quantify the access to companies or people at different time intervals. Using the example of a firm, this measure will provide information on the number of consumers it can reach in a given time period or within a given distance, which is extremely relevant for estimating, for example, the demand for its products. A central element underlying the time required to connect two locations is the available transportation infrastructure, which determines the speed at which different cities can be connected.

Given that this chapter focuses on access to regional markets, the following are computed: 1) measurement of market access between cities within a country (access to domestic markets) and 2) measurement of market access in cities in neighboring countries (access to foreign markets). Both these measurements are built similarly, so for the sake of simplicity, only the measurement of access to domestic markets will be described in detail here.

Access to domestic markets is measured by considering the N largest locations in each country. *Pob* denotes the joint population of these cities. Google Maps is used to calculate travel time and distance between each location and the remaining N – 1 cities. Once this information has been ascertained, the access to domestic markets of each location *i* is calculated for each time interval *t*, by adding the total population which can be accessed from this *i*-th city in *t* hours of travel time. This is called AM_t^i. Finally, the aggregate AM_t indicator, which quantifies the access to domestic markets in *t* hours of travel time for the country under analysis, is calculated based on the weighted average of the locations it consists of, based on the following formula:

$$AM_t = \sum_{i=1}^{N} AM_t^i \frac{Pob^i}{Pob}$$

Source: Authors based on Allub et al. (2021b).

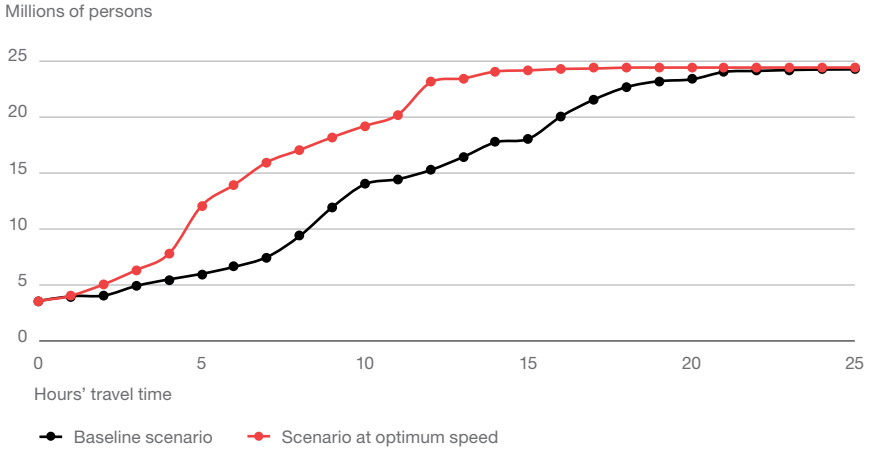
As an example, Graph 4.8 shows the level of market access in Colombia. The black line shows the number of persons/consumers that the average firm in Colombia can reach according to travel time in hours from its location. The curve was built based on travel times between the main cities in Colombia

reported by Google Maps, beginning on a business day in the morning. This indicator is called access to domestic market in the baseline scenario. This scenario considers: 1) travel times reported by Google Maps, 2) the fastest route available, and 3) usual traffic conditions. According to these calculations, the average Colombian company can access 5 million people within 3 hours [11] and about 6 million people within 5 hours.

This measure of access to domestic markets in the baseline scenario is the outcome of a combination of the following factors: a) spatial distribution of the population and degree of concentration of the population in few cities; b) geographic features and distances between the locations and cities considered; and c) coverage and quality of available road infrastructure. A contrafactual exercise can be performed to obtain a diagnostic measure of infrastructure condition and the potential of investing in roads to promote market access. The exercise considers what domestic market access would be like if road infrastructure were improved sufficiently to enable a constant travel speed of 90 km/h.[12] Market access attained in this new scenario would be represented by the red line in Graph 4.8. Thus, in 0 hours, 3.3 million people could be reached (the same amount as in the baseline scenario), but in 3 hours, 7.7 million people could be reached, instead of the 5 million in the baseline scenario, while in 5 hours, 14 million people could be reached—more than twice as many as in the baseline scenario.

Graph 4.8

Change in access to domestic markets in Colombia based on improvements in road infrastructure



Notes: Market access indicates the population accessed in each country within a given number of hours. The baseline scenario uses optimal routes at the speed provided by Google Maps, while the optimal speed scenario uses the same routes but at a speed of 90 km/h. Data as of April 15, 2021.

Source: Authors based on data by Allub et al. (2021b).

11. Consumers in the same location are considered, for which travel time is normalized at zero.

12. This exercise can be performed considering higher or lower speeds than the one selected.

By comparing the measurements of market access described above for the two scenarios, the potential gains in market access can be calculated as the ratio between the contrafactual scenario indicator (an average speed of 90 km/h) and the baseline scenario indicator. Table 4.1 shows the potential gains from improving roads, calculated using this methodology, considering 6 hours' travel time (first column) and the maximum value across all possible travel times (second column) for the economies in Latin America, also including Spain and the U.S. as benchmark countries.

Table 4.1
Gains in access to domestic markets as a result of improvements in infrastructure

Country	Gain up to 6 hours' travel time (%)	Maximum gain (%)
Uruguay	6.1	6.1
Panama	1.9	9.4
Costa Rica [a/]	0.0	11.7
Chile	0.0	12.9
Argentina	1.5	18.8
Mexico	7.8	26.1
El Salvador [a/]	0.0	26.7
Venezuela	27.5	29.5
Peru	23.2	42.8
Paraguay	7.1	50.3
Nicaragua	7.5	53.0
Honduras	6.7	60.7
Ecuador	55.6	68.3
Guatemala	17.0	73.9
Brazil	23.8	78.1
Bolivia	103.3	103.3
Colombia	110.7	113.2
Spain	0.0	0.4
United States	0.0	0.0

Notes: The gain in domestic market access is calculated as the percentage change between the baseline scenario and the scenario at optimal speed. The baseline scenario uses the optimal route at the average speed provided by Google Maps, while the scenario at optimal speed uses the same route, but a travel speed of 90 km/h. The first column reports the gains in access for routes with a maximum duration of six hours' travel time for each scenario. The second column reports the maximum gain in access between the two scenarios, without limiting travel time. Data as of April 15, 2021.

a/ Countries in which the maximum distance between any pair of internal locations is covered within 6 hours' travel time, wherefore the metric for these cases is irrelevant.

Source: Authors based on data from Allub et al. (2021b).

The market access analysis reveals a generalized lag in Latin America, with Uruguay, Panama, Costa Rica, and Chile representing the few exceptions.

There is broad heterogeneity in gains in market access among countries in Latin America when considering the cutoff value of 6 hours' travel time. First, there are very significant gains for Bolivia and Colombia. In both these cases, the average firm could increase market access by over 100% with this contrafactual situation compared to the baseline situation. The indicator is 56% for Ecuador and about 25% for Brazil, Peru, and Venezuela. In comparison, gains for Spain and the U.S. are null.[13]

As expected, Graph 4.8 shows that the value for this metric varies according to the cutoff time used. This limitation is particularly relevant in countries like Costa Rica and El Salvador, where, because of their smaller surface area, all pairs of locations can be connected in both scenarios. The second column in Table 4.1 reports the maximum value found considering all cutoff times, which enables comparison among countries regardless of their size. The analysis reveals highly significant gains for most countries, with an average of 50% in the region, in contrast to an almost null gain for Spain and the U.S. Colombia and Bolivia have the highest potential gains with this contrafactual scenario, with approximately 103% and 113%, respectively. Scores for Brazil, Ecuador, and Guatemala are between approximately 70% and 80%. The analysis shows a generalized state of road infrastructure deficiency for internal connectivity in Latin America, with Chile, Costa Rica, Panama, and Uruguay representing the few exceptions.

This measure of gaps in road infrastructure, based on market access and calculated as the quotient between the value for the proposed contrafactual scenario and the baseline value, provides some advantages over the coverage indicators discussed in the previous subsection. It captures the structure of the road infrastructure network simply and intuitively and measures the service gaps in this type of infrastructure in terms of a key aspect for economic integration within a country: the ability of businesses to reach consumers.

Access to foreign markets

Like the calculations performed above, the present analysis continues with a set of indicators for market access to neighboring countries, i.e. those that share borders with the country studied. This is done by evaluating travel times from the full set of locations considered in the country of origin to all locations in all countries with shared land borders.

This exercise uses a reference speed of 90 km/h and considers a range of 12 hours for countries in Central America and 36 hours for countries in South America and Mexico, and also reports the maximum gain across the entire travel time range.[14] The first two columns in Table 4.2 show gains measured in millions of persons/consumers between the 90 km/h scenario and the baseline

13. In Spain and the U.S., used for comparison, average speeds reported by Google Maps are usually higher than the 90 km/h target speed, i.e., the contrafactual situation considered involves loss in market access. For such cases, any negative values were replaced by zero, which is equivalent to considering only interventions that improve road infrastructure, and preserving current quality in the cases discussed.

14. For an analysis of total hours at a speed of 110 km/h, see Allub et al. (2021b).

scenario, while the last two columns show these gains as a percentage of total access to domestic markets. One relevant point in this exercise is that the benefit of access to foreign markets depends on who the country's neighbors are, in terms of market size and road quality. Thus, for countries with a neighbor with a large economy such as Brazil, the improvement in road connectivity toward neighboring countries could provide a great opportunity for increasing access to foreign markets, while for countries with small neighbors, the potential access to bordering markets is lower.

Table 4.2
Gain in access to neighboring markets

	Absolute gain (millions of persons)		Gain as percentage of domestic market	
	12 or 36 hours	**Maximum**	**12 or 36 hours**	**Maximum**
Argentina	11.1	26.5	35.6	84.6
Bolivia	41.5	57.0	635.2	873.0
Brazil	6.6	34.4	7.1	37.0
Chile	1.9	17.3	15.3	138.9
Colombia	13.8	77.6	56.5	317.8
Costa Rica [a/]	0.3	2.4	10.8	88.3
Ecuador	6.4	26.1	71.8	291.5
El Salvador [a/]	0.2	7.3	8.5	275.0
Guatemala	3.9	34.0	38.5	332.2
Honduras [a/]	1.9	8.1	38.5	163.1
Mexico	0.0	5.0	0.0	7.3
Nicaragua [a/]	0.2	4.3	8.6	162.7
Panama [a/]	0.2	2.3	8.6	82.8
Paraguay	3.1	43.9	70.7	1003.4
Peru	21.0	59.6	117.9	334.9
Uruguay	2.4	22.5	92.9	855.6
Venezuela	2.1	82.3	10.9	423.5
			0.0	0.0
Spain [a/]	0.0	0.3	0.0	1.2
United States	0.0	0.0	0.0	0.0

Notes: The first two columns show the calculation of the absolute gain in access to border markets as the difference between the baseline scenario and optimal speed scenario, measured in millions of persons. The baseline scenario uses the optimum route at the average speed provided by Google Maps, while the optimal speed scenario uses the same route but at a speed of 90 km/h. The last two columns show absolute gain in relation to the size of the domestic market. Data as of April 15, 2021. For further details on the calculation methodology, see the Appendix (p. 221).

a/ Countries where the maximum distance between any city in the domestic market and any city in a neighboring country is covered within 36 hours of travel, and therefore, it is replaced by the 12-hour travel time metric. For the rest of the countries, the 36-hour travel time metric is used.

Source: Authors based on data from Google Maps.

Deficient quality in a country's own road infrastructure and that of its neighboring countries results in a major loss of access to foreign markets.

Analysis of the absolute variations in access to foreign markets shows that, within the range of 12 or 36 hours, whichever applies (first column), Bolivia and Peru stand out as having the highest potential gains, with gains of 41 and 21 million consumers, respectively. This result shows that their lag in road infrastructure prevents them from reaching much of the potential market access in their neighboring countries. Analysis of maximum gains considering the entire possible range of travel times (second column) shows Colombia and Venezuela as having the highest values, followed by Peru and Bolivia. In these cases, the deficient quality of road infrastructure and consequent low speed allowed by the roads also result in a major loss of access to foreign markets.

How important are these losses in market access for the countries analyzed? Answering this question also requires consideration of the size of the domestic country's economy. For example, although Argentina and Ecuador have similar maximum potential gains in absolute terms, these gains may be more relevant to Ecuador due to its smaller population. The third and fourth columns show these gains as a proportion of access to the domestic market. In this case, the results are outstanding for Bolivia and Paraguay, two relatively small economies compared to their neighbors. Thus, maximum gains would be 11 times the domestic market for Paraguay and almost 10 times the domestic market for Bolivia. For Central American economies, even though gains in absolute values are relatively small (except for Guatemala, because it has Mexico as a neighbor), the gains in access to foreign markets are important in relation to their size, representing up to almost 4 times the domestic market for El Salvador, and nearly 2 times for Honduras and Nicaragua. Finally, the benchmark countries, Spain and the U.S., again show null or almost null gains.

New tools for analyzing projects in the transport sector

The previous section showed how improvements in road infrastructure quality enabling higher transport speeds could significantly increase market access. Quantifying road infrastructure improvements based on the increase in market access focuses on the potential benefits that these improvements would generate for trade and productive integration of the region's economies. Road infrastructure is key to the extent to which it enables trade gains to be shared by outlying regions, beyond capital cities. However, potential market access is an intermediate indicator of gains in welfare that could be achieved by improving the infrastructure. The ultimate impacts on development caused by a particular investment to improve connectivity, both at an aggregate level and per region within a country, depend on a delicate interrelation of forces operating therein. They include the spatial distribution of the population, geographical conditions, and the productive structure of the locations, among other factors.

It is remarkably difficult to anticipate the full direct and indirect impacts that an intervention in transport infrastructure may have. This is because an improvement in a link in the transport network results in changes in the relative costs of transport throughout the network, i.e., better connectivity between locations A and B may imply relatively more costly shipping from A to C, under equal conditions, with potential to unleash a set of changes in the decisions made by the economic agents. First, there may be rerouting of freight or trade flows, to the detriment of now relatively more distant locations, and an increase in demand for journeys along the improved link. This rerouting generates changes in traffic congestion levels on the roads, leading to changes in the costs of transport. Second, there may be an increase in aggregate trade, enabling improvements in welfare through specialization and economies of scale, but, in turn, with the potential to affect transport costs due to congestion. Third, it may trigger decisions to relocate people and firms, thereby leading to changes in trade flows.

It is difficult to foresee the direct and indirect impacts and to evaluate ex-post the effects of improvement in transport.

The difficulties involved in establishing the potential impacts ex-ante with absolute certainty are added to the difficulties in identifying causes once an intervention has been completed. This is due, primarily, to the problem of «reverse causality.» Infrastructure siting decisions are usually based on policy objectives that have been clearly defined beforehand, which conflicts with the possibility of causally estimating the impacts. Moreover, there are «displacement» effects. The evaluation of causal impacts of an improvement in transport infrastructure on the regions intervened requires finding an adequate control group, i.e., a set of regions for comparison that have not been treated, but this is practically impossible if there are indirect effects. If the intervened regions perform better on average than those that are not, it may be due either to the positive impacts of the interventions on the former or to displacement effects, by which the regions not directly intervened are indirectly harmed by the intervention. Finally, there is a great deficiency of reliable data for many of the expected improvement dimensions in transport infrastructure, in particular for emerging economies. In general, it is very difficult to obtain production data at a subnational level. Moreover, the smaller the unit to be measured, the more difficult it is. On occasion, when there is information at the subnational level, the subnational divisions with available data are based on administrative criteria that do not match the areas of influence of transport interventions, attenuating the impacts found for those interventions.

Despite all the difficulties mentioned above, different ways of evaluating causal impact have been developed based on reduced-form estimates. There is also a set of recent developments that address some of the barriers associated with the analysis of transport infrastructure interventions: quantitative spatial models driven by the increasing availability of non-traditional data. These models are based on a rich structure to account for many indirect or aggregate impacts resulting from transport interventions. They are flexible enough to fit to the data and to respond to concrete questions on public policies. In turn, analyses of infrastructure are more and more often based on alternative data sources, which are becoming increasingly available.

Box 4.4 reviews some uses of non-traditional data sources in infrastructure analysis to bridge the data gaps in both spatial granularity and frequency.

Box 4.4
Data from remote sensors and digital services in economics

As a way to make up for the lack of data at disaggregated levels, or to complement existing but poor quality data, the economic literature has increasingly relied on non-traditional data sources, particularly those produced by remote sensors and the use of internet and cellular telephone services. These data enable the generation of proxy measures for outcome variables of interest.

The aim of one of these uses is to improve official production statistic measurements, e.g., to calculate approximations of changes in production levels at the subnational level. One example of early use of these alternative measures was night-time light (NTL), which was used to estimate gross domestic product. It was originally used after the declassification of the first data of this kind in 1972 (Croft, 1973). More recently, with the help of better baseline images and robust econometric tools (Henderson et al., 2012), major progress has been made in establishing the stability and precision of NTL as a proxy for economic activity, finding that a 1% increase in light is associated with a 0.28 to 0.32% increase in GDP, an association that does not show evidence of non-linear or asymmetric effects between increase and reduction of GDP.

Once this robust association was found between NTL and GDP, numerous economic studies used this technique for two main goals. The first was to improve production indicators at the national level. In this field, Henderson et al. (2012) show that in countries where the quality of statistical data is low, using light measurement helps correct errors in GDP measurement. However, these data were not largely relevant in countries with high-quality statistical data. The second goal was to use NTL data to approximate production at subnational levels. Many papers began to use changes in light as a proxy for measuring changes in production levels for different research questions regarding the distribution of production or the effects of infrastructure projects, for example.

Another application of this type of data in economics relevant to transport infrastructure interventions consists of estimates of agricultural production by analyzing frequency bands in satellite and aerial images. During the 1970s, researchers studying vegetation coverage and status developed a normalized difference vegetation index (NDVI), which enables this type of estimation to be made simply, based entirely on the relative intensities of various spectral bands present in the images (Rouse et al., 1974). In economics, using the NDVI, the production of the agricultural sector was included as an outcome variable in numerous studies (Farmaha et al., 2016).

The following section discusses the main elements of quantitative spatial economic models and presents the application of a standard model of this type to analyze two corridors in Latin America: the Santa Cruz-Puerto Su‡rez corridor in Bolivia, and the Rosario de Santa Fe-Paso de Jama road corridor in Argentina. Then, it presents a summary of transport infrastructure impact evaluation results, and the main mechanisms by which it affects the welfare of the economy, with a particular focus on projects for Latin America.

Quantitative spatial models

Quantitative spatial economic models provide a set of tools that enable solid analyses of transport infrastructure.

Quantitative spatial economic models are a set of tools that combine components of *urban economic models* (which include congestion costs and agglomeration gains), and *international trade models* (which consider multiple regions or countries that produce and exchange goods and services). The main component in these models is the consideration of a transport network among all regions or locations, resulting in the fundamental factor in the cost of trade and mobility among them.

The components that spatial economic models generally take from *urban economic models* include a set of basic attributes associated with regions: amenities, productivity, exogenous and limited land availability, and, as mentioned above, congestion costs and agglomeration gains. These components make models consistent with the data and account for the observed distribution of population and economic activity. A model must be consistent with the data if it is to be used as a laboratory for studying the effects that improving the transport network would have on production, location, consumption, and welfare decisions.

The components that spatial economic models take from *international trade models* are costs of trade determined by the underlying transport infrastructure and comparative advantages, which open the door to the existence of trade and enable certain locations to specialize in producing certain goods and services.

In short, quantitative spatial economic models are based on a set of assumptions. They mainly pertain to productive structure, frictions for movement of goods and persons, the structure of the goods and factors market (e.g., whether they are competitive markets or there is monopoly power, etc.), type of consumer preferences, and agglomeration and dispersion forces prevalent in the economy.

Once a model has been defined to provide a theoretical framework, values must be assigned to the relevant parameters so that the model matches a set of important attributes of the situation under study. Some of these values can be obtained directly from the data, e.g., the number of locations or population in a location. In other cases, statistical values can be inferred to help parametrize the model. For example, wages may be an indicator of productivity; travel times or price differences for certain goods may serve as a proxy for transport costs and thus be used to parametrize the quantity and quality of infrastructure between different locations; residential rent may be an indicator of the amenities in a location, etc. Even more parameters may be established by using estimates from other studies.

To illustrate the potential of these tools as an instrument for public policies, this section presents an application of a quantitative spatial economic model to analyze two road connectivity projects relevant to regional integration. The first case analyzes the construction of a road corridor in Bolivia. The project—the Santa Cruz-Puerto Suárez highway—connected different points in eastern Bolivia to neighboring Brazil. It was implemented in several stages between 2005 and 2010. The second case is a prospective analysis of a projected road corridor to foster connectivity between northwest Argentina

and neighboring Chile, between Paso de Jama and the Rosario port outlet in the Province of Santa Fe (Argentina). The canonical economic geography model described in Box 4.5 is used for this analysis. A discussion of the results follows, focusing on the underlying mechanisms and the spatial heterogeneity of the impacts.

Box 4.5
Components of the spatial economic model implemented

This section uses a canonical quantitative spatial economic model to analyze the two infrastructure projects in South America previously mentioned. The model consists of a multiregional version of the economic geography scheme developed by Helpman (1998) and described and implemented by Redding and Rossi-Hansberg (2017), comprising three main assumptions.

First, regarding consumers, there is an exogenous quantity of persons living in each country, with homogeneous preferences regarding consumption of tradable goods and land, and there is a single good that is produced in multiple varieties. The availability of more varieties increases consumer welfare. These consumers offer all their work time inelastically, for which they receive wages. In turn, all inhabitants within each country receive an equal share of total rents produced by the land.

Second, regarding production, each firm produces a different variety of the good, using only one productive factor, labor, and is immersed in a monopolistic competition market structure: each firm is a monopolist of its specific variety, but faces competition from other varieties, while free entry of firms pushes their profits to zero.

Third, regarding geography and transport costs, each economy consists of a set of cities, with a fixed quantity of land and an exogenous productivity parameter. Cities can trade with each other, facing transport costs that are a function of travel time between them and tariffs for pairs of cities in different countries. Both transport costs and tariffs follow the iceberg specification, according to which x units of the good must be sent for each unit that arrives at destination, with $x>1$. Tariffs are calibrated such that resulting trade between countries matches that observed in the data. Transport costs are included as a linear function of travel time, adjusted to data on transport cost per kilometer for freight shipment.

The main agglomeration force in this model is the production technology available to cities, with increasing returns to scale: when the population grows, and the workers in the city increase, production rises more than proportionately. This force contrasts with the dispersion force present: the limited availability of the land factor, which summarizes the finite capacity of inhabitable space in cities, and which, among other consequences, implies higher housing prices when the population in a location increases.

Source: Authors based on Allub et al. (2021a).

Santa Cruz-Puerto Suárez road corridor

The Santa Cruz—Puerto Suárez highway is part of Bolivia's main integration corridor. Its construction completed the connection between the country's eastern and western borders, enabling regional integration between Chilean and Peruvian ports on the Pacific and Brazilian ports on the Atlantic. At the same time, it has promoted connectivity of a large proportion of the Bolivian population that lives near the road. This project has already been completed; it was the first paved road linking Bolivia with Brazil, facilitating the flow of goods and bilateral and multilateral trade.

This project was part of the Initiative for the Integration of the Regional Infrastructure of South America (IIRSA). It consisted of paving two roads over their length of 650 km, enabling circulation speeds of 110 km/h on flat terrain, and 80 km/h on undulated terrain. Total investment was nearly USD 500 million.[15] Figure 4.2 shows a map of the intervention under study.

Prior to the project's completion, this important link consisted mainly of gravel roads, with sections of dirt roads, frequently subject to deterioration and interruptions due to waterlogging and accumulation of mud. Road usability was greatly compromised during the summer when much of the annual precipitation occurs. To reflect this low road quality, the assumption for this exercise is that without the project (which provides paving, improved routing, and water management structures), travel time on the road between Santa Cruz de la Sierra and Puerto Suárez would double the current times. Google Maps data are used to measure current travel times.

The analysis takes into account cities in Bolivia and Brazil, assuming that people (and firms) can relocate at no cost within each country, though not at all between countries. This exercise considers the 12 main cities in Bolivia and the 24 largest cities in Brazil, representing, respectively, 80.6% and 53.1% of the total urban population in each country. The following discussion focuses on the impacts of this project on the population living in the main cities in Bolivia because the scale of Brazil's economy is much larger and the effects on its cities are very limited.

What was the impact of the project on wages, land rent, price levels, and the population? What was its impact on welfare? The exercise answers these questions in two stages. First, it considers the impacts on wages, prices, and land rent under the assumption that the population cannot migrate between cities. Although this assumption is restrictive and contrasts with actual mobility of persons, particularly within a country, it addresses the expected short-term impacts. Second, this restriction is removed and the case is analyzed under the assumption of perfect population mobility among cities within the country, where the impacts are more closely associated with the long term when individuals and firms have had enough time to adjust to the new economic reality.

15. Financing for this project came from multilateral entities such as IDB, CAF and the European Union, plus the country's own financing from the Bolivian national treasury. The project was executed by Administradora Boliviana de Carreteras (ABC).

Figure 4.2
Map showing intervention in the Santa Cruz—Puerto Suárez corridor

Source: Authors based on Cosiplan (2017).

Figure 4.3 shows the results of this exercise regarding percentage change in real wages. Panel A shows the results under the assumption that distribution is immobile, i.e., individuals cannot choose a residence optimally, while Panel B shows the results under the assumption of unrestricted mobility of persons within each country. Percentage difference is shown with respect to the baseline scenario (without road improvement), represented by the color scale, with the range of light reds showing positive changes and the range of dark reds showing negative changes. The size of the circles represents the magnitude of change (i.e., absolute value).

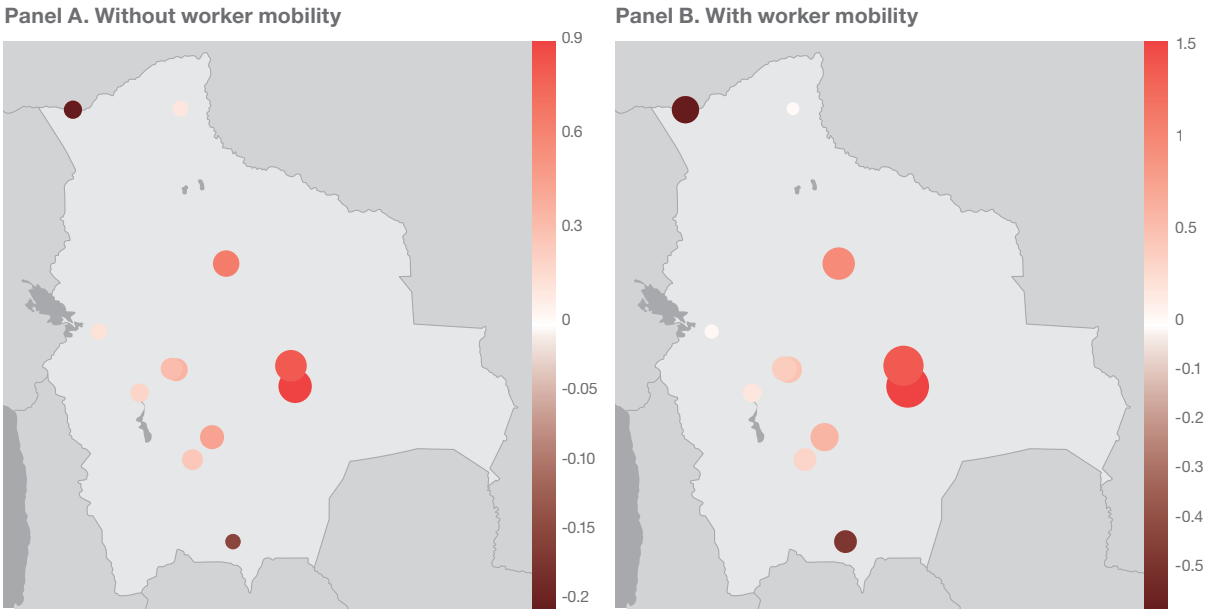
As a result of improved connectivity, in absence of worker mobility (Panel A), real wages increase by an average 0.3% in most cities in Bolivia. However, in other cities (Tarija in the far north and Cobija in the far south of Bolivia), real wages decline. The explanation is that, prior to project completion, deficient infrastructure acts as a

natural barrier to trade, benefitting these cities, which can sell their products to the rest of the cities in Bolivia. Once the road is improved, these cities lose that advantage. In the markets where they formerly sold their production, they now face competition from other cities in Bolivia and new products entering from Brazil.

When allowing job mobility (Panel B), there is a greater increase in real wages of about 0.4% on average in Bolivian cities. However, in this case, the disparity between cities is greater: real wages drop in the cities of Cobija (-0.6%) and Tarija (-0.4%) and results are almost null in La Paz.

As a result of this project, real wages increase in most cities, but decrease in others, such as those in the far north and south of Bolivia.

Figure 4.3
Percentage change in real wages as a result of intervention in the Santa Cruz—Puerto Suárez corridor



Note: Percentage change in real wages is reported for the 12 main Bolivian cities included in the model, under the assumptions with population mobility (Panel B) and without population mobility (Panel A). The size of the circles represents the magnitude of change in real wages. The color scale of the circles is asymmetrical, with darker colors representing the more extreme values observed. For details on the model and its implementation, see Allub et al. (2021a).

Source: Authors based on data from Allub et al. (2021a).

Figure 4.4 provides some clues on the mechanisms underlying greater loss of real wages in the scenario with worker mobility: as the underlying connectivity conditions change, the population relocates to cities with better relative market access in search of better living conditions. When this happens, there is a loss in efficiency due to lower scale in the cities of origin and a consequent increase in productive efficiency in the receiving cities (Panel B). The cities Cobija (-3.6 %), Tarija (-3 %), La Paz (-1.6 %) and Oruro (-1.2 %) lose the most population, while the population in Santa Cruz de la Sierra, Montero and Trinidad increases by 2.7 %, 2.1 %, and 0.6 %, respectively.

Figure 4.4

Percentage change in population and welfare as a result of intervention in the Santa Cruz—Puerto Suárez corridor

Notes: Analogously to Figure 4.3, percentage changes are reported in population (Panels A and B) and welfare (Panels C and D) for the 12 main Bolivian cities included in the model, under the assumptions with and without population mobility. The size of the circles represents the magnitude of change in population or welfare. The color scale of the circles is asymmetrical, with darker colors representing the more extreme values observed. For details on the model and its implementation, see Allub et al. (2021a).

Source: Authors based on data from Allub et al. (2021a).

This road project led to overall gains in welfare for both countries, which in Bolivia are about 0.34% under the assumption of no worker mobility and 0.48% when allowing worker relocation. Panels C and D in Figure 4.4 show the spatial distribution of gains in welfare in Bolivia for both scenarios. In the scenario without worker mobility, there are great benefits for the cities closest to the project—Santa Cruz (0.91 %) and Montero (0.80 %)—while welfare decreases in Tarija (-0.27 %) and Cobija (-0.20 %). When allowing internal mobility, workers seek to relocate until welfare is equal across all cities.

The road project leads to global gains in welfare in both countries equivalent to a 0.34% permanent increase in GDP in Bolivia.

The model illustrates a first approximation to comparing the costs and benefits of this infrastructure project. The gains in welfare reported above refer to what is known as *consumption equivalence*: the percentage of increase in aggregate consumption (i.e., in GDP) that is equivalent to the welfare gains enjoyed by consumers. These results, applied to the production of one year in the economies considered under these assumptions, are equivalent to USD 193 million in Bolivia and USD 432 million in Brazil, adding up to a total benefit equivalent to USD 625 million. It is worth highlighting that this value refers to a long-term state, once all firm and worker relocations have taken place, and trade patterns among cities have reorganized. The way toward this long-term outcome is affected by numerous frictions among firms and workers, while interruptions in traffic flow during the construction period lead to losses in welfare which must be taken into account. Considering all of this, these gains can be contrasted to the total costs of all the segments that comprise this corridor, which is about USD 500 million.

Road corridor toward northwest Argentina

The second exercise quantifies the simulated effects based on planned improvements in the route of the logistic corridor in northwest Argentina (NOA, by its acronym in Spanish), of which the purpose is to facilitate connectivity of said region to the ports of Rosario and Buenos Aires. This project considers investment in physical transport and logistics infrastructure, focusing mainly on investment in roads, but also includes transfer centers and logistic activity zones. Moreover, fostering the use of multimodal transport, as well as training and use of tools for optimization of planning and logistics, would improve the competitivity of the provinces in northern Argentina. In connection with this project, the development of the NOA connector toward Chile, via Paso de Jama (Jujuy), would facilitate foreign trade as a result of better access to ports on the Pacific Ocean.

This exercise considers a simplified version of the Logistic Corridor for Integration of Northwest Argentina—Ports of Greater Rosario project. It considers an improvement in road infrastructure from the city of Rosario in Santa Fe, via national routes 34 and 9, to the international border checkpoint between Argentina and Chile known as Paso de Jama. It considers an intervention that leads to a reduction in travel time equivalent to attaining an average travel speed of 90 km/h along the 1600 km from end to end (see Figure 4.5). The current average speed reported by Google Maps is approximately 76 km/h, with speeds of less than 60 km/h along some stretches.

Given that this corridor significantly affects the connectivity between productive hubs in Argentina and Chile and ports on the Pacific coast, Chile is included in the modeling of the infrastructure improvement. In contrast to the previous exercise, Argentine and Chilean international trade with other countries is allowed, including an abstract *Rest of the World*, linked to both countries via the four main maritime ports: Buenos Aires and Rosario in Argentina, and Santiago and Iquique in Chile. This location, which summarizes the rest of the world, imposes discipline on the prices in the two countries considered, given that its population is large enough so that changes in Argentina and Chile are insignificant for prices in the rest of the world.

Figure 4.5
Infrastructure improvement project in the NOA logistic corridor

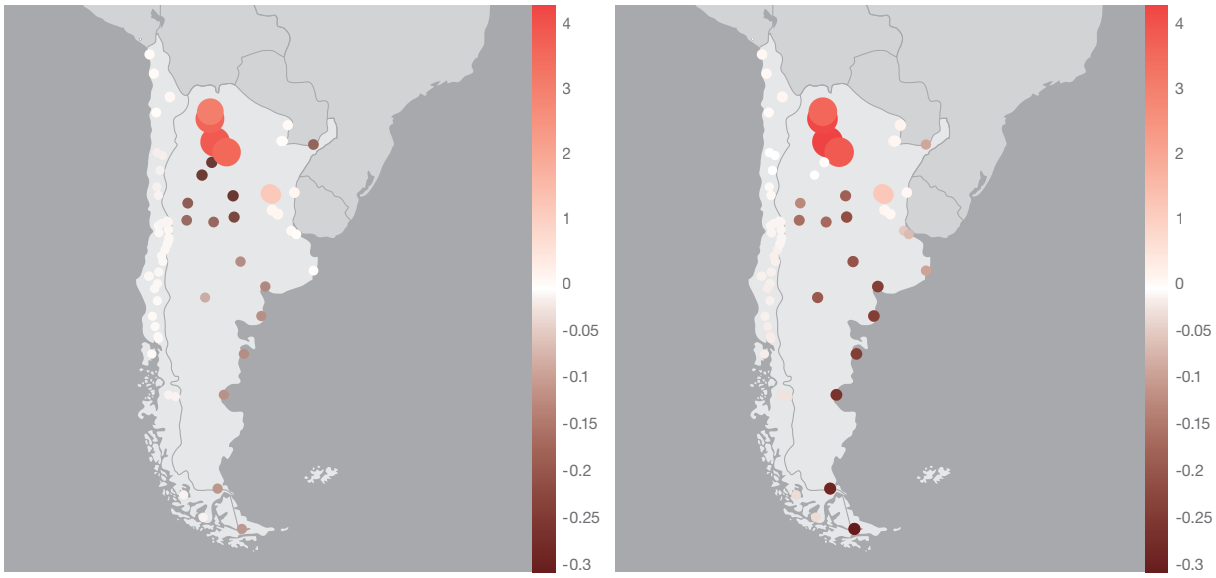
Source: Authors based on Google Maps.

As in the previous exercise, the impact on wages, prices, and land rent is calculated first under the assumption of no migration within each country. Then this restriction is removed, allowing mobility within each country.

Figure 4.6 shows the percentage change in real wages, i.e., in purchasing power of tradeable goods enabled by workers' wages. Without worker mobility (Panel A), the most directly affected cities show a significant increase in real wages, which would increase by 3.1% to 3.9% in Tucumán, Salta, Santiago del Estero, and Jujuy. However, the news is not good for all locations. There would be losses in purchasing power in Córdoba, Mendoza, Posadas, and San Juan, among other cities, given that in the new scenario they would have less access to the market in relative terms, because they would now be relatively more distant. As described in the exercise for Bolivia, this change in relative wages creates incentives for relocation of persons, who move to the benefited locations.

Figure 4.6
Percentage change in real wages as a result of intervention in northwestern Argentina

Panel A. Without worker mobility **Panel B. With worker mobility**



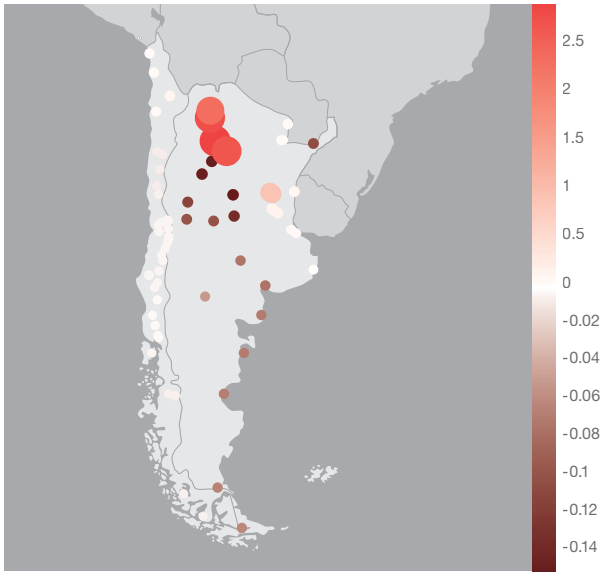
Note: Percentage change in real wages is reported for the 31 Argentine cities and 37 Chilean cities included in the model, under the assumptions of population mobility (Panel B) and without population mobility (Panel A). The size of the circles represents the magnitude of change in real wages. The color scale of the circles is asymmetrical, with darker colors representing the more extreme values observed. For details on the model and its implementation, see Allub et al. (2021a).

Source: Authors based on Allub et al. (2021a).

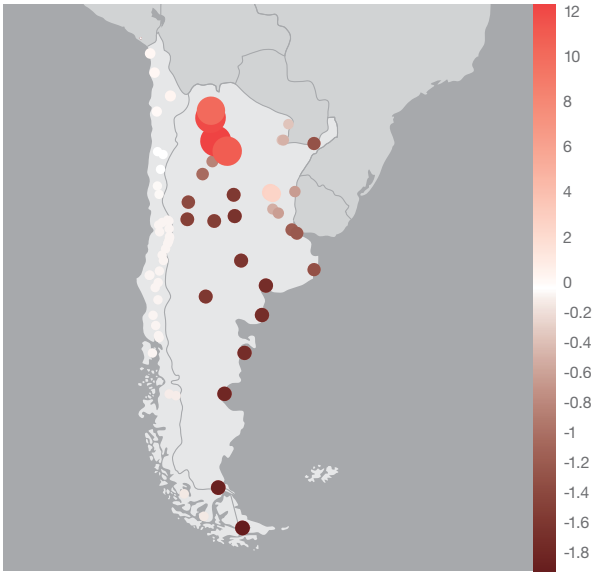
The loss of population intensifies the uneven impact on real wages because lower population in this context involves less efficiency due to a smaller scale of production. Panel B in Figure 4.7 shows this effect: after allowing population migration, the uneven impact on real wages increases, favoring locations in northwestern Argentina. Behind this pattern, there is a marked redistribution of population toward the four abovementioned locations in the NOA where population increases by 13% (Tucumán) and 10% (Jujuy).

Figure 4.7
Percentage change in welfare and population redistribution as a result of intervention in northwestern Argentina

Panel A. Change in welfare without mobility



Panel B. Relocation of population with mobility



Notes: Analogously to Figure 4.6, percentage changes are reported in welfare (Panel A) and population (Panel B) for the 31 Argentinian cities and 37 Chilean cities included in the model, under the assumptions of population mobility (Panel B) and without mobility (Panel A). The size of the circles represents the magnitude of change. The color scale of the circles is asymmetrical, with darker colors representing the more extreme values observed. For details on the model and its implementation, see Allub et al. (2021a).

Source: Authors based on data from Allub et al. (2021a).

Consistently with these patterns, Figure 4.7 shows that in absence of worker mobility, welfare improves significantly in NOA locations and is affected negatively (though not much) in locations that now have relatively lower market access: the south and coastal regions of the country. This uneven incidence of gains leads the population to relocate to regions with better outcomes until land rent increases sufficiently to stop the process. Reallocation of workers among locations without frictions softens the impact until a new balance is reached, with homogenous improvements in welfare for all locations. The outcome for Argentina is equivalent to an estimated 0.25% increase in GDP as a result of improvement in connectivity once the NOA road corridor project is completed. The impact on Chilean locations is negligible under this parametrization of the model. At this point, if there were a draft project reporting the expected costs of this intervention, estimated costs and benefits could be considered again to facilitate decision-making processes.

Analysis of transport infrastructure in Latin America: new tools for old questions

As discussed throughout the chapter, even though assessing the effects of infrastructure can be complicated, the field of spatial economics has developed new and better tools—like structural models—and new data sources are available. Some of the more general knowledge gained from this literature is summarized below.

One of the most direct effects of transport infrastructure is on trade. The literature reports significant positive effects of infrastructure improvements. Freund and Rocha (2011), for example, have shown that a reduction of one day in land transport in Africa results in a 7% increase in exports. Portugal-Pérez and Wilson (2012) report that the lower the income level in a country, the greater the impact of improvements on export performance. Donaldson (2018) shows that the introduction of the railway in colonial India led to an increase in trade and income per land unit.[16]

Infrastructure can also affect the location of firms and sectorial composition of production. In different countries, such as Cameroon, India, Indonesia, and Vietnam, the reduction in transport costs and increase in market access led to a reallocation of capital and labor from agriculture to other activities, in particular manufacturing.[17] Likewise, the construction of the so-called golden quadrilateral in India (the part of the national road network that connects the country's four main metropolitan areas: Bombay, Calcutta, Chennai, and Delhi) had positive effects on the entry of firms near the highway. These firms showed higher labor productivity and total factor productivity. In addition, it was found that management at firms near the highway was more efficient, with less inventory accumulation.[18]

One of the most direct effects of transport infrastructure is the increase in trade. In addition, it may affect location of firms and sectorial composition of production.

Beyond trade or the location of firms, it is important to know whether these infrastructure improvements lead to higher income levels. Bosker and Garretsen (2012) found that in Sub-Saharan Africa, a 1% increase in market access was associated with a 0.03% increase in GDP per capita. Banerjee et al. (2012) and Roberts et al. (2012) found that improvements in roads and highways in China had positive effects on GDP per capita at the municipal level and increased real income. Other studies in African countries associated proximity to the railway with higher levels of development in the short and long term. Moreover, they found that cities near the main port grow faster.[19]

16. See Berg et al. (2015) for a more thorough review of the impact of transport infrastructure.

17. See Castaing Gachassin et al. (2015), Asher and Novosad (2017), Mu and Van de Walle (2011), Gertler et al. (2014), and Ali et al. (2015).

18. See Ghani et al. (2016) and Datta (2012).

19. See Jedwab et al. (2017), Jedwab and Moradi (2016), and Storeygard (2016).

Table 4.3
Summary of evidence on the economic impact of infrastructure in Latin America

Authors	Aim	Country	Outcomes
Mitnik et al. (2018)	Impact of transport infrastructure projects on income	Haiti	GDP increased between 0.6% and 1.2% in the districts benefited by the projects.
Bolivar (2020)	Impact of paving the Fundamental Road Network in the southwest region of Bolivia	Bolivia	In the benefited districts, economic activity increased by 0.5%, poverty decreased, and use of land increased for agricultural activity and development of urban areas.
Bolivar (2021)	Impact of primary road network paving projects	Bolivia, Ecuador, and Paraguay	Increases of 0.5% to 0.6% in GDP for the municipalities benefited, and even higher in areas near the paved road (2% in Bolivia, 3% in Paraguay, and 9% in Ecuador).
Volpe Martincus et al. (2017)	Measuring the effects of road network improvements on export performance and employment	Peru	Positive effects on firm exports and employment growth rate.
Baldomero Quintana (2021)	Study of the impact of Ruta del Sol highway on comparative regional advantages	Colombia	Changes in comparative advantages in Colombia: from mining to manufacturing. Greater impact considering input-output ratios because manufacturing uses more imported supplies than does mining.
Sotelo (2020)	Impact of the potential paving of 100% of the primary network on agricultural production, productivity, and welfare.	Peru	Increase in grain production due to the improvement in productivity (as a result of greater regional specialization); decrease in the price of agricultural goods (due to greater competition). Uneven impacts among locations.
Quintero and Sinisterra (2021)	Impact of road improvements in the 1993-2012 period	Colombia	Increase in aggregate and sectorial GDP (services and industrial) due to improvements in market access. The land near the roads is concentrated in a few hands.
Blankespoor et al. (2017)	Impact of road improvements	Mexico	A 10% increase in market access leads to employment increases ranging from 1.6% to 2.1%, and specialization of the local job market. Most benefited sectors: trade of goods and services.
Fajgelbaum and Redding (2021)	Impact of reduction in domestic and international transport costs on the productive structure	Argentina	Locations with lower international trade costs concentrate on production of tradeable goods that are more sensitive to transport costs. The positive impact of the railway on land rent surpassed the cost of its construction.
Belmar and Gentile Passaro (2021)	Impact of substitution of railways with highways on production, employment, and migration	Argentina	The substitution of the rail network with highways led to a decline in local industrial activity and an increase in migration.

Source: Authors.

There are also studies evaluating the impact of infrastructure projects in Latin America. Using data on light as a proxy for change in income level of locations, Mitnik et al. (2018) and Bolivar (2020, 2021) studied the effect of paving roads in Haiti, and in Bolivia, Ecuador, and Paraguay, respectively. For Haiti, Mitnik et al. (2018) found that paving after the 2010 earthquake had a 0.6% to 1.2% positive effect on GDP, with uneven effects on income levels and with stronger impact in locations with low and medium income. Bolivar (2020) studied the effect of paving roads in southwest Bolivia, finding

a positive effect equivalent to a 0.5% increase in GDP as a result of paving primary and secondary roads. Moreover, Bolivar (2021) observed that paving the main road network in Bolivia, Ecuador, and Paraguay was associated with an increase in GDP of 0.5%.

Regarding the analysis of the impact of infrastructure projects on production and exports, Volpe Martincus et al. (2017) showed that road improvements in Peru increased the growth rate of exports by 6.4% and the employment rate by 5.1%. With regard to export performance and costs of transport as determinants of a country's comparative advantages, Baldomero Quintana (2021) studied the impact of the construction and rehabilitation of the Ruta del Sol highway between Bogota and the Atlantic ports in Colombia. He found that the road improvements produced a change in the country's comparative advantages, passing from mining to manufacturing.

An improvement in the main road network produces gains in productivity and may lead to changes in the productive specialization across regions.

Sotelo (2020) studied the impact of road projects in Peru on the composition of agricultural production, concluding that an improvement in the main road network would imply gains in productivity and a specialization different from the current one in terms of grain production according to regions. The improvement in the transport network would therefore lead to an increase in production and better access to inputs. It would also increase competition because producers farther away could sell in local markets previously beyond their reach. This would lead to a reduction in the price of traded agricultural goods. This improvement would imply heterogeneous gains among agricultural locations in Peru (depending on which effect prevails: the specialization effect or the price effect), as well as between agricultural locations and urban zones.

Another study on the impact of road improvements in Colombia between 1993 and 2012 conducted by Quintero and Sinisterra (2021) showed that the improvement in road infrastructure—and the subsequent improvement in market access—has a significant effect on aggregate GDP in the service and manufacturing sectors but not in agriculture. In distributive terms, roads generate a concentration of nearby land in a few hands. In addition, there are spillover effects in municipalities located up to 35 km away from the project.

Blankespoor et al. (2017) studied the effect of road improvements in Mexico, finding that a 10% increase in market access leads to an increase in employment in the order of 1.6% to 2.1% and a significant increase in the degree of specialization in the labor market. In turn, a 10% increase in market potential (another measure of access that considers income) results in a 2.9% to 6.5% increase in employment level and an increase in productive specialization of about 13%. The results are heterogeneous across sectors, with trade of goods and services benefitting more than manufacturing.

Regarding railway infrastructure, Fajgelbaum and Redding (2021) studied how international and intra-national costs of trade affected the production of tradeable and non-tradeable goods in different locations in Argentina in the late 19th and early 20th centuries. The cost of intra-national trade was mainly affected by the construction of the railway in the late 19th century. The

The introduction of the railway in Argentina reduced the costs of transport of goods and enabled inland regions to participate in international trade.

authors found that the locations with the lowest international trade costs concentrate on the production of tradeable goods that are most sensitive to transport costs. They also showed that by reducing the cost of transport of exportable goods, the railway enabled hinterland regions to participate in international trade. There was also a positive impact on land rent, which surpassed the cost of building the railway.

Belmar and Gentile Passaro (2021) studied the effect of the plan initiated in the 1960s that led to the substitution of railways with roads in Argentina. They found that it was associated with a decline in industrial activity, in terms of production value, employment, and wages. They also found evidence suggesting an increase in migration.

Public policies to improve the management of investments in transport infrastructure

This chapter has shown the importance of transport infrastructure in determining the costs of domestic and foreign trade. As discussed, transportation infrastructure provides access to consumers and suppliers, driving productivity of firms and increasing their market access. But it also puts into play the benefits of participating in regional and global value chains. But to participate, trade costs and uncertainty about the dispatch and receipt of inputs must be reduced in order to optimally plan production.

The evidence presented shows an overall lag in the available infrastructure and related services in the countries in the region. This lag is particularly significant in land transport infrastructure—both rail and road—which is of vital importance in promoting regional trade.

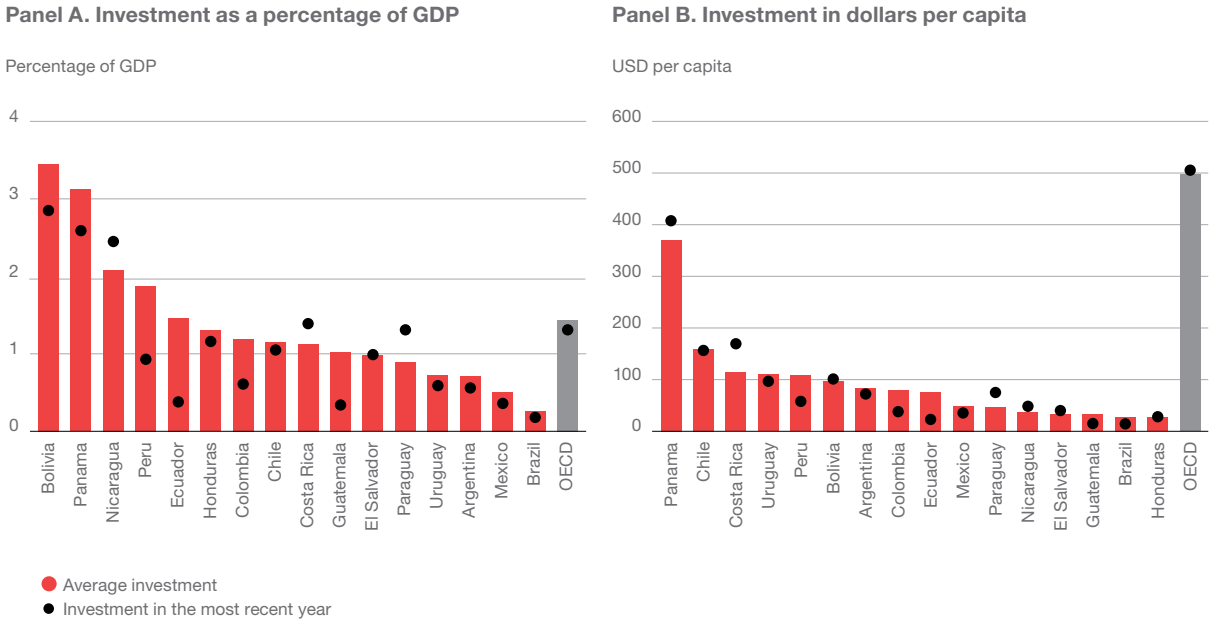
It is therefore relevant to enquire into the role played by public policy in improving the quality and coverage of transport infrastructure to gain greater access to consumer markets and companies in Latin America and to analyze which are the best courses of action for the future.

This section begins by discussing the budget effort made by the countries in Latin America compared to more developed regions. Then it presents three crucial aspects for addressing these policy decisions: 1) the importance of infrastructure maintenance as a complementary strategy to reconstruction and new projects; 2) logistics corridors as a policy target, with emphasis on the value chains that must be supported from beginning to end by the physical infrastructure; and 3) the importance of regional coordination to maximize the impacts of investments in transport infrastructure on trade and productive integration, both regionally and globally.

Investment in transport infrastructure in the region

Do countries in Latin America allocate sufficient resources to investment in transport infrastructure? One way to measure how much effort is involved in countries' current investments is to consider the expenditure on this type of infrastructure as a percentage of GDP.[20] Panel A in Graph 4.9 shows average investment in transport infrastructure in relation to GDP from 2008 to the most recent year for which data are available (bars), and the value for the latest year available for this indicator (circles). The graph shows great heterogeneity in investment levels in the region, with values ranging from less than 0.5% of GDP in Brazil to nearly 3.5% in Bolivia. Comparison of the situation in countries in the region to the average OECD expenditure shows that although most countries in the region have lower levels than the OECD, some, such as Bolivia or Panama, spend twice as much.

Graph 4.9
Investment in transport infrastructure, 2008-2019



Notes: The transport infrastructure investment indicator includes investment in road, rail, port, and airport infrastructure. OECD corresponds to the simple average of its member countries, excluding countries in Latin America. For each country, average investment is considered from 2008 to the most recent year available, which ranges from 2016 to 2019. The values in panel B are expressed in current dollars per capita, corresponding to the most recent year available for each country; population data are from the World Bank (2021b). The details for countries and years are provided in the Appendix (p. 220).

Source: Authors based on data from the World Bank (2021b), Infralatam (2021), and OECD (2021).

20. Analysis of the composition of investments in transport shows that they are mainly made in road infrastructure, in Latin America and in the OECD, although the difference is much greater in Latin America, with the exception of Panama.

Reaching investment levels per capita in transport infrastructure similar to those in developed countries would require allocating an average of 9.2% of GDP for economies in the region.

Although the indicator «investment relative to GDP» somehow reflects the effort being made by countries, it may conceal low levels of investment in absolute terms. For a broader view of the situation, the investment level in transport infrastructure is presented in dollars per capita. This indicator, shown in Panel B of Graph 4.9, clearly differs from the OECD, which spends around 500 dollars per capita, while most countries in the region spend 100 dollars or less per capita. Here lies the great challenge: reaching investment levels in dollars per capita similar to those of developed countries would require an average allocation of 9.2% of GDP for economies in the region. In this context, the instruments to maximize the impact of investments in transport infrastructure in the region are of vital importance.

Infrastructure maintenance and the role of preventive conservation

Like any other capital asset, transport infrastructure depreciates. The rate at which it does depends on its use and maintenance investments. Moreover, maintenance investments determine the quality of the services that infrastructure will provide over time. Not providing the necessary maintenance will involve not only greater reconditioning expenses and shorter serviceable infrastructure life span for the agency in charge of managing it, but also higher costs for users in terms of time, expenditure on fuel, and deterioration of rolling stock, in addition to higher costs due to negative externalities associated with environmental impact and traffic accidents. According to Roxenberg and Fay (2019), about 30% of the budget items assigned to transport infrastructure should be allocated to maintenance expenses.[21]

Different kinds of maintenance can be performed during infrastructure life, including rehabilitation, preventive conservation, and complete replacement, as illustrated in Figure 4.8. Preventive conservation involves smaller regular interventions to maintain the condition of the infrastructure at a consistently high level, at the cost of requiring more frequent budget disbursements. Rehabilitation involves making investments in maintenance once the services provided fall below a level deemed acceptable. Finally, total depreciation and replacement consist of investing a minimum amount during the infrastructure lifecycle and then replacing the infrastructure when that cycle ends. The best strategy depends on multiple factors like the type of infrastructure, construction characteristics, climate conditions, and traffic level, among others.[22]

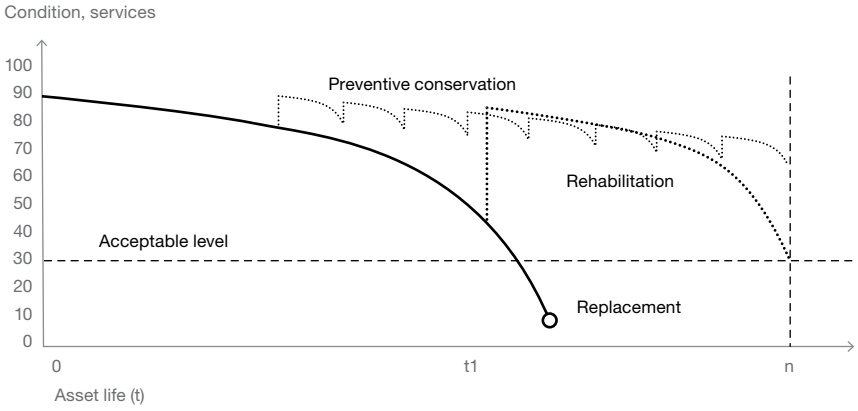
Infrastructure maintenance poses different challenges. First, to make a proper diagnosis of the maintenance expenditure required, an updated record is needed of infrastructure age and condition, which is unavailable in most countries. Second, financing maintenance costs involves multiple limitations. There are political considerations because the political revenue for financing these projects is usually lower than for resources spent on new projects. There are tax issues because, at times of little fiscal space, urgent expenses are usually prioritized to the detriment of expenditure on maintenance. There

21. The countries Aruba, Bahamas, Barbados, Chile, French Guinea, Guadalupe, Martinique and Uruguay are outside the scope of the cited study.

22. See Yepes Piqueras (2019).

are institutional considerations because there may be a time lag between the appointment of the investment's decision-maker and the project lifecycle. Moreover, there are state capacity constraints, like those mentioned at the beginning, due to the lack of precise data for conducting an adequate diagnosis of existing infrastructure status (Blazey et al., 2020). Finally, another aspect that can affect the decision on whether to invest in a new infrastructure project or maintenance is that it is often easier to secure financing from international agencies for new infrastructure, while countries are expected to use their own sources for maintenance investments (Rioja, 2013).

Figure 4.8
Transport infrastructure maintenance strategies



Source: Extracted from Clemente (2012).

Infrastructure maintenance in Latin America

In recent decades, road corridors and networks have been managed more efficiently in the region, helped by the concession processes and public-private partnership (PPP) contracts. Although PPPs have led to improvements in the maintenance of some networks, government actions, in general, have been insufficient. For example, public resources have been withdrawn without an equivalent flow proceeding from the private sector or resources for road conservation and maintenance have been poorly managed.

The situation of tertiary roads is one of the critical issues in the region. Not only do they account for the greatest extension in national networks but also have notably worse traffic flow conditions and low available resources for maintenance because of the insufficient budgets available to local governments. Tertiary roads are essential for connecting local production to national corridors, domestic markets, and international markets through outlet

hubs (ports, airports, and border checkpoints). If their condition is deficient, it increases regional logistic costs between production sites and domestic consumption and export markets.

Low quality standards of existing roads, plus insufficient territorial coverage, not only result in high logistic costs and loss of time and comfort for users but also create significant impacts on safety and sustainability.

Digitalization is clearly improving road infrastructure planning and management. Regarding maintenance, technology is enabling better data collection and analysis at lower costs. This progress enables more precise forecasts of maintenance needs and construction of scenarios on how these needs may depend on changes in demand or other conditions affecting infrastructure, such as climate. The new mobile apps even enable much of this information to be collected from infrastructure users.[23] Moreover, the application of information and communication technologies is enabling significant changes in the way of understanding and managing road infrastructure, based on the asset management approach. This new approach seeks to convert management into a strategic area responding to a long-term plan, and focusing on providing efficient, consistent, and high-quality transport services.

Logistics corridors

To act as an effective facilitator of economic integration, transport and logistics infrastructure needs to satisfy value chain needs from beginning to end.

There are policy implications stemming from the interdependence between hubs (e.g., airports, ports, border checkpoints) and spokes (e.g., roads) involved in the transport infrastructure network. To act as an effective facilitator to economic integration, logistics infrastructure must be able to serve the needs of production (B2B) and consumption (B2C) value chains from beginning to end. Evaluation of the service level that transport infrastructure can provide to a value chain must take into account its weakest link. This highlights the importance of resorting to the concept of logistics corridors as policy objective.

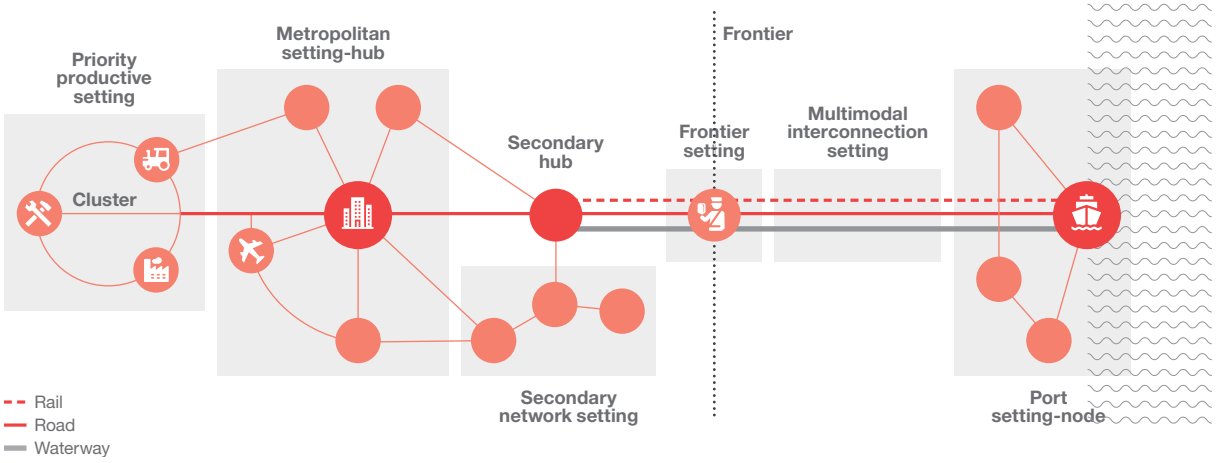
A logistics corridor is an interconnected complex of structures (physical and institutional) comprising production and consumption settings. In other words, it consists of a subset of the logistics infrastructure on which the flow of one or multiple value chains is superimposed.

The existence of a corridor is marked by a stable functional relationship through different linking components (infrastructure, services, trade flows, and population, among others) and by different realms over its extension: urban stretches, inter-urban stretches, production and consumption hubs, borders, multimodal interconnection (Farromeque Quiroz, 2018). In turn, the concept of corridor spans beyond main hubs or cities located along the main route to other smaller population and production centers that participate in the value chain, connected to the corridor via secondary or tertiary access networks. Figure 4.9 shows the different spheres of influence of an integrated logistics corridor.

23. For example, Denmark is testing a system by means of which automobile drivers report road condition while driving. This test is financed by the Innovation Fund Denmark. See Roxenberg and Fay (2019).

In response to the improvements needed in transport and logistics services in general, and in emerging countries in particular, agencies and institutions competent in this sphere have developed numerous strategies focusing on logistics corridors. A paradigmatic example is China's Belt and Road Initiative. This foreign policy and integration strategy is based on financing infrastructure investments around the main export routes of goods from China to each region. The long-term vision of this initiative is structured on six corridors, grouped according to a geographic and productive criterion. The European Union also has initiatives for intervention in transport infrastructure based on corridors. The Trans-European Transport Network (TEN-T) consists of action plans defined for nine corridors, each of which includes several modes of transport.

Figure 4.9
Spheres of influence of an integrated logistics corridor



Source: Extracted from Farromeque Quiroz (2018).

Some multilateral agencies and development banks share this focus on logistics corridors as policy objectives. For example, CAF embraced an infrastructure strategy based on logistics corridors (described in Box 4.6) and conducts an active agenda of intervention in the matter, including data production, knowledge generation, and prioritization of interventions in transport infrastructure focusing on improving service provision and supporting the development of value chains (AC&A et al., 2020; Barbero, 2019; Farromeque Quiroz, 2017a, 2017b). To strengthen the impact on the development of investments in infrastructure in the region, CAF has a methodology for prioritizing projects, called Logistics Corridor for Integration, which is described in greater detail in Box 4.6.[24]

24. Other agencies with presence in Latin America also have intervention strategies based on logistics corridors. For example, the World Bank has a toolkit for administration of corridors, based on diagnostic settings, covering both areas of hard investment in infrastructure, and the soft aspects of regulations, institutional framework and trade facilitation (Kunaka and Carruthers, 2014).

Box 4.6
Logistics corridors: driving forces for physical and functional integration

One of the great historical challenges in Latin America is the implementation of infrastructure projects that contribute to reducing logistics costs[a] and help drive productive complementarity between countries by developing intraregional and extra-regional value chains to foster trade.

Within the international context, there is strong global support for the functionality of integrated corridors, focusing on systemic logistics performance, advanced application of new technologies, and innovation. This has enabled the creation of successful solutions for functional integration (e.g., in Europe, Canada, and Central Asia). Within this context and to promote regional integration and drive competitivity of countries in Latin America,[b] work focusing on Logistics Corridors Integration (CLI, for its acronym in Spanish) can be a great driving force for physical and functional integration of infrastructure.

Along this line, stakeholders need to foster an evolutionary leap in their understanding of the regional integration infrastructure agenda, moving from a «one-dimensional paradigm» focusing on physical integration to a «multidimensional paradigm» of physical and functional integration. This functional approach must include systemic interventions—infrastructure, services, governance—in CLI, coordinating various integral development settings (ADI, for its acronym in Spanish) such as productive clusters, border checkpoints, metropolitan areas, and ports, among others.

Once the interventions have been identified, they need to be translated into sets of projects and simultaneous actions on «specific impact vectors» (e.g., intermodal transport, port logistics, connectivity of a productive cluster, integration of customs processes, urban logistics in metropolitan areas, etc.), producing combined effects (related to a cost reduction, delays, emissions, congestion, accidents, and conflicts, among others) and greater safety, quality, process integration, etc.

Via its Strategic Logistics Corridors Program, CAF has developed a methodological process for CLI analysis based on four guiding criteria: agility (the process must be simple and quick to apply); completion (focused on priorities whose realization is feasible in the short term); impact (by means of simultaneous projects and actions in hardware, software and orgware[c]); and sustainability (providing technical and financial support for project implementation).

It is a methodology that enables moving swiftly from the strategic plane (integrated corridors and development settings) to concrete interventions and projects at the level of priority development programs (PPD, for its acronym in Spanish). These are conceived with a systemic, comprehensive orientation to maximize the driving effects on development. The PPDs include anchor or tractor projects, complementary projects, and systemic actions.

The CLI methodology has been applied successfully in northern Argentina (2018), Ecuador (2019) and Mexico, specifically in the Tehuantepec Isthmus Corridor (2021), resulting in PPPs for investment projects for regional integration for over USD 6.8 billion.

a. Average logistic performance in Latin American countries is 39% lower than in the 20 countries with the best performance in the world (World Bank, 2016, 2018). While logistics costs in countries with the best performance are about 9% of GDP, in Latin America they are 16% to 26% of GDP (Guasch, 2011).

b. Productivity and mean travel time along land logistics corridors in Latin American countries are 50% lower than in Germany and China (calculations based on the World Bank logistics performance index [2018]). In other words, «productivity is diluted on land.»

c. *Orgware* refers to the training of different institutional actors involved in the processes of adaptation to new technologies.

Source: This box was prepared by Rafael Farromeque Quiroz.

The role of supranational agreements in physical integration

As a central component in the costs of transport between countries, infrastructure plays an essential role in trade and productive integration of economies. Its network structure requires policies that focus on improving infrastructure based on its various hubs and spokes. Moreover, domestic, regional, and global value chains must be strengthened from beginning to end. This often involves solving coordination failures between countries that participate in these productive integration processes. Due to these characteristics and the large scale of the investments required, it is key to have a supranational institutional framework to plan and execute these investments and reduce uncertainty in implementation.

Transport infrastructure must support domestic, regional, and global value chains, which requires resolving coordination issues among the countries involved.

This need to establish an institutional framework to accompany the development of infrastructure projects is reflected in the most relevant supranational organizations in the region. Some of these initiatives are described briefly below.

Within the Mercosur agreement, there are two initiatives for the convergence of infrastructure levels. One is the Fund for Mercosur Structural Convergence (*Fondo para la Convergencia Estructural del Mercosur*, FOCEM), and the other is the International Cooperation Policy.

The FOCEM is defined as a redistributive instrument. It establishes a marked difference among the contributions corresponding to each Mercosur country and the distribution of those resources among them. With regard to infrastructure, it is organized into four action areas: the structural convergence program, the competitivity development program, the social cohesion program, and the program to strengthen institutional structures and the integration process.

The Mercosur international cooperation policy establishes the principles, goals, and modalities that should guide technical cooperation among its member countries. The general goals are to: i) strengthen management and coordination of international cooperation for development; ii) deepen regional integration; iii) reduce asymmetries among countries in the bloc; and iv) exchange knowledge and experience, good practices, and public policies across countries.

The Andean Community of Nations (CAN) promoted the Andean Road System (SAC), consisting of approximately 24,000 kilometers of trunk, interregional, and complementary roads. In addition, the Andean Committee on Road Infrastructure was created, with several functions related to gathering and exchanging information on infrastructure and projects related to the SAC; coordinating execution and monitoring tasks related to the programs, projects, and actions involved in the infrastructure of that system; and establishing the basis for the adoption of an Andean Manual of Road Design and the Inter-American Manual of Geometric Design Standards for Roads.

In 2019, the CAN took an important step toward greater physical integration by implementing a set of actions to streamline international transport of goods by road and drive regional trade. One of them was to establish the Permit at Origin for Providing Services (*Permiso Originario de Prestación de Servicios*) as the only document that is necessary to credit that a carrier has been authorized by the competent national agency in the country of origin to provide a service, thereby reducing and simplifying administrative procedures. Another important step was the launch of a dynamic system for information and questions among member countries and the agency's General Secretariat, available to competent authorities of national transport, customs, and migration agencies. It drafted the International Cargo Manifesto, a document specifying the cargo carried by a transport unit for submission to customs authorities of transit countries. These measures to simplify and harmonize legislation will enable a reduction in transport and logistics costs—and, thereby, trade costs.

The Pacific Alliance Infrastructure Fund (PAIF) seeks to channel resources from regional and global capital markets to finance infrastructure projects in its four member countries: Chile, Colombia, Mexico, and Peru. The viability of the PAIF as a vehicle for financing infrastructure in the Pacific Alliance is based, in part, on the existence of a sequence of projects. Moreover, it is a means to minimize the legal changes required for its operation, as well as a way to channel resources and interest from institutional investors in this trade bloc and abroad.[25]

One of the main initiatives of the Mesoamerica Project is the so-called Mesoamerican Integration Corridor, a strategic project representing the shortest route between Mexico and Panama, crossing seven countries and transporting 95% of the goods traded by land in the region. Moving forward, one of the most relevant objectives is to continue building the institutional framework needed to implement projects of the complexity and scale proposed. To achieve this, the goal is for the Transport Agencies of Mesoamerica to approve the Mesoamerican Transport Agenda. This will provide certainty and sustainability to the sectoral agenda. Moreover, it will facilitate the channeling of cooperation resources to the countries and ensure its consistency and link with the mobility and logistics policy in the region (Mesoamerican Integration and Development Project, 2021).

The Union of South American Nations (UNASUR) spearheaded the main initiative—the Initiative for the Integration of the Regional Infrastructure of South America (IIRSA) within the framework of the South American Council of Infrastructure and Planning (COSIPLAN).

The UNASUR bloc's main objective was to resolve coordination problems among countries in the region to promote integration. However, in 2018 and 2019, political changes in its member countries led to most of them breaking away from the bloc. Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, and Uruguay decided to suspend their participation in UNASUR. They

25. The CAF and the IDB prepared a document identifying alternatives for structuring the fund, highlighting the existence of over 200 potential investment projects.

formed a new space called Forum for the Progress and Integration of South America (PROSUR). PROSUR's goals include infrastructure development in South America, specifically a system of quality transport and infrastructure services that will be efficient, fair, sustainable, and resilient, within the framework of integration among the countries.

As we have seen, investments in physical infrastructure, particularly transport, have been present in the agendas of the different trade agreements and supranational integration initiatives in Latin America. Clearly, the States in the region recognize the need to develop the institutional framework required to resolve coordination problems and achieve the needed consensus among countries for physical integration. However, although some of them have proved successful in achieving their goals, e.g., the Mesoamerica Project or the IIRSA, others have been delayed or suffered setbacks, partly as a result of the political cycles in the countries, which have hindered the effectiveness of the initiatives. These initiatives must be conducted within a solid institutional framework resilient to political fluctuations to ensure their development.

Transport infrastructure development has an important presence in the agendas of supranational agreements in the region.

Key points in transport infrastructure for integration

1 Transport costs for intraregional freight are substantially higher in Latin America than in other regions like North America, Oceania, and Europe, according to indirect measurements based on CIF-FOB margins that consider the same basket of goods.

2 The modal composition of transport for international trade in Latin America is highly dependent on maritime transport, even for intraregional exchange. Moreover, the lag in land transport infrastructure for trade is more pressing than for other modes.

3 An assessment of physical infrastructure reveals clear lags in the region, illustrated most clearly by the high potential gains that would be achieved in market access if roads were improved.

4 Companies perceive ports and airports as working better than land border checkpoints for trade. However, maritime and airport connectivity levels are still far behind those in more developed regions, resulting in higher transport costs in these modes for firms in the region.

5 Analysis of the impacts of transport infrastructure involves two main difficulties. The first is the presence of indirect effects that occur when connectivity within and between countries is modified. The second is that the spatial dimension of the problem involves substantial externalities: the complementarity between transport infrastructure and other investments, and the agglomeration economies and congestion costs involved in decisions regarding the location of people and firms and the shipping of goods.

6 Measurements of domestic and foreign market access suggest that improving the quality of the road network to enable traffic to move at 90 km/h would result in major gains. Countries like Bolivia or Colombia could increase access to domestic markets by over 100%. Moreover, low road connectivity between countries prevents economies from benefitting from market access in neighboring countries.

7 Spatial economics has developed several tools to assess the general equilibrium effects (desired and undesired) of investments in transport infrastructure, thereby improving the available information for policymakers.

8 The attainable infrastructure policy alternatives are particularly stark in Latin America due to the low investment per capita that can be achieved. The following are key in this context: a) adequate prioritization of projects; b) resorting to a logistics corridor approach focusing on providing adequate support to the most relevant value chains; and c) balancing expenditure among new projects, restoration, and maintenance.

9 Improving transport infrastructure to foster trade integration in Latin America requires resolving coordination problems among countries in the region. Supranational organizations, multilateral credit agencies, and multilateral trade agreements in the region play a key role in improving the connectivity among their economies.

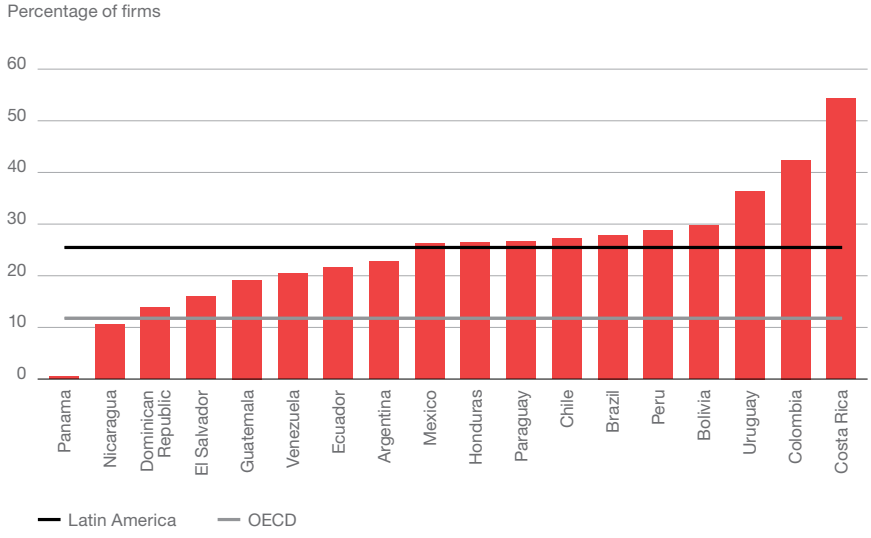
Appendix

Subjective metrics on transport infrastructure quality for production and trade

The World Bank's Enterprise Surveys (WBES) are firm-level sample-based surveys which provide information about firms' operational situation and performance perspectives. The surveys cover a wide range of topics, including perception of the extent to which transport constitutes a barrier for firms' operations. Analysis is based on the question «To what extent is each of the following an obstacle for this firm's current operations?», with transport included among the obstacles. Answer options are: *0 - not an obstacle, 1 - minor obstacle, 2 - moderate obstacle, 3 - major obstacle, 4 - very severe obstacle*.

Graph A 4.1 shows the percentage of firms in Latin America that evaluate transport as *3 - major obstacle* or *4 - very severe obstacle* in the latest year available, and the OECD average (excluding Latin American members). There is great disparity in performance among countries in the region, which ranges from 0.5% for companies in Panama to 54.3% in Costa Rica. The average in Latin America is 33.2%, more than double the average value for 18 countries in the OECD with available data, which is 15%.

Graph A 4.1
Transport infrastructure as a barrier for firms



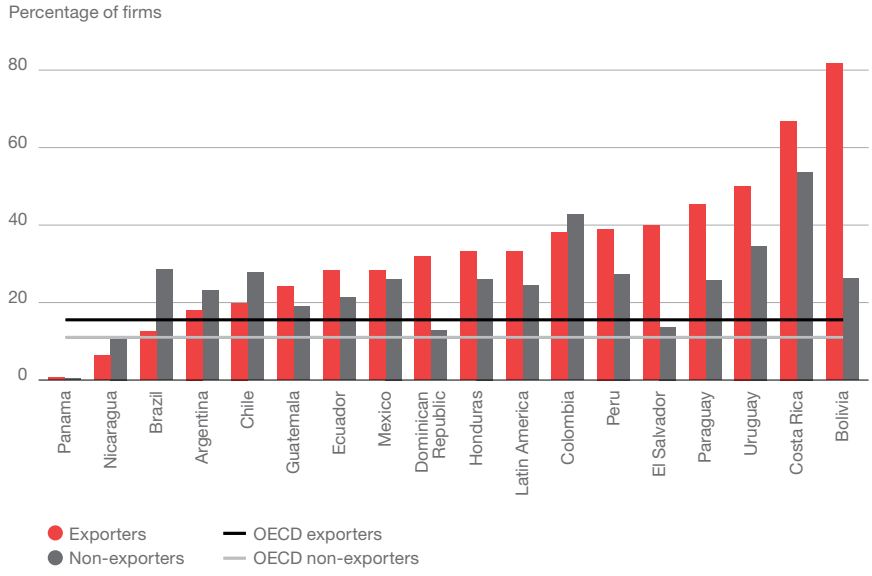
Notes: The horizontal lines indicate the simple average for the countries in Latin America (included in the graph) and the OECD (excluding Latin American countries). The year with the most recent available information (between 2009 and 2020) is used for each country. The details of countries and years are provided in the Appendix (p. 220).

Source: Authors based on data from Enterprise Surveys (World Bank, 2021a).

A breakdown of the above results enables distinction between exporting companies, which send at least 10% of their final product out of the country, and non-exporters, which sell their production on the domestic market. On average, exporting firms report greater restrictions due to transport, both in Latin America and in the OECD. However, the opposite is true for Argentina, Brazil, Chile, and Colombia. Again, as shown in Graph A 4.2, the average levels for both subgroups are lower in the OECD sample than in the region.

Graph A 4.2

Transport infrastructure as a barrier, according to type of firm



Note: The horizontal lines indicate the simple average for OECD countries (excluding Latin American countries). The year with the most recent available information (between 2009 and 2020) is used for each country. The observation for Venezuela is omitted due to lack of data for exporting firms. The details of countries and years are provided in the Appendix (p. 220).

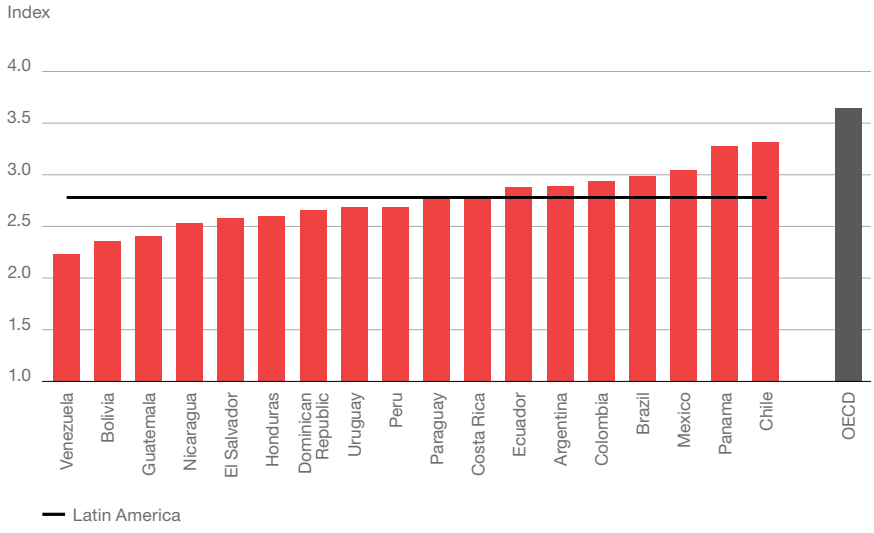
Source: Authors based on data from Enterprise Surveys (World Bank, 2021a).

The Logistics Performance Index (LPI), prepared by the World Bank and published twice a year since 2010, enables evaluation and comparison of the performance of different aspects of logistic management through surveys on freight forwarders and the main express carriers in each country. The index consists of six dimensions: operation efficiency in customs controls; infrastructure quality for trade and transport; ease of determining competitive prices for transport of goods; quality and efficiency of logistics services; ease of global real-time tracking of goods; and punctuality of logistics in complying with delivery terms.

The scale assigns a score to each LPI dimension and provides their aggregate index on a scale of 1 to 5. Graph A 4.3 presents the indexes reported for 2018, showing that average performance in Latin America is 24% lower than the average for OECD countries, although with uneven performance among different countries in the region. Outstanding are the cases of Panama (3.3) and Chile (3.4) with the best performances in the region, even though they are also lower than the average performance in the OECD (3.6).

Graph A 4.3

LPI in countries in Latin America and average for OECD, 2018



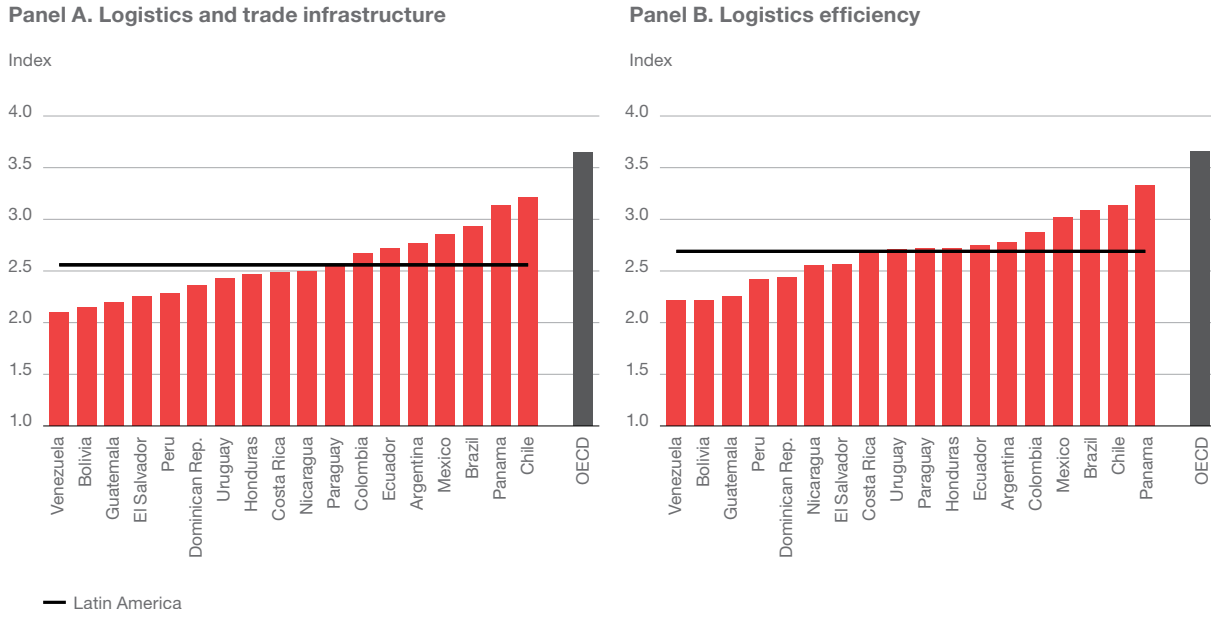
Note: The graph shows the Logistics Performance Index (LPI) on a scale of 1 to 5, with 5 being maximum achievable logistics performance. The horizontal line indicates the simple average for countries in Latin America (included in the graph). OECD corresponds to the simple average for its member countries, excluding Latin American countries. The year 2018 is considered for all countries except Nicaragua (2016). Details on the OECD countries are provided in the Appendix (p. 220).

Source: Authors based on data from World Bank (2021c).

The index enables separate evaluation of each of the six components. Given the focus of this chapter, Graph A 4.4 presents the two most relevant components: infrastructure quality for transport and trade, and efficiency of logistics services. The patterns revealed are similar to the pattern found for the global indicator, though with greater relative lag for the infrastructure component. The logistics and trade infrastructure component in Latin America is 30% worse than in OECD countries, while the efficiency in logistics operations differs by 26% between Latin America and the OECD. The evolution of the indicator during the past decade does not show convergence in performance for the region: while in OECD countries the indicator increased on average 0.7% between 2010 and 2018, in Latin America it dropped by 2.7%.

Graph A 4.4

LPI Indicator components in Latin American countries and average for the OECD



Note: The graph shows two components of the Logistics Performance Index (LPI). Panel A presents the component that evaluates logistics and trade infrastructure, and Panel B shows the component that evaluates logistics efficiency. The scale for both components is 1 to 5, with 5 being the maximum achievable score. The horizontal lines indicate the simple average for Latin American countries (included in the graph). OECD corresponds to the simple average of its member countries, excluding countries in Latin America. The year 2018 is considered for all countries, except Nicaragua (2016). Details on OECD countries are provided in the Appendix (p. 220).

Source: Authors based on data from World Bank (2021d).

Graph 4.1 Clarifications

The following countries and territories with 2019 information from ECLAC are included:

South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, and Uruguay.

Mexico, Central America and the Caribbean: Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Caiman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Granada, Guadalupe, Guatemala, Haiti, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Puerto Rico, Saint Barthelemy, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Saint Lucia, Trinidad and Tobago, Turks and Caicos Islands, Virgin Islands.

Graph 4.2 Clarifications

The graph considers the following countries and territories with information from ECLAC for 2019 and BTS for 2021:

South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, and Uruguay.

USMCA (formerly NAFTA) members: Canada, Mexico, and the United States.

Notes on Graph 4.3

The graph considers the following countries and territories with information in the United Nations database for 2021:

Mexico, Central America and the Caribbean (ACE): Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Granada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Saint Kitts and Nevis, Saint Martin, Saint Vincent and the Grenadines, Saint Lucia, Saint Thomas and Prince, Suriname, Trinidad and Tobago, and Turks and Caicos Islands.

Asia Minor and Southeast Asia (ASA): Afghanistan, Armenia, Azerbaijan, Bangladesh, China, Fiji, Hong Kong (China), India, Indonesia, Japan, Laos, Macao, Malaysia, Myanmar, Nepal, North Korea, Pakistan, Singapore, South Korea, Sri Lanka, Thailand, Tajikistan, Turkmenistan, Turkey, Uzbekistan, and Vietnam.

South America (ASU): Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela.

Eastern Europe (EEC): Albania, Byelorussia, Bosnia and Herzegovina, Bulgaria, Cyprus, Croatia, Georgia, Hungary, Poland, Rumania, Russia, Serbia, Slovakia, Slovenia, and Ukraine.

Asia Minor and Southeast Asia (MENA): Argelia, Bahrein, Egypt, Iraq, Iran, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, and Yemen.

Oceania (OCE): Australia and New Zealand.

Sub-Saharan Africa (SSA): Angola, Benin, Botswana, Burkina Faso, Burundi, Cape Verde, Cambodia, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Ethiopia, Gabon, Gambia, Ghana, Ivory Coast, Kenia, Lesotho, Liberia, Madagascar, Namibia, Niger, Nigeria, Rwanda, Western Sahara, Samoa, Senegal, Sierra Leona, Somalia, South Africa, South Sudan, Tanzania, Uganda, Zambia, and Zimbabwe.

Graph 4.5 and Graph 4.6 Clarifications

The graphs consider the following European countries with information from the UNCTAD database (2021b):

Germany, Belgium, Bulgaria, Cyprus, Croatia, Denmark, Slovenia, Spain, Estonia, Finland, France, Greece, Ireland, Iceland, Latvia, Lithuania, Malta, Norway, the Netherlands, Poland, Portugal, Rumania, and Sweden.

Graph 4.9 Clarifications

The following years are considered for the countries in Latin America: 2016 for Argentina, Ecuador and Peru; 2017 for Guatemala, Honduras and Paraguay; 2018 for El Salvador, Nicaragua and Uruguay; 2019 for Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, and Panama.

The following OECD countries are considered, all for 2018: Austria, Belgium, Canada, Denmark, Slovakia, Slovenia, United States, Estonia, Finland, France, Hungary, Iceland, Italy, Japan, Latvia, Lithuania, Luxembourg, Norway, New Zealand, the Netherlands, Poland, Portugal, UK, Czech Republic, Republic of Korea, Sweden, Switzerland, and Turkey.

Graph A 4.1 and Graph A 4.2 Clarifications

The following years are considered for the countries of Latin America: 2017 for Argentina, Bolivia, Colombia, Ecuador, El Salvador, Paraguay, Peru and Uruguay; 2016 for El Salvador, Honduras, Nicaragua and Dominican Republic; 2010 for Chile, Costa Rica, Mexico, Panama and Venezuela (considered only in Graph A 4.1); and 2009 for Brazil.

The following countries and years are considered for the OECD: 2020 for Belgium, Ireland, Luxembourg and the Netherlands; 2019 for Slovakia, Slovenia, Estonia, Hungary, Italy, Latvia, Lithuania, Poland, Portugal, Czech Republic and Turkey; 2018 for Greece; 2014 for Sweden; 2013 for Israel.

Graph A 4.3 and Graph A 4.4 Clarifications

The following countries are included for the OECD:

Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

Graph 4.8, Table 4.1, Table 4.2, Figure 4.3, Figure 4.4, Figure 4.6, and Figure 4.7 Clarifications

For Graph 4.8 and Table 4.1, access to domestic markets is an indicator that can be used to quantify the size of the accessible market given a number of travel hours along the road infrastructure. The size of the market is measured in millions of persons that can be reached by means of the road and highway network in use in the territory under analysis. The market access indicator is constructed individually for each city, considering it as origin and calculating the population in the cities of destination which can be accessed per number of hours' travel. For the value 0 hours' travel, the number of residents in the same city of origin are considered.

The access to domestic markets indicator is constructed at national level based on the weighted average of the indicators of cities comprising the sample in each country. Weighting corresponds to market size in each city, measured in millions of persons, with relation to the total market of the cities included in the sample.

For Table 4.2, access to neighboring markets is an indicator that enables quantification of the market size in neighboring countries that is accessible for a given number of travel hours along the road infrastructure. Market size is measured in millions of persons that can be reached by the road and highway network in use in the territory under analysis and in its neighboring countries. The market access indicator is constructed individually per city, considering that city as origin and calculating the population in the cities of destination in neighboring countries which can be accessed according to each number of travel hours. For the value zero travel hours, market access is zero because any cities that are included in the domestic market are excluded from the calculation.

The indicator for market access in neighboring countries is constructed, on a national level, based on the weighted average of the indicators of the cities that belong to the sample in each country. Weighting corresponds to market size for each city, measured in millions of persons, with relation to the total market of the cities included in the sample in the country of origin.

For Graph 4.8, Table 4.1, Table 4.2, Figure 4.3, Figure 4.4, Figure 4.6 and Figure 4.7, the following cities were used in each country studied:

Argentina: Bahía Blanca, Buenos Aires, Catamarca, Comodoro Rivadavia, Concordia, Córdoba, Corrientes, Formosa, La Plata, La Rioja, Mar del Plata, Mendoza, Neuquén, Paraná, Posadas, Rawson, Resistencia, Río Cuarto, Río Gallegos, Rosario, Salta, San Juan, San Luis, San Nicolás, San Salvador de Jujuy, Santa Fe, Santa Rosa, Santiago del Estero, Tucumán, Ushuaia, and Viedma.

Bolivia: Cobija, Cochabamba, Colcapirhua, La Guardia, La Paz, Montero, Oruro, Potosí, Quillacollo, Riberalta, Sacaba, Santa Cruz de la Sierra, Sucre, Tarija, Tiquipaya, Trinidad, Viacha, Vinto, Warnes, and Yacuiba.

Brazil: Agreste, Aracaju, Baixada Santista, Belem, Belo Horizonte, Boa Vista, Brasilia, Campiñas, Campo Grande, Carbonífera, Cariri, Chapeco, Cuiaba, Curitiba, Florianópolis, Fortaleza, Foz do Rio Itajai, Goiania, Joao Pessoa, Lages, Londrina, Maceio, Manaos, Maringa, Natal, Palmas, Petrolina, Porto Alegre, Porto Velho, Recife, Rio de Janeiro, Salvador, San Pablo, Sao Luis, Teresina, Tubarao, Vale do Aco, Vale do Itajai, and Vitoria.

Chile: Angol, Antofagasta, Arica, Calama, Caldera, Castro, Chillán, Coihaiqué, Concepción, Copiapó, Curicó, Graneros, Iquique, La Serena, Linares, Los Andes, Los Ángeles, Osorno, Ovalle, Puerto Aysén, Puerto Montt, Puerto Natales, Puerto Varas, Punta Arenas, Quillota, Rancagua, Rengo, San Antonio, San Felipe, San Fernando, San Pedro de La Paz, Santiago, Talca, Temuco, Valdivia, Vallenar, and Valparaíso.

Colombia: Armenia, Barranquilla, Bello, Bogotá, Bucaramanga, Cali, Cartagena, Cúcuta, Florencia, Ibague, Manizales, Medellín, Montería, Neiva, Pasto, Pereira, Popayán, Quibdó, Riohacha, Santa Marta, Sincelejo, Soacha, Soledad, Tunja, Valledupar, and Villavicencio.

Costa Rica: Alajuela, Cartago, Grecia, Guapiles, Heredia, Liberia, Puerto Limón, Puntarenas, Quesada de San Carlos, San Isidro de El General, San Jose, San Rafael de Alajuela, and San Ramón de los Palmares.

Ecuador: Ambato, Babahoyo, Chone, Cuenca, Daule, Durán, El Carmen, Esmeraldas, Guayaquil, Huaquillas, Ibarra, La Libertad, Latacunga, Loja, Machala, Manta, Milagro, Montecristi, Nueva Loja, Pasaje, Portoviejo, Quevedo, Quito, Riobamba, Samborondón, Sangolqui, Santa Rosa, Santo Domingo, and Tulcán.

El Salvador: Acajutla, Ahuachapán, Antiguo Cuscatlán, Apopa, Ayutuxtepeque, Ciudad Arce, Cojutepeque, Colón, Izalco, Nahuizalco, Opico, Quezaltepeque, San Miguel, San Salvador, San Vicente, Santa Ana, Sonsonate, Tonacatepeque, Usulután, and Zacatecoluca.

Spain: Algeciras, Alicante, Almería, Barcelona, Bilbao, Cádiz, Cartagena, Castellón de la Plana, Córdoba, Gijón, Granada, La Coruña, León, Madrid, Málaga, Marbella, Murcia, Pamplona, San Sebastián, Santander, Sevilla, Tarragona, Valencia, Valladolid, Vigo, Vitoria, and Zaragoza.

United States: Atlanta, Austin, Baltimore, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Columbus, Dallas, Denver, Detroit, Houston, Indianapolis, Jacksonville, Kansas City, Las Vegas, Los Angeles, Miami, Milwaukee, Minneapolis, Nashville, Nueva York, Orlando, Philadelphia, Phoenix, Pittsburgh, Portland, Providence, Riverside, Sacramento, Saint Louis, San Antonio, San Diego, San Francisco, San Jose, Seattle, Tampa, Virginia Beach, and Washington.

Guatemala: Chiantla, Chichicastenango, Chimaltenango, Chiquimula, Ciudad de Guatemala, Coatepeque, Coban, Escuintla, Huehuetenango, Jalapa, Jutiapa, La Libertad, Malacatan, Mazatenango, Momostenango, Morales, Nebaj, Playa Grande Ixcan, Puerto Barrios, Quetzaltenango, Santa Cruz

Barillas, Santa Cruz del Quiche, Santa Lucia Cotzumalguapa, Sayaxche, Solola, Tecpan, and Totonicapán.

Honduras: Choloma, Choluteca, Comayagua, Danli, El Progreso, Juticalpa, La Ceiba, Puerto Cortes, San Pedro Sula, Siguatepeque, Tegucigalpa, Villanueva.

Mexico: Acapulco, Aguascalientes, Cancun, Celaya, Chihuahua, Ciudad Juarez, Mexico City, Coatzacoalcos, Colima, Cordoba, Cuautla, Cuernavaca, Guadalajara, Heroica Matamoros, La Laguna, Leon, Merida, Mexicali, Minatitlán, Monclova, Monterrey, Morelia, Nuevo Laredo, Oaxaca, Orizaba, Pachuca de Soto, Poza Rica, Puebla, Puerto Vallarta, Queretaro, Reynosa, Saltillo, San Luis Potosi, Tampico, Tepic, Tijuana, Tlaxcala, Toluca, Tuxtla Gutierrez, Veracruz, Villahermosa, Xalapa.

Nicaragua: Bluefields, Boaco, Chichigalpa, Chinandega, El Viejo, Esteli, Jalapa, Jinotega, Juigalpa, Leon, Managua, Matagalpa, Nagarote, Nueva Guinea, Ocotal, Puerto Cabezas, Rivas, Sebaco.

Panama: Aguadulce, Arraijan, Cativa, Changuinola, Chitre, Ciudad de Panama, Colon, Cristobal, David, Juan Demostenes Arosemena, La Chorrera, La Concepción, Las Tablas, Penonome, Santiago de Veraguas, Vista Alegre.

Paraguay: Asuncion, Caacupe, Caaguazu, Caazapa, Ciudad del Este, Concepcion, Coronel Oviedo, Encarnacion, Filadelfia, Fuerte Olimpo, Paraguarí, Pedro Juan Caballero, Pilar, Salto del Guairá, San Juan Bautista, San Pedro, Villa Hayes, Villarica.

Peru: Abancay, Andahuaylas, Arequipa, Ayacucho, Bagua, Bagua Grande, Cajamarca, Cañete, Cerro de Pasco, Chachapoyas, Chiclayo, Chimbote, Chincha Alta, Chivay, Cuzco, Huancavelica, Huancayo, Huanta, Huanuco, Huaraz, Ica, Ilo, Jaen, Juliaca, Lambayeque, Lima, Moquegua, Moyobamba, Oxapampa, Pisco, Piura, Pucalpa, Puerto Maldonado, Puno, Sullana, Tacna, Tarapoto, Tarma, Trujillo, Tumbes, Yurimaguas.

Uruguay: Artigas, Bella Union, Canelones, Carmelo, Castillos, Chuy, Ciudad De La Costa, Ciudad Del Plata, Colonia Del Sacramento, Dolores, Durazno, Florida, Fray Bentos, Juan Lacaze, Libertad, Maldonado, Melo, Mercedes, Minas, Montevideo, Nueva Helvecia, Paysandu, Rio Branco, Rivera, Rocha, Salto, San Carlos, San Jose De Mayo, Santa Lucia, Tacuarembo, Treinta Y Tres, Trinidad, Young.

Venezuela: Acarigua, Barcelona, Barinas, Barquisimeto, Cabimas, Caracas, Carupano, Ciudad Bolivar, Ciudad Guayana, Ciudad Ojeda, Coro, Cumana, El Tigre, Guacara, Guanare, Guarenas, Guatire, La Victoria, Los Teques, Maracaibo, Maracay, Maturin, Mérida, Puerto Cabello, Puerto La Cruz, Punto Fijo, San Cristobal, San Fernando de Apure, Tocuyito, Turmero, Valencia, Valera.

Challenges of energy integration

5

Challenges of energy integration[1]

Energy integration is spurred by the advantages of interconnecting the power grids of countries in geographic proximity and the multiple benefits this can bring. Benefits include economies of scale in production leading to reduced costs and improved supply security, the mitigation of the impact of unforeseen events, improvements in quality of service and environmental protection. All of this generates positive impacts on consumers and businesses. Integration processes can range from interconnection of electrical power systems to broad-scale integration. Depending on the countries involved in the network, bilateral or multilateral agreements are usually required.

This chapter focuses on electrical energy, which cannot be stored (at least not until large-capacity batteries can be produced affordably) and must be transported over transmission grids.[2] Electricity trade between countries requires special infrastructure (interconnections) and dispatch coordination[3] (to incorporate flows and define payments in the respective systems) among national systems, which may have different pricing and operating rules. As such, electricity is a tradable commodity at the regional level and its exchange entails the homogenization of regulations and coordination of policies among the countries involved. In this regard, energy integration processes are closely related to the processes of productive integration discussed in Chapter 6 of this report. In addition to enabling the necessary channels for energy trade (e.g. through interconnections), integration requires countries to coordinate their energy production targets if the goal is to achieve levels of trade beyond spot trading. These processes must also be part of a joint strategy to leverage the productive advantages of power plants for each economy.

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1. This chapter was written by Diego Barril and Walter Cont, with research assistance from Agustín Carbó.

2. In the case of natural gas, before technological advances allowed the trading of liquefied natural gas (LNG), trade depended on the resource's existence in the region. The experiences of energy integration over gas networks (Argentina and Chile, Bolivia and Argentina, Bolivia and Brasil) hold lessons in several cases that are like those in the electricity sector (see Figure 5.3 and Navajas, 2008). Nevertheless, recent trends (mainly, the liquefaction and regasification of natural gas) make LNG a globally tradeable commodity.

3. Dispatch is the process by which electric power plants are assigned as needed by a coordinator to cover a certain demand level based on established rules. A dispatch is coordinated by the systems of both countries when the interconnection is included as a supply point (similar to a generator on the border node) in the respective systems.

In Latin America,[4] progress toward regional integration has been achieved to different degrees. Significant progress was made in Central America with the formation of a regional electricity market and the completion of the physical interconnection between all the member countries, with a 300-megawatt capacity. However, regulatory modifications to fully harness the benefits of this initiative are still pending. In South America, in contrast, progress has been limited to bilateral connections (more advanced in the Andean subregion than in the Southern Cone) and the harnessing of common resources, such as bi-national hydroelectric dams (mainly in the Southern Cone). Although the energy policy agendas of many countries recognize energy integration among their objectives, it has been quite difficult to implement them in practice.

In this context, this chapter studies in detail the experience of energy integration in the region, in terms of aspects related to electricity flows traded between countries and main drivers, such as institutional, policy, and regulatory arrangements that support trade. Based on this analysis, the chapter highlights the political challenges faced by the region when it comes to deepening this process.

The analysis shows that, despite the multiple benefits of integration, electrical energy trade volumes cover 4% of consumption in Central America and 0.5% in South America (once exchanges sourced from binational hydroelectric dams are subtracted).[5] In the latter subregion, there is evidence of underutilization of existing infrastructure and some significant obstacles, such as the concept of energy security—very present in several countries—or a lack of robust institutional frameworks. Furthermore, electricity trade in Central America through its regional electricity market (MER) has consistently grown. However, this process must still overcome the challenges inherent to the search for greater harmonization and integration of the system.

The analysis in this chapter also shows that drivers of trade in South America are consistent with those highlighted in the literature: the impetus from demand (captured by the size of the economy and the price of electricity in the importer country), the negative effect of distance, and the structural conditions stemming from energy policies in exporter countries (captured by the differences between capacity and maximum demand, and supply from renewable sources). In the case of Central America, the integration process came hand in hand with a reduction in the cost of energy and MER spot price convergence. These results are consistent with the idea that energy exchanges contribute to the mitigation of risks associated with shocks that affect electricity generation or demand and their consequences on prices.

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4. In this chapter, Latin America (LA) refers to the following countries: Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Peru, and Uruguay; Central America encompasses Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama; South America includes the countries of the Andean region (Colombia, Ecuador, Peru and, whenever possible, Venezuela) and the Southern Cone (for the purposes of this document, this encompasses a broader geographic area including Brazil and Paraguay, in addition to Argentina, Chile, and Uruguay).

5. Energy exchange via binational hydroelectric dams is determined by factors other than exchange through interconnections. These projects have defined rules of purchase-sale of electricity in the event that one of the countries does not consume the entire assigned amount. The problems surrounding the construction of these dams are discussed in Ruchansky (2013).

They also help to improve the reliability of supply and diversify sources of production for improved environmental sustainability.

The chapter ends by standing out the institutional and regulatory conditions governing electricity transactions in the Southern Cone that could provide flows with greater predictability and reliability, hence stimulating sustainable trade beyond spot levels. In the case of Central America, the main challenges are related to regulatory harmonization measures (in addition to resolving the feasibility challenges), investment, and market conditions that reduce constraints to electrical energy flows among countries.

Benefits and obstacles to integration

Energy policy is at the center of discussions involving the long-term outlook for Latin American countries. The security of primary sources, reliability of supply, efficient management of energy resources, expansion of access, affordability of service, and environmental sustainability form part of government agendas across the region.

Energy integration (in particular, electricity integration) is a strategy that allows countries to at least partially address these objectives together. It is defined as the act of two or more countries recurrently exchanging electricity flows through physical interconnection under an established regulatory framework. There are at least four types of benefits of energy trade for countries that participate in this type of initiative, as laid out in Figure 5.1.

Energy integration provides a framework to address the objectives of energy security, efficiency and reliability of supply, access, affordability, and environmental sustainability.

First, given the heavy share of hydroelectricity in generation in Latin America (62% of total generation in the 2014-2018 period), the possibility of trade allows countries to mitigate the risks associated with the random nature of this source caused by unforeseen climate phenomena (e.g., droughts). Such exchanges thus increase the reliability of the electrical power system.

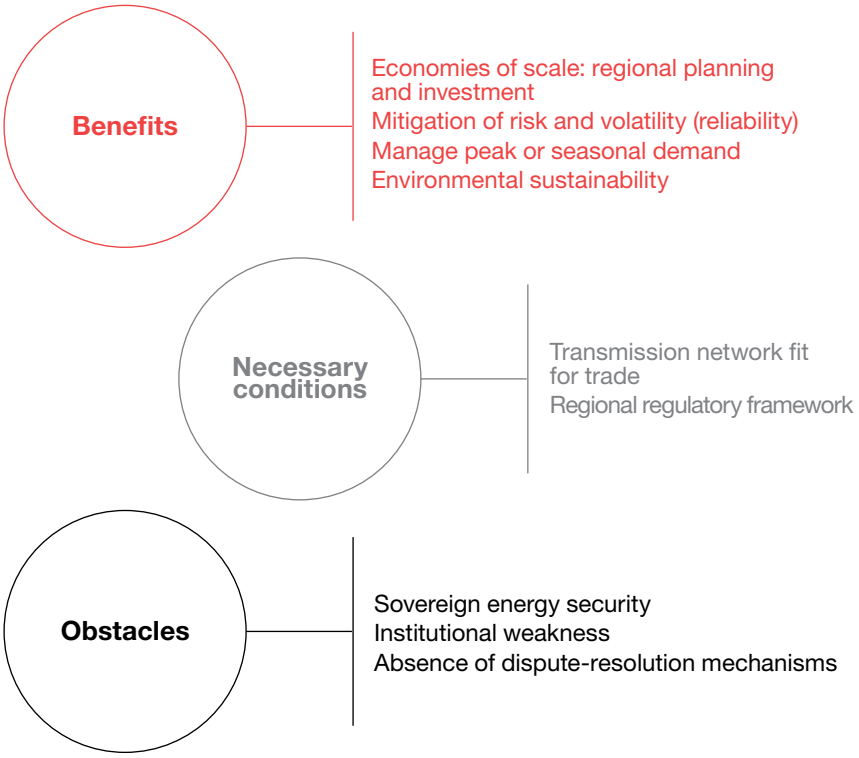
Second, integration allows countries to take better advantage of more supply options to address peak and seasonal demand. Price volatility at these times is reduced by substituting high-cost local power generation with low-cost electricity sourced from an interconnected system.

Third, it provides the opportunity to leverage economies of scale. The expanded market allows countries to plan and invest in large-scale power plants for regional use (that would not be profitable at the local level), reducing the cost of energy. Likewise, countries can avoid or postpone investments that are only justified when needed to address spikes in demand, thus using resources more efficiently.

Fourth, integration fosters environmental sustainability (protecting the environment and fighting climate change) by taking advantage of the electricity generated by countries in a position to use non-conventional renewable

energies[6] (NCREs) or sources with lower carbon emissions at a competitive cost. For instance, in 2019, 42% of the electric power generated in Uruguay came from NCREs, with exports from that country replacing power generation from higher carbon-emission sources in partner countries (see Figure 5.2, Panel B). Before the irruption of these sources, positive environmental impact was achieved by replacing carbon or fossil fuels-based electricity with hydroelectricity or natural gas-based plants.

Figure 5.1
Benefits, necessary conditions, and obstacles to energy integration



Source: Authors.

6. Non-conventional renewable energies (NCREs) include wind and solar, biomass, and small hydroelectric generators with less than 50 MW capacity

Integration experiences in South and Central America were, in principle, focused on these objectives. Integration initiatives, including those involving energy, began in the region in the mid-twentieth century. The first projects were in the form of joint exploitation of hydro resources (Salto Grande between Argentina and Uruguay went into operation in 1980; Itaipú between Brazil and Paraguay, in 1984; and Yacyretá between Argentina and Paraguay, in 1994). Later, the process of energy integration via interconnections among South American countries advanced more slowly, while in Central America an ambitious process of interconnection was fully implemented by 2014, fostering more fluid trade (CAF, 2013; Ruchansky, 2013).

The uneven pace of integration across Latin America shows that despite the potential benefits a set of conditions are necessary for countries to adopt this strategy. The most important is the national grid's capacity to support electricity trade without affecting each country's supply, even in contingency cases (Levy Ferre et al., 2020). This is related to the specificity of assets necessary to exchange electricity (high cost, complexity, and long maturity of investment), and is what sets this market apart from other goods or services. This is why electrical energy trading is usually a bilateral phenomenon that, if successful, then extends regionally. Furthermore, there must be regulations to guide operations and trade in the region.

Electricity trading is usually a bilateral phenomenon that, if successful, then extends regionally.

In addition to the necessary conditions, the path to integration may come up against obstacles that block or at least reduce investment incentives. An initial aspect is each country's concept of energy security. In some countries with a net deficit of energy products, the search for energy security, meaning a country's economy is independent of external energy shocks, requires measures aimed at self-supply. The reasons that usually justify policies of this kind include increasing price volatility, scarcity conditions, and potential geopolitical conflicts with other countries.[7] Institutional weakness or lack of dispute-resolution mechanisms in regional trade blocs are additional barriers to integration. It has been very difficult to define and implement stable and predictable rules that provide legal security through adequate dispute-resolution mechanisms, particularly in the South American region.

7. The definition of energy security, in this case, refers mainly to sovereignty, i.e. the capacity to preserve and manage energy resources. However, other definitions encompass concepts of robustness against engineering factors, and the resilience of systems to different sector shocks (economy). For details, see Rodríguez Padilla (2018).

Characterization of the electricity sector and electrical energy flows in the region

This section introduces selected indicators in Latin America's electricity sector that are considered the main drivers in the integration experiences analyzed throughout the rest of the chapter. It describes the diverse instruments used for interconnection initiatives, as well as the situation of Central and South American countries concerning relevant dimensions in the electric energy sector (installed capacity, generation, consumption, and peak demand in relation to capacity). When pertinent, comparisons to other continents or regions (e.g., the United States and Europe) are made.

The experiences with electrical energy integration in Latin America can be broken down into three groups: joint exploitation of water resources (between neighbor countries); interconnections that allow bilateral trading of electrical energy (according to spot or contract modalities), and broader, more far-reaching initiatives involving countries that aim to form single markets. The first two are predominant in South America, while the last is the chosen model in Central America. Figure 5.2 illustrates the interconnections through bilateral networks (operating and under construction), the Central American Electrical Interconnection System (SIEPAC), and established dams, as well as various projects under study (marked in red.)[8]

Figure 5.2
Interconnections and binational dams in Central and South America

Continued on the next page →

8. Numerous references explain in detail the interconnections, integrations, and dams: (CAF, 2013; CAF and CIER, 2012; CIER, 2020; Levy Ferre et al., 2020; Ruchansky, 2013, among others). See description in Appendix (p. 262-263).

Notes: References included on maps can be found in the Appendix (p. 264).

Source: Adapted from CIER (2020).

Selected indicators for the electricity sector

Integration has allowed Central American countries to relax the power needs of some countries in order to address maximum demand in others where the capacity of response has been compromised in the past.

The region has invested in electric power generation to meet demand needs over the past decade, as shown in Graph 5.1. On the one hand, Central America has greater nominal reserves;[9] on the other, the subregions of South America (Andean and Southern Cone) have similar generating capacities to meet their respective demand needs.[10]

Using 2009 and 2019 as points of reference, there was a reduction in the ratio between maximum demand and capacity in all countries. This may be an indicator of lack of integration, in which case countries should individually invest in guaranteeing their electricity supply, even in times of peak demand. However, it can also be inferred that integration in Central America has allowed some countries to relax their power needs, such as Honduras and El Salvador. In Honduras, the capacity of response has been compromised in the past.[11] El Salvador is the country with the lowest increase in reserve capacity and is the main demand country in the MER.

One front where LAC countries have made headway is in the incorporation of NCREs in the energy matrix, increasing their generating capacity. Graph 5.2 shows that Central American countries have expanded their advantage compared to the United States during the past decade, while the Southern Cone is on par with the situation in the United States (10% of total generation from renewables). However, the region is still far from progress made by the European Union (even compared to their situation a decade ago).

Progress in Central America suggests that energy integration can serve to bolster the argument in favor of less-contaminating power sources (i.e., it allows for risk-management in the face of the randomness of these sources and, at the same time, provides a market for the excess generation). South America lags furthest as a region (particularly the Andean subregion), although it has a baseline of greater hydroelectric power generation. Within the Southern Cone, Uruguay stands out as the country that has radically modified its energy matrix (with 42% of generating power from NCREs in 2019).

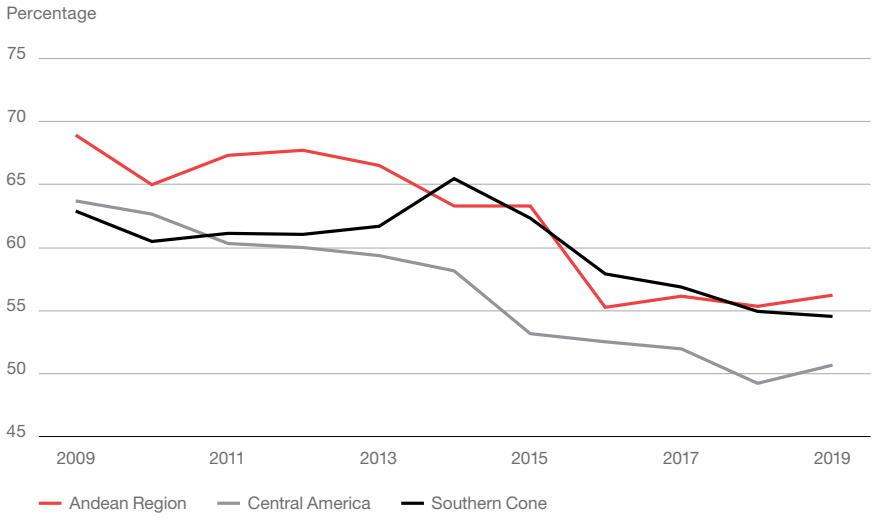
9. In electrical grids, the reserve is the generating capacity available for the system operator to meet demand quickly if a generator goes out or there is an interruption in supply.

10. This comparison is for purposes of illustration and should be taken with caution: nominal, effective and firm capacity data may differ significantly. There is no systematic data on effective or firm power. However, nominal capacity in Guatemala was 4,095 MW and effective capacity was 3,463 MW in 2018. Likewise, Panama registered firm capacity of 2,325 MW in 2018, with a nominal rate of 3,849 MW. Installed or nominal capacity is what is reported on the nameplate of the power plant. Effective capacity refers to a generator's actual performance, which is usually lower than nominal. Firm power is the maximum power that can be generated with a high level of security in a set timeframe (e.g., one month). It is usually less than effective power because plans may be unavailable (due to maintenance or unforeseen situations).

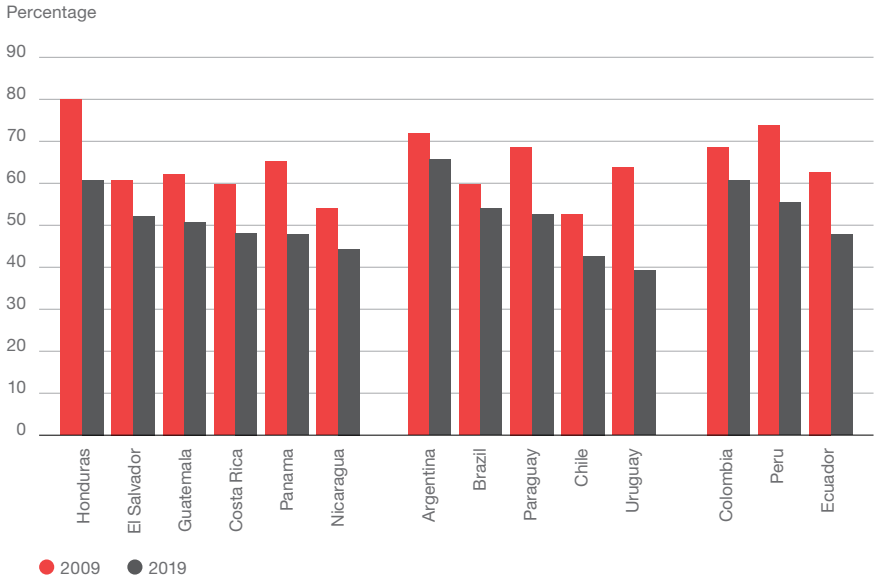
11. In this case, the capacity of the SIEPAC network (300 MW) offsets the ratio between maximum demand and installed capacity, functioning as an additional energy source on top of each country's domestic supply.

Graph 5.1
Maximum demand over installed capacity

Panel A. Evolution over time by subregion[a/]



Panel B. Selected countries[b/]



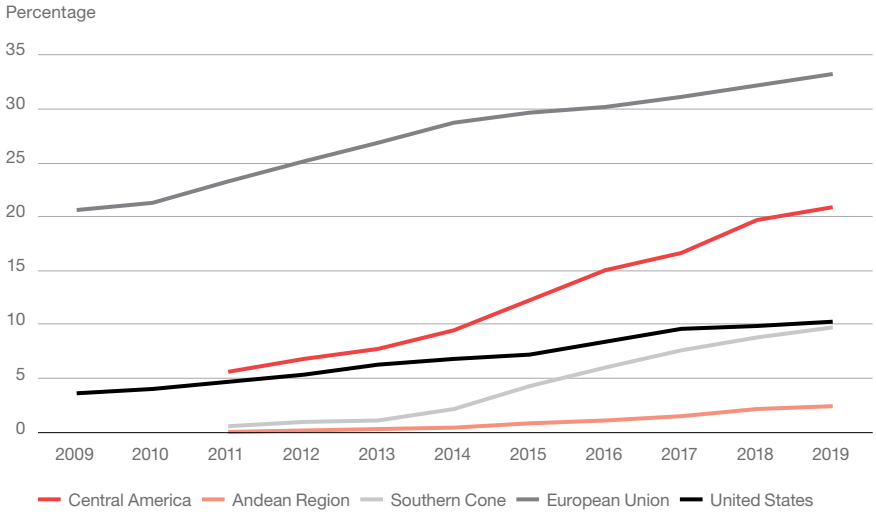
Notes: Installed capacity is nominal; therefore, the ratio of reserve capacity is less than what is inferred in the graph. The countries included in each region can be found in footnote 4 (p. 228).

a/ Due to the absence of official data from some countries, regional averages for the Southern Cone do not include values for Brazil for 2009, Paraguay for 2019, or Uruguay for 2009-2011.
b/ Due to the absence of official data for some years, calculations were made based on the values for the nearest year in Brazil (2010 instead of 2009), Paraguay (2018 instead of 2019), and Uruguay (2012 instead of 2009).

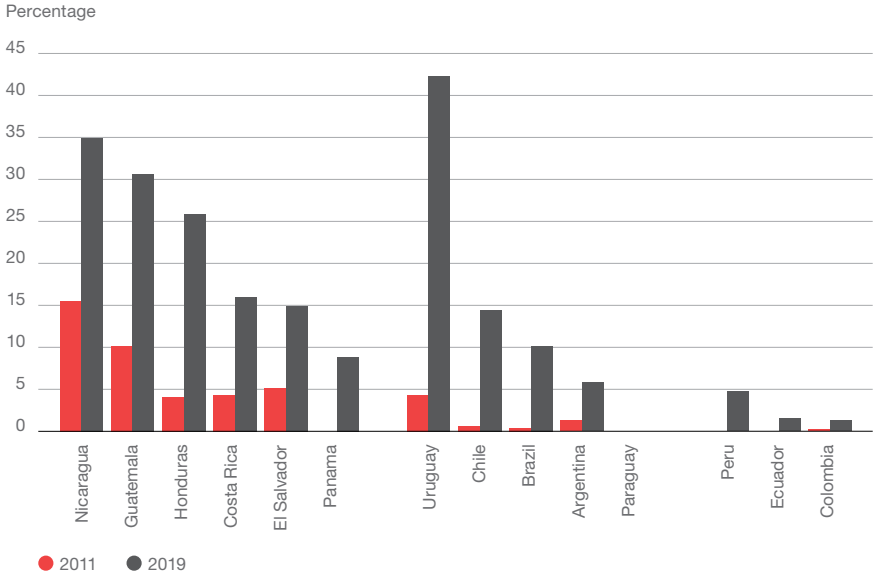
Source: Authors based on information from national statistics offices.

Graph 5.2
Generation from NCREs

Panel A. Evolution over time by subregion



Panel B. Selected countries



Notes: Values correspond to the percentage of power generated using non-conventional renewable energies over total generation.

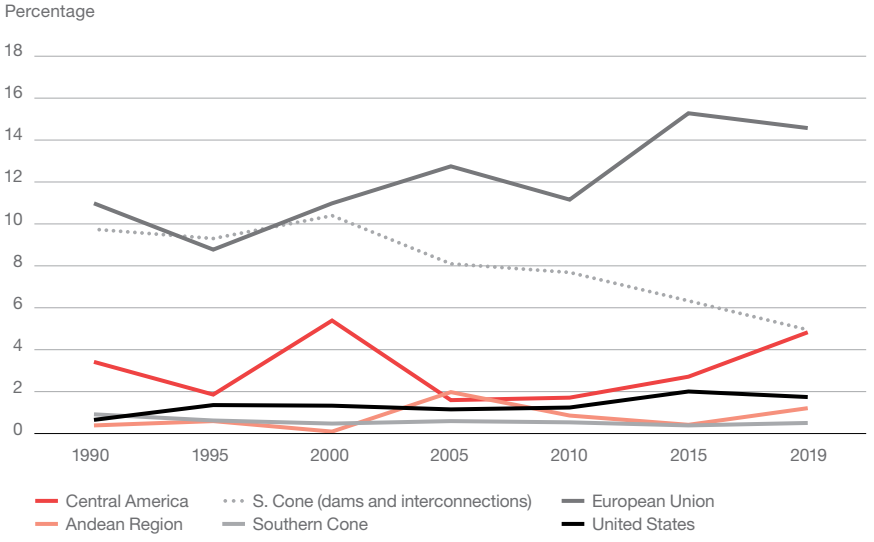
Source: Authors based on information from national statistics offices, Eurostat (2020), and EIA (2020).

Electricity trade: aggregated data

Electricity trade in Latin America in recent years has been low, as can be observed in Graph 5.3. Even if flows generated from shared sources (bi-national hydroelectric dams) are included, the electricity flows between countries vary between 5 and 10% of total consumption in the Southern Cone, much less than the European Union (EU), where trade exceeded 14% of consumption in the last five years, although with differences by country. Excluding the energy generated by binational dams, just 0.5% of electricity consumption comes from transactions through interconnections. In the case of the Andean subregion, such transactions were more active between 2005 and 2011 (1.3%), then fell to 0.4% of consumption. In contrast, Central America shows a growing volume of transactions after the Regional Electricity Market (MER) began operating, surpassing 4% of consumption in the region in 2017 and 2019.[12]

Excluding the energy generated by bi-national dams, just 0.5% of electricity consumption comes from transactions via interconnections.

Graph 5.3
Electricity imports



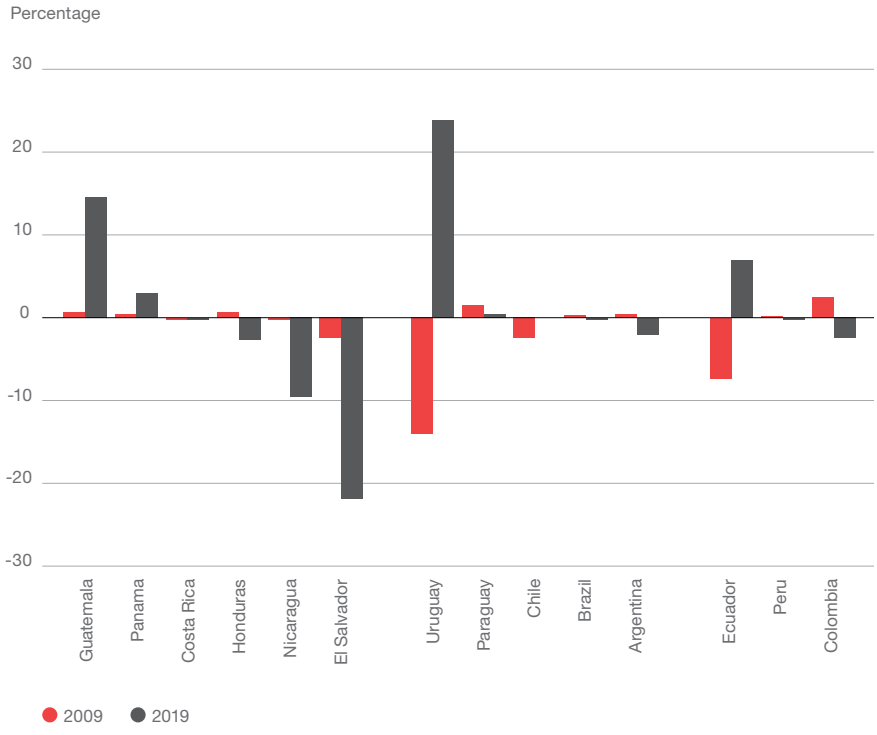
Notes: Values reflect the percentage of electricity imported over total consumption. Total electricity consumption for the 1990-2005 period in Central America, Southern Cone, and Andean Region is calculated based on per capita consumption information from CAF and CIER (2012) and population data from the World Bank.

Source: Authors based on information from national statistics offices, CAF and CIER (2012), World Bank (2020e), EIA (2020), and Eurostat (2020).

12. Transactions varied between 1% and 2.2% for the 1995-1998 period, then rose to 4% in 1999 and exceeded 5% in 2000. Later, they fell to 3% in 2001-2004, mainly due to exchanges between Guatemala and El Salvador (Ruchansky, 2013).

The balance between exports and imports for the years 2009 and 2019 shows variations in roles (Graph 5.4). In the Southern Cone, Uruguay transitioned from importer to net exporter, while in the rest of the subregion the net trade position in 2019 is practically nil. One interpretation of this is that electricity sovereignty is the prevailing strategy in these economies and, therefore, no country wants to be exposed as a net importer. In the Andean subregion, the most interesting case is the role change between Ecuador and Colombia, where the former went from net importer to net exporter, while the opposite occurred in Colombia. Peru has maintained its position of zero net balance for both years. Shifting patterns can also be observed in Central America. Guatemala and Panama are net exporters, very marginal in 2009 but much more significantly so by 2019, while Nicaragua and El Salvador increase considerably their positions as net importers in 2019 (approximately 10% and 20% of internal consumption, respectively).

Graph 5.4
Net electricity balance



Notes: Net balances between exports and imports are shown as a percentage of consumption. Venezuela is not included, since the latest available data for consumption and generation is from 2015.

Source: Authors based on information from national statistics offices.

Electrical energy exchanges: openness by origin and destination in South America

The available information on bilateral electricity exchanges in South America makes it possible to identify the origin and destination of trade (with flows measured in GWh). This identification is not possible in Central America because countries import and export electricity through the regional electricity market rather than bilaterally.

Total electricity trading in 2019 fell by 31% in comparison to 2009.

Table 5.1 shows electricity flows between South American countries for two years, 2009 and 2019.[13] The level of flows in the Southern Cone is dominated by commerce in binational dams (from Paraguay to Argentina and Brazil). Exchanges via interconnections amounted to 14% of total flows for the two years reported. In 2009, Chile was the only importer, the same as in previous years, and Paraguay was an exporter. The remaining countries (Argentina, Brazil, and Uruguay) imported and exported that year. In the Andean region, Colombia exported electricity to Ecuador and Venezuela, while Peru exported a small volume to Ecuador. The existing connection in use for exports from Venezuela to northern Brazil is the only point of contact between the Andean and Southern Cone countries.

The situation in 2019 presents some changes. Total electricity exchanges fell by 31% in comparison to 2009, coming in at 37,172 GWh (31,620 GWh from dams and 5,552 GWh from interconnections). In the Southern Cone, Uruguay became an exclusive exporter of electricity. Argentina and Brazil, meanwhile, remain the biggest net importers of the subregion (even when flows through binational dams are subtracted); Paraguay and Uruguay consolidated their position as net exporters.

In the Andean subregion, Colombia lost its leading role as an exporter: since 2017, it has ceased to export electricity to Venezuela and reduced sales to Ecuador, at the same time increasing imports from the latter. Peru went from net exporter to net importer in relation to Ecuador, but always in low quantities. In all cases, opportunities appear to exist to expand trade.

13. The information for the 2009-2019 period is used in the analysis done in the section «Determinants of bilateral electricity trade and impacts on development.»

Table 5.1
Electricity trade in South America by origin and destination

Panel A. 2009

		Exports									Total
		Argentina	Chile	Paraguay	Uruguay	Brazil	Venezuela	Colombia	Ecuador	Peru	
Imports	Argentina			521 / 7,081	241	1,278					2,040 / 8,600
	Chile	1,348									1,348
	Paraguay										0
	Uruguay	963				506					1,469
	Brazil	329		0 / 39,786			631				960 / 40,746
	Venezuela							281			281
	Colombia								21		21
	Ecuador							1,077		63	1,139
	Peru										0
Total		2,640	0	521 / 46,867	241	1,784	631	1,358	21	63	7,258 / 53,603

Panel B. 2019

		Exports									Total
		Argentina	Chile	Paraguay	Uruguay	Brazil	Venezuela	Colombia	Ecuador	Peru	
Imports	Argentina			127 / 7,561	2,407	212					2,746 / 10,180
	Chile										0
	Paraguay										0
	Uruguay										0
	Brazil	261		0 / 24,186	604		109				974 / 25,161
	Venezuela										0
	Colombia								1,765		1,765
	Ecuador							6			6
	Peru								61		61
Total		261	0	127 / 31,747	3,011	212	109	6	1,825	0	5,552 / 37,172

Notes: Values are expressed in gigawatt-hours (GWh). The years 2009 and 2019 are shown for purposes of illustration. Figures in black reflect exchanges over interconnections, and in red total exchanges (via dams and interconnections).

Source: Authors based on information from national statistics offices.

Graph 5.5 complements these results, showing details for bilateral exchanges between pairs of selected countries during the 2009-2019 period, highlighting that exchanges are not constant over time (excluding exchanges via binational dams). In the Brazil-Argentina pair, flows during the first three years go in the

direction of Argentina (on average, 1,464 GWh). This period corresponds to critical years of the energy crisis in Argentina. However, gross commerce has fallen since 2019, although not entirely, and the balance between both countries remained near zero. Net exports were only recorded from Argentina to Brazil for 2018.

In the Uruguay-Argentina pair, flows go in both directions during the first four years, with a net favorable balance for one or the other, depending on the year. As of 2013, Uruguay became a net exporter in the relationship and held that position until 2019.

In the Uruguay-Brazil pair, three sub-periods were identified: the first, with Uruguay as an importer (2009-2012),[14] a second in which there were practically no exchanges (2013-2016), and a third period (2017-2019) in which exchanges began anew and Uruguay went from importer to exporter.

In the Ecuador-Colombia pair, there is a clear swapping of roles (similar to Uruguay-Brazil). During the 2009-2015 period, Ecuador imported electricity from Colombia—only exporting minor quantities to its neighbor. In that period, the country imported an annual average of 764 GWh and exported an average of 24 GWh.[15] As of 2016, Ecuador became a net exporter of electricity to Colombia, sending an annual average of 643 GWh, while Colombia exported 41 GWh per year. The shifting trade pattern between the two countries was due to needs stemming from extreme weather phenomena like El Niño (Paredes, 2017). In early 2016, there was a reduction in precipitation in Colombia, while in Ecuador rains increased. The interconnection between the two countries allowed Ecuador to supply 2.6% of the demand in Colombia in March 2016, when the latter faced one of the driest periods in the past decade. In 2019, favorable water conditions allowed Ecuador to export record levels to its neighbors (CENACE, 2019).

The Ecuador-Peru pair is similar to Ecuador-Colombia, although with transactions of lesser magnitude. By the end of the period analyzed, the direction of these flows reversed and Ecuador became a net exporter. Finally, the Venezuela-Brazil pair is notable for both the high volume of exports to Brazil, as well as for the stability of the trade node (until 2018). It is one of the interconnection nodes characterized by the unidirectional flow of electricity. In any case, service was interrupted in the early months of 2019.

The conclusion from this flow data is that in South America, electricity trading is limited, both in comparison to other regions and in relation to demand. This may be attributable to the limited capacity of interconnections (extensive margin), or in contrast, may indicate underutilization of installed resources (intensive margin).

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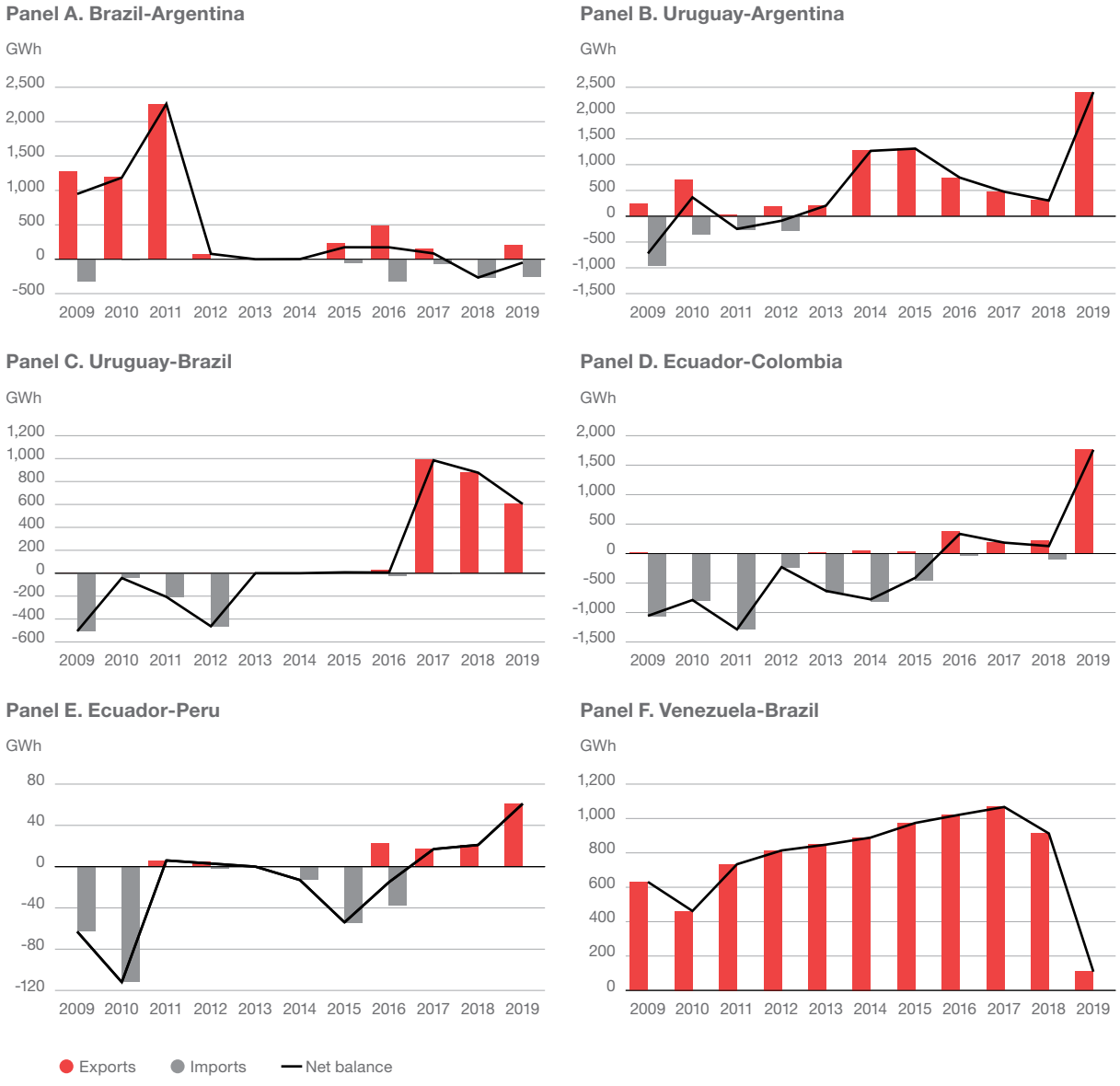
14. Uruguay imported electricity from Brazil using Argentina's transmission grid (CAF, 2013).

15. The Colombia-Ecuador interconnection was created to replace the use of liquid fuels and inefficient thermal generation with efficient thermal (natural gas) and hydroelectric energy (abundant) in Colombia (CAF, 2013). In 2005, imported volume reached nearly 13% of demand in Ecuador and 3.6% in Colombia. As of 2007, Ecuador reduced its imports due to the incorporation of a hydroelectric plant (San Francisco) and other generating equipment.

Graph 5.5
Bilateral electricity exchanges



Notes: Values are expressed in gigawatt-hours (GWh) and correspond to the country pairs in each panel title. For example, in Panel A, exports from Brazil to Argentina appear in red; Brazil imports from Argentina in gray, and the net balance (difference between exports and imports) in black.

Source: Authors based on information from national statistics offices.

Graph 5.6 shows the usage of interconnection capacity compared to two alternative usage ratios (80% and 60%).[16]

Graph 5.6
Usage of interconnection capacity by bilateral trade pairs

Notes: Percentage usage of interconnection capacity is presented for the country pairs selected. Horizontal lines indicate usage factors commonly mentioned in the literature on the subject (60% and 80%).

Source: Authors based on information from national statistics offices and capacities reported in Appendix (p. 262).

16. Percentage usage of interconnection capacity is calculated as the ratio between annual energy flows and the nominal capacity of the nodes (converted to annual equivalent energy). In nodes with different capacities for different directions, the assumption is a 50% use of nominal capacity in each direction. Given the lack of information on the availability of programmed and effective capacity on specific days and times, usage thresholds were established at 80% and 60% as references. There may be interconnections designed for emergency exchanges that could not be corrected in this exercise.

There is underutilization of the intensive margin, with the exception of the flow from Venezuela to northern Brazil (until its interruption in 2019).

Graph 5.6 shows that there is an underutilization of the intensive margin, with the exception of the flow from Venezuela to northern Brazil (until its interruption in 2019). In all cases, the average usage of interconnection capacity is under 10%, except between Ecuador and Colombia, which is 30%. This information may be reflecting, on one hand, a certain degree of optimism in the South American trade outlook, which is relevant when it comes to evaluating any future interconnection projects; or, on the other, national policies that prioritize energy security and complicate the implementation of solid regulatory frameworks (a low level of commitment and poor compliance mechanisms) for electrical energy exchanges, leading to trade flows concentrated around spot trade, or seasonal exchanges under agreements between governments.[17]

Determinants of bilateral electricity trade and impacts on development

Several restrictions stand in the way of the development of transmission networks in the subregions of Central and South America. Most of them have to do with the size of these territories (the surface area of South America is around 30 times larger, while its population density is about one-third that of Central America) and the diverse topography (such as the Amazon or the Andes, in comparison to the Central American range), all of which affect the capacity to develop an interconnected network. In this context, Central America (excluding Belize) is interconnected over a 1790 km network, while interconnections in South America are typically bilateral, as shown in Figure 5.2 (p. 232).

The data on electricity exchanges in South America suggest that the robustness and capacity for these exchanges to be sustained over time strongly depend on the type of infrastructure (e.g., a bi-national dam or interconnected power grids). In any case, the experience of Central America shows that a sound and reliable integration process provides the groundwork to sustain greater electrical energy flows compared to bilateral connections.

The next section analyzes electrical energy exchanges according to origin and destination country. The available information on South America can be used in a quantitative exercise to identify the drivers that facilitate or hinder electricity trade for this set of countries. In the case of Central America, the information on trade prices can be used to study the effects of the regional interconnection on spot MER pricing,[18] which complements a discussion of the results of the existing studies on the effects on development. Finally, the section provides some reflections on the challenges posed by the different modalities of bilateral or multilateral energy exchanges.

17. These conclusions are in line with the observations in Gomelski (2013) in their analysis of the Peru-Ecuador-Colombia subregion and with the study by Mercados-Aries Internacional (2021) for the same subregion and Panama. This last document in particular studies the suitability of reinforcements for existing connections to address exchanges given the current dispersion in the technologies used by the countries.

18. Given the particularities of the MER in Central America, the energy flows in terms of origin-destination cannot be identified (they can only be observed at the level of imports or exports for each country through the regional interconnection).

South America: determinants of electricity trade

Electricity trade among South American countries is, by nature, bilateral and can be identified according to origin and destination. As described in Chapters 1 and 2, a gravity model is appropriate for explaining trade between two countries based on the size of their economies, the distance between their markets, and the economic and sectoral determinants of trade costs. Box 5.1 presents the background and formal structure of the gravity model of trade in order to arrive at the relevant elasticities for electricity trade in this region.

Box 5.1
Gravity model approach for bilateral electricity trade

There is a vast amount of literature on the gravity model applied to international trade, to study the structural determinants of bilateral trade and the impact of trade policies (tariffs or trade agreements) on the international flows of goods, services, people, or knowledge. The most important references are presented in Chapter 2 of this report. Applications of this model to the electricity sector can be found in Antweiler (2016) for electricity trade between the United States and Canada or among regions of both countries; in Costa-Campi et al. (2018) for energy inputs; Batalla et al. (2019) for the effects of energy integration in Europe on the creation and rerouting of trade; and Batalla et al. (2021) for the effects of the regional interconnection development in Central America on foreign direct investment.

The methodology applied in these studies (gravity model) is useful to identify drivers to electricity trade in South America, using the following equation:

$$x_{ijt} = exp\ (\beta_0 + \beta_1\ ln(GDP_{it}) + \beta_2\ ln(GDP_{jt}) + \beta_3 Dist_{ij} + \beta_4\ ln(p_{it}) + \beta_5\ ln(p_{jt}) + \beta_6\ H_{it} + \beta_7\ H_{jt} + \beta_8\ ERNC_{it} + \beta_9\ ERNC_{jt} + \beta_{10}\ Res_{it} + \beta_{11}\ Res_{jt} + \gamma\ controls + \delta_t) \times \varepsilon_{ijt} \quad (1)$$

according to which the energy flow through interconnections between country of origin *i* and destination *j* in year *t* (x_{ijt}), measured in annual GWh, depends on the size of the economies (their respective *GDP*s) and distance between electrical grids and consumer centers (considered usual determinants of trade in equation (2.1) in Chapter 2 of this report).

A second group of structural determinants stems from the energy policies adopted in the connected countries (specifically, the hydroelectric component [*H*] and the share of non-conventional renewable energies [*ERNC*] in power generation, as well as the margin of reserves [*Res*] held by the respective electricity sectors). Insofar as these energy sources imply lower costs, flows to neighboring countries are expected, providing not only efficiencies but also environmental benefits. The equation also incorporates spot prices in the countries of origin and destination.

In studies on international trade of goods and services, these effects are also subsumed in the dummy variables μ_{ij}, ψ_{it}, and n_{jt}, as illustrated in equation 2.2 in Chapter 2.[a] Moreover, the evidence from the electricity sector in South America suggests that there are no additional determinants (or frictions) in bilateral trade in this sector (such as the existence of trade alliances, external tariffs, trade policies, favored-nation status, etc.). For this same reason, domestic electricity commerce has not been incorporated. There is a clear prioritization of the national market in this sector aimed at energy security, explained in the first section of this chapter, where trade between countries plays a secondary role. One way of capturing this prioritization is by including the ratio between maximum demand and production capacity as an indirect indicator of the internal conditions in a country for trading with its neighbors.

The equation includes the variable δ_t to capture the fixed effect by year. Finally, ε_{ijt} is a classic error term.

With the proposed functional form, the estimated coefficients can be interpreted as elasticities (when the explanatory variable is measured in logarithms) or semi-elasticities (when the explanatory variable is measured in levels). The omission of flows via binational dams is attributable to the fact that this trade mechanism and the specific contracts involved follow a different logic from that applied to network transactions.

Given the nature of the information (annual quantities), it is not possible to explore benefits associated with the reduction in randomness stemming from the different sources of power generation or with the reliability of electrical systems. This point will be analyzed in the next subsection on Central America's MER.

Nor is it possible to explore elements that either facilitate or hinder the capacity to engage in trade between countries, even if they do not fully capture an ideal measure of proximity based on explicit agreements between pairs of countries to exchange energy (e.g., from a predominantly hydroelectric system to a predominantly thermal one).

The equation is estimated using Poisson's pseudo-maximum likelihood method (PPML), following the methodology that generates robust estimates in the presence of heteroscedasticity in the error term (Santos Silva and Tenreyro, 2006, 2011). This methodology is appropriate for samples with short time periods, in this case, a few years (Baltagi et al., 2015).

The database on electricity flows between 2009 and 2019 was built based on raw data published by ministries, statistics agencies, regulator bodies, and market operators.

a. This study opted for estimating explicit relationships instead of using fixed origin-year effects (suggested by Baldwin and Taglioni, 2006). Otherwise, the structural and national policy effects are absorbed by the dummy variables.

Source: Authors based on Cont et al. (2021a).

Graph 5.7 presents the results of the gravity model analysis. The first conclusion is that the relationship between electricity flows and economic activity is positive. Moreover, the rate of response is greater in the importing country than in the exporting country. These results are in line with the literature for commodities trade (with an expected magnitude of 1) and with the results obtained by Batalla et al. (2019) for the European electrical system (GDP elasticity for the destination country is estimated at 1.3).

Secondly, because the observed flows correspond to either spot trading or swaps between countries, they respond to conditions of relative scarcity captured mainly by the importer country's spot prices.[19] The impacts on the cost of trade do not appear to be significant, given that there is a reaction in exports when prices in destination countries increase.

There is a significant correlation between electricity exports and countries that invested more heavily in NCREs.

Thirdly, aside from any unexploited opportunities in bilateral exchanges (if compared with the node capacities in the region and trade levels in Central America), these exchanges appear to be guided by a combination of the structural conditions of the respective countries' electrical sectors related to their energy policies. In particular, electricity exports are higher in countries that have invested more heavily in NCREs. These investments foster optimization of resources and environmental sustainability in countries involved in electricity trading (the most notable case being Uruguay).[20,21] A significant correlation is also shown with the exporter country's reserve system.[22] All these results point to the conclusion that energy exchanges are demand-driven (activity and prices) to the extent that supply conditions are present (lower-cost energy sources, with available capacity in exporter countries).

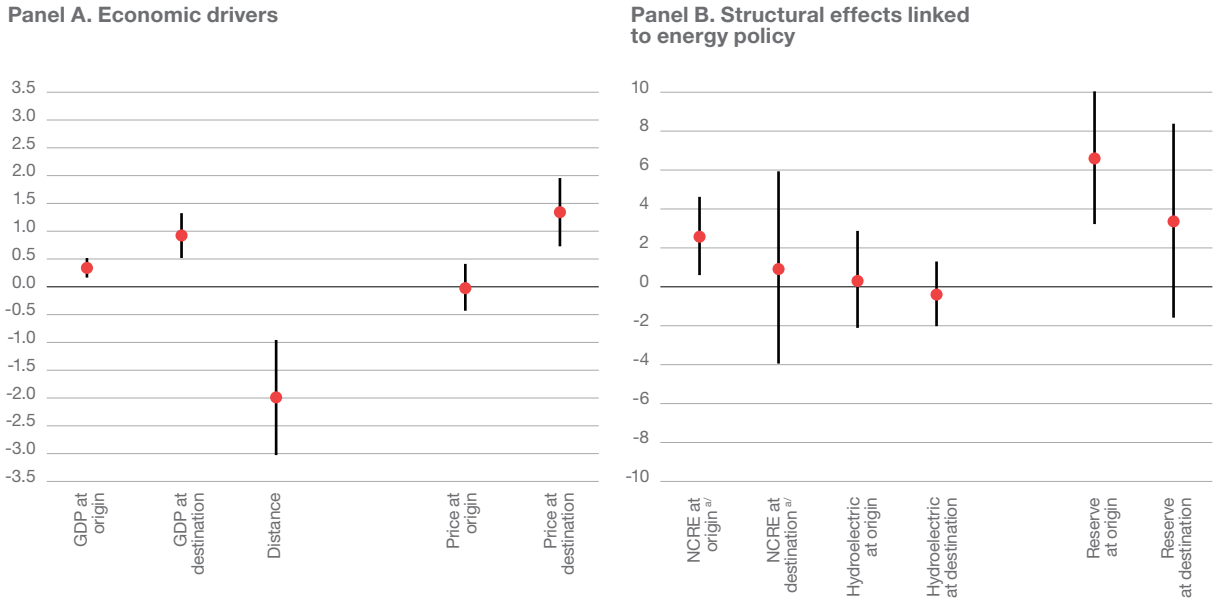
19. In a configuration that excludes the structural components associated with energy policy, price elasticity in the country of origin is approximately -0.5.

20. The effects associated with hydroelectric power generation are not significant (Graph 5.7), but point estimates have the expected sign (more exports from countries with higher levels of hydroelectric power toward countries with lower hydroelectric capacities). These energy sources are low-cost (added to NCREs in recent years), and therefore countries with a larger supply of cheaper sources can export at more competitive prices.

21. Sources of hydroelectric energy and other renewables depend on random factors (rain in the case of hydroelectric; time of day and brightness of the sun in the case of solar; and wind in the case of wind energy), and energy exchanges can contribute to the mitigation of the associated risks and improve the reliability of electrical systems. Though this hypothesis cannot be tested due to the frequency of information, there are specific examples worth mentioning, such as the exports from Ecuador to Colombia in 2016, which allowed the latter to confront a reduction in local generation due to a sharp reduction in precipitations associated to the phenomenon El Niño, and increased exports from Ecuador to its partner countries in 2019 as a result of its favorable hydrological conditions.

22. In this case, it is a proxy variable, since a system might have little reserve power during peak demand, but plenty the rest of the time, exporting during periods without capacity restrictions.

Graph 5.7
Drivers of electricity trading in South America



Notes: The coefficients for determinants of electricity exchanges are estimated using the Poisson Pseudo Maximum Likelihood method, with confidence intervals at 90%, on data from the period 2009-2019. For details on regression and variables used, see Box 5.1.

a/ NCRE means non-conventional renewable energies.

Source: Authors based on Cont et al. (2021a).

The absence of considerations related to energy in trade policy implies that there are no *i*, *j* variables to include in the analysis other than structural ones (such as distance). These types of variables are very common for each pair of countries and could account for, among other effects, regional energy policy or existing regional regulations. An example would be the interconnection between Argentina and Brazil aimed at better, more coordinated harnessing of both countries' resources, but this experience lasted a few years (see Box 5.3, p. 260). The absence of this type of variable points to poor regional coordination when it comes to energy policy.[23] Energy integration, just like productive integration, requires coordination in which trade partners can plan their energy production and trade policy at the regional level, thus making it possible for trade to cease being of a spot nature, as can be observed at present. The high levels of underutilization of available interconnections support this argument, which suggests that countries are not exploiting the full

23. Billette de Villemeur and Pineau (2016) analyze this point in the context of superficial integration (with different regulations in the interconnected regions) between the provinces of Quebec and Ontario (Canada). In their study, the authors highlight that a superficial integration can end up in a worse situation (in terms of welfare, including environmental considerations) than a broad integration (unifying market rules in both regions) or isolated systems.

potential of integration in this sector. As seen in the section «Characterization of the electricity sector and electrical energy flows in the region,» progress in coordination, like Central America with the MER and the SIEPAC network, derives in higher levels of energy trade.

Central America: regional interconnection and development

As explained in the section «Benefits and constraints of energy integration,» a process of profound integration will lead to economic and environmental benefits. One of the notable economic benefits is the reduction in price levels and volatility.

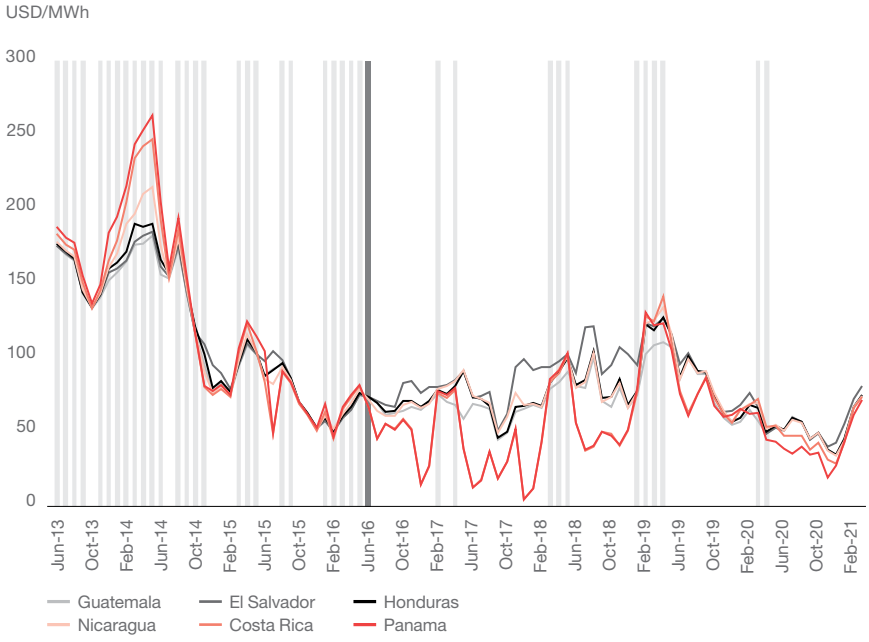
The first result is achieved by leveraging economies of scale. On one hand, scheduled dispatches make it possible to take advantage of cheaper sources among those available in the region. On the other hand, in more advanced integration processes, additional reductions in energy cost can be achieved by planning and executing investments on a regional scale (that would not be profitable on a national scale) and coordinating national and regional dispatches (that would allow for avoiding or postponing investments by using backups from the regional network).

The second result is achieved by mitigating the risks associated with the random nature of different energy sources, such as hydroelectric (related to climate events like rain or drought) or non-conventional renewables, which have seen major development in recent years. Moreover, they make it possible to address peak demand in the different systems at lower cost in shorter time frames, even within a day. Likewise, taking advantage of the coordinated dispatch of electricity generated by countries in a position to use NCREs or low-emissions sources (e.g., hydroelectricity) at a competitive cost benefits environmental sustainability (protecting the environment and fighting climate change).

This subsection provides a review of the results from studies that focus on the process of regional energy integration in Central America. The recent study by Cont et al. (2021b) analyzes the convergence of spot prices in the context of regional electrical interconnection and the creation of the Regional Electricity Market (MER). Graph 5.8 presents the ex-ante prices reported by the Regional Operator Entity for the nodes connected to SIEPAC. The analysis does not support the convergence hypothesis for the entire period. However, it is possible to identified two subperiods with specific characteristics: one begins with the formal operation of the MER in June 2013 until June 2016, and another starts that month and continues until the last month available when the study was done (March 2021). For each subperiod, the price evolution satisfies the conditions of convergence.

Graph 5.8

Ex-ante price of electricity on the regional electricity market



Notes: The price in each country reflects the monthly average for daily prices on the nodes where the country connects to the SIEPAC network. Values are expressed in USD per megawatt-hour. The bars in light gray correspond to the months in which Costa Rica generates electricity with natural gas at the margin; the dark-gray bar represents a structural change in that country.

Source: Extracted from Cont et al. (2021b).

MER spot prices converge, adjusting to the structural conditions of the different participants.

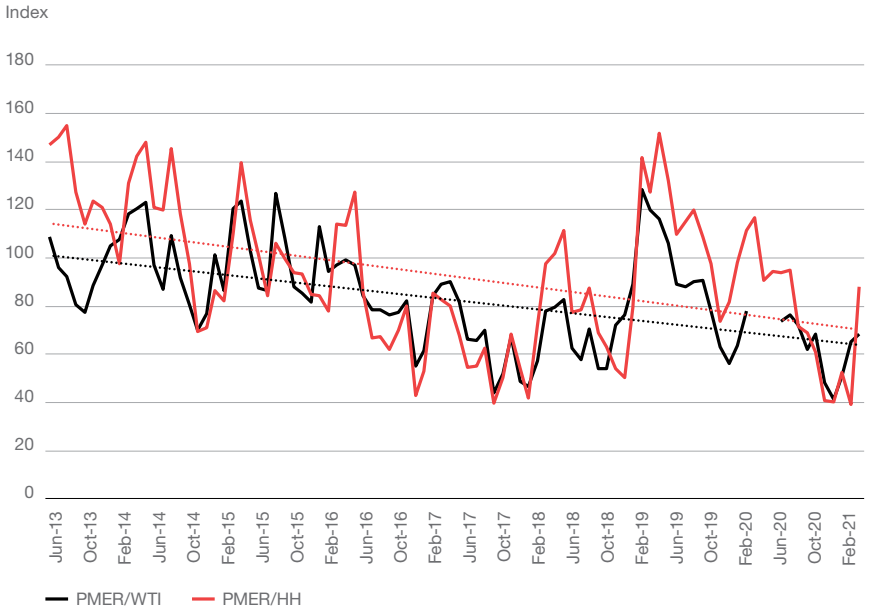
The first period, from June 2013 through June 2016, is characterized by high prices and low levels of exchange. In addition, the costs of all the national systems were determined by thermal power generation. In contrast, as of mid-2016, the Reventazón hydroelectric plant went into operation in Costa Rica. This project, in addition to the country's policy promoting renewables, shifted its electricity system to power generation from hydroelectric and renewable sources, relegating generation from natural gas to just isolated occasions (this technology remains as backup). As of June 2016, prices in the region split into two major groups in which spot prices in Costa Rica and Panama stayed below the prices in Guatemala, Honduras, El Salvador, and Nicaragua, followed later by a new process of price convergence, subject to the new market conditions. Although there are a few pending phases in the regional interconnection experience (see the section on «Political, policy and regulatory challenges to energy integration»), spot price convergence during the second period has been much faster than in the first subperiod.[24]

24. Details available in Cont et al. (2021b).

Furthermore, Graph 5.9 illustrates the evolution over time of the ex-ante price on the MER in relation to prices of two fossil fuels generally used to generate electricity with a thermal Source: the price of oil, identified by West Texas Intermediate (WTI), and natural gas, identified by the value in the Henry Hub, both from the United States. The purpose of this comparison is to analyze the relative price trend of electricity after it becomes official and the uninterrupted operation of the regional market (June 2013). The graph shows a downward price trend after the formation of the regional market for reasons other than the price variation of input for thermal generation.[25], [26]

Graph 5.9

Ex-ante price on MER compared to international energy price



Notes: Two indexes are built based on the ratio between the MER monthly price (PMER is a simple average of ex-ante electricity prices by country) and the average monthly WTI price or the Henry Hub (HH) price of natural gas, respectively. The annual average from 2015 is taken as the basis for each index. Dotted lines indicate trends. In the case of the index that uses the price of oil, values from March-May 2020 are omitted due to the unusual situation of that sector then (the WTI price fell to negative numbers on certain days). This omission does not affect the results. For more information about the construction of ex-ante electricity prices by country, see the notes on Graph 5.8.

Source: Extracted from Cont et al. (2021b).

25. The transfer of these price variations over the marginal costs of national systems has not been studied, mainly because the information is not available to the public. In this regard, it bears noting that Echevarría et al. (2017) mention the existence of national regulations that restrict the cost transfer to end users (especially regulated ones), benefiting generators or wholesalers due to the savings in the supply price.

26. Although direct causality cannot be assigned to the formation of the regional market, the real reasons behind this fall in prices, if not due to the MER, apply to a context in which these countries are participating in regional initiatives. For example, during the same period, Central American countries embarked upon initiatives to expand capacity (Graph 5.1).

The findings from a series of evaluations point to the positive effects of the regional initiative in Central America. For example, prospective studies[27] and retrospective studies[28] assess the total benefits of the MER in Central America at 0.02%–0.04% of regional GDP (Consejo Director del Mercado Eléctrico Regional de América Central, 2020; Echevarría et al., 2017; Levy Ferre et al., 2020). These exercises highlight the importance of achieving coordination among countries in the future to expand power generation, considering a regional market, and deeper consolidation of economic dispatch,[29] assigning electricity flows based on the costs of generation in each country or state (which are pending matters in the current configuration of the sector, as explained in the section on «Institutional and regulatory challenges in Latin America»).

Regional integration has not only benefited the electrical sector but has also had a positive impact on the region's economies.

Regional integration has not only benefited the electricity sector (in terms of level, price volatility, and trade benefits). It has also had a positive impact on the region's economies. The effects identified can be specific or global. In the first case, an example can be a greater flow of foreign direct investment in the region, measured both in terms of monetary flows as well as the number of projects (Batalla et al., 2021). In the second case, one prospective study that stands out estimates the benefits of the SIEPAC network on regional GDP at approximately 0.3% (compared to a scenario without integration), distributing these benefits between a price reduction for energy inputs to productive sectors (30%) and greater investment in productive projects (70%) (Echevarría et al., 2017). These results support the hypothesis that the institutional robustness generated by energy integration would spill over into other economic sectors, enabling investments and other economic decisions.

Finally, the MER provides the means to resolve the risks associated with the randomness of different energy sources. Extreme weather events occur sporadically (although increased frequency in the future cannot be ruled out), so the benefits of this system are registered in these circumstances. For instance, during the drought experienced by some countries in 2014 and 2015 due to El Niño, the MER allowed the reduction in hydroelectric power to be offset by imports from the system, thus mitigating the potential risks of having to resort to electricity supply rationing.[30]

27. Prospective studies are ex-ante simulations featuring scenarios involving the benefits to generators, consumers, and shareholders, and the links between investments and coordination and planning for expanded generation.

28. Retrospective studies are ex-post estimates featuring scenarios involving the benefits of trade—savings in production costs, efficiency gains and benefits from exports by each country—charges and fees.

29. Economic dispatch is the distribution of electricity demand among the different generating units in service at minimum generating cost.

30. See details in Echevarría et al. (2017).

Political, regulatory, and policy challenges of integration

Regional electricity exchanges, from the simplest to the most sophisticated, require a minimum amount of coordination between the countries involved. In general, the more coordination, the lower the transaction costs and greater predictability for electrical systems (for the systems themselves and the stakeholders involved), thus providing more benefits to society. In general, interconnection or electricity integration (and energy in general) initiatives have occurred in the context of broader integration initiatives (which, at the same time, have evolved from commercial initiatives toward those with broader interests).

The evidence from exchanges presented in the previous sections (exchanges stemming from a regional interconnection, like the one in Central America, or bilateral interconnections, like most of the cases in South America) is supported by different experiences in terms of institutional and regulatory frameworks. This section presents a conceptual framework for analyzing some of these experiences and later goes into detail on the cases of Central America and the Andean and Southern Cone subregions. Background is presented on the different interconnection or integration initiatives, the challenges they face, and the opportunities to deepen them or evolve toward more advanced steps of the integration process.

The «steps» of regulation to support integration processes

This section identifies the different stages that integration processes are going through in the region based on the different regulatory contexts that underpin them and on international experience (Figure 5.3).[31]

The countries in the region are at different stages in their integration processes.

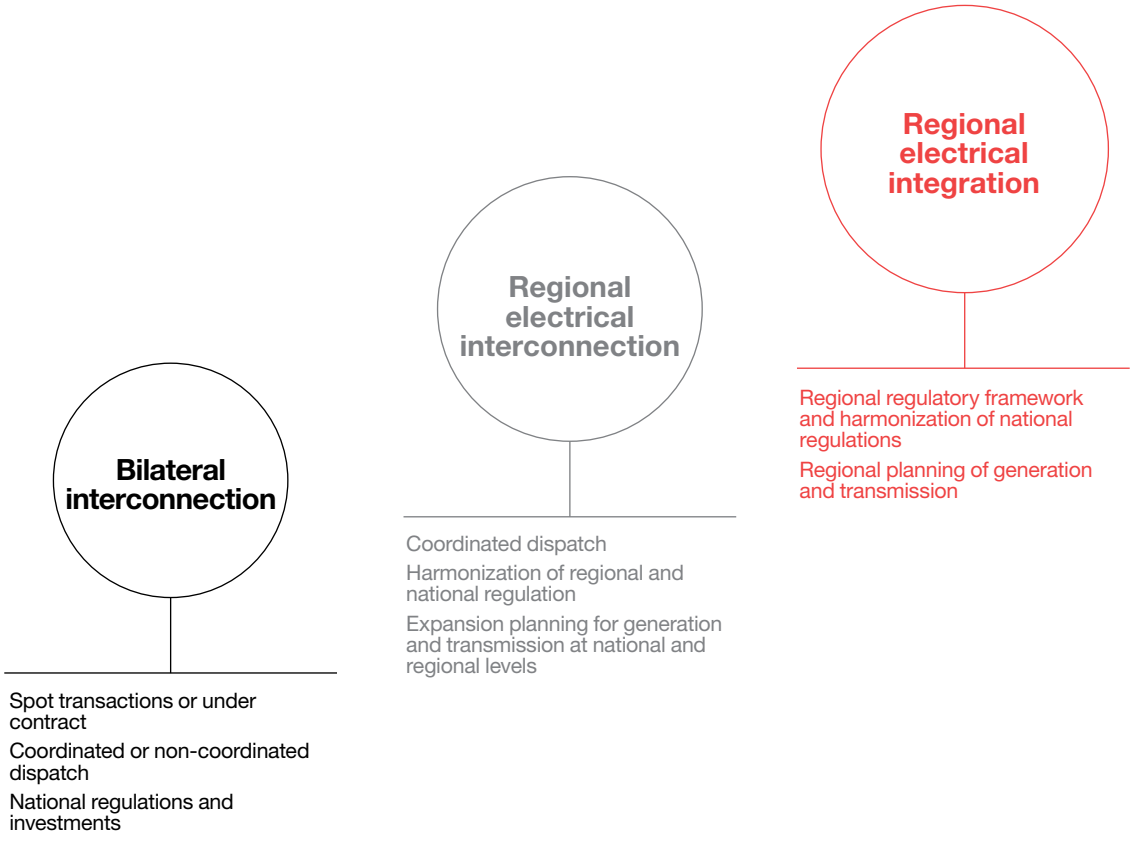
The first steps countries take to link their electricity systems are usually bilateral electrical interconnections, accompanied by rules of operation, dispatch, and pricing. The transactions that happen via interconnections can thus be spot trades or by contract, either on a regular basis or to address emergencies. The electrical systems of interconnected countries can coordinate their dispatches (as occurs between Ecuador and Colombia) or not (as between Ecuador and Peru).[32]

31. Background on this conceptual framework can be found in Consejo Director del Mercado Eléctrico Regional de América Central (2015), Gomelsky (2013), García et al. (2012) and Batalla et al. (2021).

32. When this coordination is not present, surplus exchanges are determined based on each country's individual projected power and energy provisions.

These types of initiatives require upgrades in national regulation, including the coordination of dispatches when applicable, and the creation (or updating) of bilateral regulations that support the transactions. When cross-border transactions happen (e.g., between Colombia and Peru, passing through Ecuador's grid) the regulation of transmission fees must also be updated in order to avoid application of the double-margin between pairs of countries (this was a challenge that had to be resolved in the process of energy integration in Europe). The expansion of generation and transmission grids is the responsibility of the countries or sector stakeholders in the countries. In fact, the inclusion of firm power contracts (as is the case between Argentina and Brazil in the early 2000s) allows the national systems to make decisions about the use of the interconnection as a substitute for local capacity to compute reserve margins.

Figure 5.3
Stages in the integration process of electricity markets



Source: Authors.

The second step toward integration is the regional electrical interconnection, which entails integrated dispatch (currently the situation of SIEPAC in Central America). At this level, national and regional regulations must be harmonized and recognize a hierarchical operation among different levels. They also need dispute-resolution mechanisms in place. Coordination is also required to expand generation and transmission grids on a national and supranational scale. In this model, generation projects can be implemented in one country or several to meet regional demand.[33]

The final step is regional electrical integration in which the hierarchy is reversed in favor of the region. This level requires heavy adaptation of the national regulations to regional ones. The same applies to the expansion plan for generation and transmission at the regional level. There are no examples of this in Latin America. The benchmark is the European Market (see Box 5.2).[34]

Box 5.2
The European Union Experience

The European Union's pursuit of a single energy market is an emblematic case that illustrates how its member countries prioritized energy exchange. The process required considerable joint efforts to promote investments in interconnection and transmission, enact energy and environmental policy packages (including regulations), and reconfigure sectors in different countries to create and harmonize a framework to facilitate energy exchange.

In 2002, the European Council set an interconnection target of 10% of production capacity (to be reached in 2020). It was raised to 15% in 2014 (to be reached in 2030). In recent years, energy exchanges averaged 14% of electricity consumption, although performance among countries was varied (trade is below the threshold for many of them).

Source: Authors based on Batalla et al. (2019) and Ofgem (2014)

33. In a regional electricity generation project, a country can position itself as a net exporter or net importer. A major challenge in this case is for countries to accept dependence on energy sources from another country, in a regional context where energy security usually is a significant concern in national energy policy.

34. However, it is not fully implemented. Interventions to expand cross-border transactions in markets in real time (especially the intraday and balancing markets) or introduce more efficient bidding zones are still pending. These measures would encourage the system's use in the short term and its development in the long term. (Batalla et al., 2019; Batalla et al., 2021; Gissey et al., 2019; Ofgem, 2014).

Institutional and regulatory challenges in Latin America

Central America

The most far-reaching integration process in Latin America connects six Central American countries (Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama), aiming to optimize energy reserves and harness hydrological diversity. Bilateral interconnections began back in 1975 in the context of the first wave of regional economic integration,[35] and by 1986 five countries were connected, leaving one pending connection: El Salvador. After a pause, and with the establishment of the Central American System of Integration (SICA) in 1991, regional integration once again garnered interest but this time in pursuit of broader interests (economic, social, cultural, ecological, and political). Within the SICA framework, the States of the region agreed to sign the Central American Electricity Market Framework Treaty in 1996, giving new momentum to the process of regional integration. The agreement and its two protocols created a regulatory framework and regional bodies of operation and regulation for the regional electricity market (MER).[36] EPR (Empresa Propietaria de la Red), which belongs to the member countries and other partners, developed the first system of regional interconnection (SIEPAC), which connects the national systems and has a nominal transmission capacity of 300 MW.[37]

The MER functions in parallel to the six national systems, where vertically integrated monopolies coexist with market systems.

The process is at the stage of regional electrical interconnection (second step in Figure 5.3). The SIEPAC line was built in sections and was finally unified in 2014. The MER began operating in 2002 under transitional rules of operation until the MER rules went into effect in 2013. This market functions in parallel to the six national systems, where vertically integrated monopolies (Costa Rica and Honduras) with limited input from private generation coexist with market systems (El Salvador, Guatemala, Panama, and Nicaragua). Nevertheless, regional energy transactions on the MER are governed by its rules of operation and system administration.

In this context, the countries have adopted measures to harmonize their national regulations with supranational ones. Electricity transactions on the regional market are done according to the spot modality (with a node price system that reflects the short-term opportunity costs for injection or withdrawal,

35. The Central American Isthmus Economic Cooperation Committee, created under the auspices of ECLAC, led in 1958 to the Central American Subcommittee on Electrification and Water Resources. This subcommittee created the Regional Electric Interconnection Group with the purpose of promoting electricity integration in Central America. The first meeting of the Group took place in 1968 and laid the foundations for studying a possible regional hub (Castillo, 2013).

36. The current regulatory framework is the MER rules of procedure. Network operation is handled by the Empresa Propietaria de la Red and the regional market operation by the Regional Operator Entity. The Regional Electrical Interconnection Commission is the regional regulator and the MER Board of Directors is the body in charge of energy integration policy.

37. There is currently an institutional development framework called the Mesoamerica Project created in 2008 that includes the MER countries, plus Mexico, Guatemala, Belize, and the Dominican Republic. The energy area of the Mesoamerica project entails the SIEPAC project, the Mexico-Guatemala, and Mexico-Belize nodes, projects under study regarding the interconnections of Mexico-SIEPAC, Belize-SIEPAC, Colombia-Panama, and other projects related to renewables and energy efficiency.

including losses and congestion) or to contracts between market agents. For example, based on data from the Regional Operator Entity, approximately 70% of electricity trading in 2020 was done under contract.[38]

As the development of the MER advanced, a number of concerns arose regarding this market's resilience to external events and the viability of long-term contracts that could be generated within this scheme in light of the prioritization of national markets. For example, during the period of oil price increases (starting in 2004), El Salvador and Honduras (net importers) reduced their trading and controlled prices in their respective markets. More recently, the development of the long-term contract market has been a challenge. In this case, even though the MER operating procedures give supply priority to firm contracts, national regulations have prioritized situations of national scarcity, and only contracts of less than a year have been executed (Mercados – Aries Internacional, 2021). Currently, the development of long-term transmission rights is under review (Third Protocol of the Treaty).

Another concern in the context of the MER is the effective capacity utilization and its implications with regard to planning for the expansion of the regional transmission system. Even though there is a 300 MW nominal capacity (representing approximately 10% of generating capacity of the average of the countries), for different reasons some countries use it below potential.[39] The operator (under supervision by the regulator) is responsible for planning the network expansion and coordinating the necessary reinforcements with national systems, but this joint action by countries has been limited.

The third challenge lies in the expansion of generating capacity. The MER anticipates the development of generation on a regional scale, but so far expansion planning has only happened at the national level.[40] Finally, regulatory asymmetries continue to exist in the markets of Costa Rica and Honduras.

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38. In the case of transactions under contract, they must contain associated transmission rights between injection and withdrawal nodes to be considered firm. These rights must be assigned to one of the two parties, as agreed in the contract. Transmission rights are obtained at auctions held by the system operator or through transactions in the secondary market that must be valid according to the MER rules of procedure (between October 2012 and November 2015, firm contracts were suspended). The marginal costs of each node stem from curves in the export supply based on values that must not transfer local policies (e.g., subsidies, taxes or fees) to the regional system.

39. The system operator carries out monthly effective capacity studies for the network. The limitations usually occur between Honduras, Nicaragua, Costa Rica, and Panama, mainly due to difficulties these countries face in implementing reinforcements to their networks. For example, in the June 2018 report, Nicaragua's effective capacity for flows from Costa Rica was 60 MW by local generation dispatch (see Ente Operador Regional, 2018), while in March 2021 Panama's capacity for flows to Costa Rica was 50 MW to avoid triggering the Fortuna hydroelectric dam in simple contingencies (see Ente Operador Regional, 2021).

40. See details in Echevarría et al. (2017) and Mercados-Aries Internacional (2021). In this regard, the Board of Directors of the Regional Electricity Market of Central America (2020) anticipates analyzing mechanisms to be able to offer regional generation.

Andean Community

The Andean Community (Comunidad Andina de Naciones (CAN)), created under the Cartagena Agreement in 1969, is made up of Bolivia, Colombia, Ecuador, and Peru (Chile withdrew in 1976 and Venezuela was a member country until 2011), with associated countries (Argentina, Brazil, Chile, Paraguay, and Uruguay) and observers (Spain and Morocco).

The Andean Community is in the process of creating a Short-term Regional Market framed within a broader agenda that includes the Andean Electrical Interconnection System.

The CAN is responsible for supranational regulations applicable to international transactions of intracommunity electricity for its member countries. Initially, the General Framework was created for the Subregional Interconnection of Electrical Systems and Intracommunity Electricity Trading. This led to the creation of the Andean Community of Electricity Policy Bodies and Regulators to regulate international electricity transactions in the context of a regional Andean electricity market, subject to the prioritization of its member countries' domestic supplies (CAN Decision 536). However, this decision was suspended and, in practice, binational trading was implemented through temporary protocols for Ecuador-Peru (first step of Figure 5.3, without coordinated dispatch) and Colombia-Ecuador (first step of Figure 5.3, with coordinated dispatch), that prioritized self-sufficiency and allowed short-term trading of surpluses originating from coordinated dispatches (CAN Decision 757).[41]

CAN Decision 816 in 2017 replaced the previous regulations and proposed the creation of the Andean Regional Short-term Energy Market (MAERCP). In this market, a Regional Coordinator organizes transactions of surplus electricity (defined by the system or market operators of member countries), using the interconnected national grids (i.e., without a parallel system), which are paid a «toll» fee (set by each country) and assigning congestion income from an international hub in equal parts to the export and import markets.[42] This scheme is evolving toward the second step in Figure 5.3. This regulation is in the process of developing rules of operation, trading, and regional coordination. Later, regulatory harmonization is planned between the national and regional levels.

The regulatory update is framed within the broader agenda for the region, which includes the Andean Electrical Interconnection System (SINEA), promoted since 2011 to connect the electricity markets of the Andean Community and Chile. The initiative took the form of bilateral interconnections since it does not subject the respective national authorities to a higher authority. In fact, the interconnection is a residual instrument in the context of national energy policies, coming into the equation on a lesser order of priority than the domestic capacity to meet internal demand and satisfy supply security at the

41. The interconnections between Colombia and Venezuela are also located on the first step, whereby they can enter transactions by contract without coordination between local systems.

42. When the capacity of an interconnection is less than the trade needs declared by the operators, this interconnection gets congested and the prices on either end fall out of synch (the price of the importer node rises above the one on the exporter node), generating congestion income. CAN Decision 536 set forth that this income would be assigned to the exporter market. With these rules, in a context of bilateral trade, the amounts would be distributed between the countries based on flows. In the case of the interconnection between Colombia and Ecuador (first experience under this policy), the dominant flow of electricity had been from the former to the latter and was a source of conflict until CAN Decision 720 (and later ones) resolved that the income would be assigned in equal parts to each market.

national level. In the case of Ecuador, there is an additional challenge beyond integration, given the limitations of the local system when it comes to private agents, the lack of a wholesale market, and the ban on distribution companies (something it shares with Peru).

Thus, the rules at the regional level, regulatory harmonization,[43] and interconnection infrastructure for its consolidation[44] are being considered for spot interactions (short-term) but not for firm, long-term relations. A good experience in this direction would be the first step toward a more ambitious initiative of energy integration. But a step forward in this direction depends mainly on the will of the countries (an agreement that has not been achieved in previous favorable scenarios). The technical aspects, such as treatment of financial rights of transmission, nodal pricing systems and planning for expansion, future interconnections, and regulation, could be defined once this challenge is overcome.

Southern Region

Interconnection agreements in the rest of South America have been bilateral. In the particular case of the Mercosur, there is a Memorandum of Understanding on Electricity Exchanges and Integration (1998). This MoU agrees on principles of minimum symmetries related to non-discrimination between agents of different countries, open procurement, rules regulating electricity markets to ensure supply, etc. Progress on previous interconnections was made via bilateral agreements (first institutional or regulatory step in Figure 5.3) under public as well as private initiatives (the same as the natural gas sector) and, in several cases, were exposed to conflicts like those described in Box 5.3.

The Southern Region is reconsidering the possibility of a regional relationship through the SIESUR initiative.

More recently, in December 2018 representatives from the electricity sector from Argentina, Brazil, Chile, and Uruguay, accompanied by representatives front the Interamerican Development Bank (IDB), the Latin American Energy Organization (OLADE), the Regional Energy Integration Commission (CIER), and CAF, signed a protocol to carry out a study of electrical interconnections in the Southern Cone (SIESUR initiative). This initiative is currently at the stage of identification and resolution of the main barriers limiting the use of existing infrastructure, and the formulation of opportunities and challenges for coordinated regional planning.

43. The SINEA Ministers Council is the decision-making authority and has planning and regulation working groups.

44. For example, connections are being evaluated between Peru and Chile and Peru and Bolivia, and reinforcements for existing connections between neighboring countries (currently at 220 kV). See Figure 5.2 and the Appendix (p. 264, projects under study).

Box 5.3
Trading experiences under contracts between private entities

Trade experiences under contract between private entities have been disappointing in the southern region of the continent. The interconnections between Argentina and Brazil (authorized in 1998 and operational in 2000) and Argentina and Chile (with both electricity and natural gas in the late '90s) show how a misreading of the market conditions at the time of contract design and initial investment, combined with regulatory instability, can have a negative impact on trade possibilities between economic agents from different countries.

The interconnection between Argentina and Brazil (Rincón de Santa María-Garabí) was prompted by Brazil's need to supply electricity to the market in a context that anticipated an extended period of low water supply due to extreme drought conditions.

Natale and Navajas (2016) analyze the two main shocks that led to the unviability of operations. On one hand, the normalization of Brazil's reservoir levels in 2002 generated a fall in wholesale prices, making projected imports from Argentina expensive. On the other, the project was affected by Argentina's energy crisis, which began to be evident in 2004 with the restrictions on natural gas exports imposed by Argentina's Secretary of Energy. It is worth mentioning that investments by private entities for the integration of two markets with different generating grids involve greater exposure to external shocks (water levels, gas supply, liquid fossil fuel prices, exchange rates, etc.)

In the case of Argentina and Chile, in contrast, the interconnection was in a context of competition where other participants exported gas from fields in Argentina to thermal generators located in northern Chile. This led to a proposal for a private initiative to supply electricity exclusively to the grid in northern Chile (particularly mining production) with a generating plant (Termoandes) located in Salta, Argentina, isolated from Argentina's electric grid. Despite the vertical integration between electricity buyer and seller, the increase in competition in the Chilean electricity market was not anticipated, thus leading to the underutilization of the project and a negative impact on the profitability of the investment (Navajas, 2016). The resulting restrictions in the Argentine market in 2004 (limitation on the use of natural gas for electricity generation destined for exports) ended up making the project unviable. In 2011, this power station was connected to the Argentine grid.

In summary, integration projects led by private entities experienced problems in the face of changes in the initial conditions surrounding the investment (recomposition of water conditions in the first case, and intensified competition in the second) and in situations of crisis in Argentina, which reduced possibilities of trade. At the same time, the nature of the Argentina-Brazil interconnection (thermal versus hydroelectric system), and the isolation of the thermal power station from Argentina's national grid in the case of Argentina-Chile, made these projects more vulnerable to unforeseen shocks.

Source: Authors based on CAF (2013), Natale and Navajas (2016), and Navajas (2016).

Keys to understanding energy integration

1. The benefits provided by the different forms of electrical integration include the harnessing of economies of scale, diverse sources of supply and demand, improved conditions of competition in broader markets, and the possibility of innovation in less contaminating energy sources, thus contributing to environmental sustainability.

2. In Central America the SIEPAC hub and the regional electricity market were developed, operating in parallel with national systems. At present, there have been benefits on several dimensions, including cost savings, lower price volatility, cushioning against the impacts of climate phenomena, and increased investment. Expansion of the integration process will involve additional adaptations in national regulations, development of generation at regional level, advances in the rules for short-term transactions, and unification of procedures in transactions at the supranational level.

3. In South America, in contrast, opportunity transactions were made (based on the structural conditions of country sectors) to address contingencies (e.g., El Niño). In the Andean subregion, the rules of trade and assignment of rights must be updated according to the proposed creation of the Andean Market for Regional Short-term Energy, relegating the consideration of a single market to a later instance. The key experiences in the Southern Cone were based on contract schemes between private entities that did not work due to a combination of sector-related contingencies, macroeconomic problems affecting the region, and insufficient regulation to guarantee a resilient framework.

4. A common factor across the different interconnection experiences in South America is the prioritization of energy security at the country level. This obstacle can be surmounted if the countries involved gain confidence in the value added for stakeholders (so the latter will be interested in participating voluntarily) and the predictability of energy supply in a broader market (the necessary volumes will be available at market price at the time they are required). This is achieved with adequate rules(regulations, rules of market operation, sanction mechanisms, instances of conflict-resolution, and regulatory harmonization, among others). The experience of Central America is headed in this direction.

Appendix

Joint exploitation on border rivers

Hydroelectric dam projects were first developed between the 1920s and 1960s, but construction really picked up after the oil-price shock in the 1970s. There are three major bi-national hydroelectric operations in Latin America, all located in South America: Salto Grande, with a capacity of 1800 MW, that went into operation in 1979 (with generation equally distributed among member countries); Itaipú, with 14,000 MW capacity, in operation since 1984 and reached maximum capacity in 2011; and more recently, Yacyretá, that went into operation in 1995 and reached maximum capacity of 3100 MW in 2011. Each of these has connection infrastructure to the electrical system of the importing countries.

Ownership in each company is held jointly between bordering countries (50% each). The Itaipú and Yacyretá dams are large-capacity and half of the energy they generate goes to Paraguay as a station partner, even though its consumption is much lower. Bilateral agreements for use of these water resources established the conditions for the sale of the remaining energy to their respective partners (in Yacyretá, Argentina has preferential rights to contract all the power that Paraguay does not use to supply its own demand; in Itaipú, Brazil has the right to purchase Paraguay's unconsumed energy). In contrast, Salto Grande has operated such that energy withdrawals have been relatively even between the partner countries.

Interconnection of national electrical systems

This type of interconnection is implemented with investments (public or private) in lines for international electricity trade between neighboring countries (eventually with frequency converter stations) within an institutional framework that regulates exchanges. Interconnections through networks of over 115 kV that permit transmission over long distances are identified in Figure 5.2.[45,46]

In the Mesoamerica region, there is an interconnection between Mexico and Guatemala (Tapachula-Los Brillantes). The Andean region has three between Colombia and Venezuela (Cuestecita-Cuatricentenario, Tibú-La Fría and Mateo-El Corozo); three between Colombia and Ecuador (Pasto-Quito, Jamondino-Pomasqui and Ipiales-Tulcán); and one between Ecuador and Peru (Machala-Zorritos). In northeastern South America, there is one between Venezuela and Brazil (the Guri-Boa Vista hydroelectric complex in the state of Roraima, out of operation since 2019). Finally, the Southern Cone has been more active when it comes to interconnections, with two between Brazil and Paraguay (Foz de Iguazú-Acaray and the interconnections of Itaipú); three between Argentina and Paraguay (El Dorado-Mcal. A. López, Clorinda-Guarambaré and the

45. In general, the greater the tension (e.g., 500 kV) the less energy is lost over long-distance connections.

46. Moreover, there are multiple links on borders, of low or medium-tension, isolated from the interconnected national systems. In general, these have a very low usage factor due to their backup status (CAF, 2013).

Yacyretá interconnections); two between Argentina and Brazil (Rincón Santa María-Garabí, Paso de los Libres-Uruguayana); three between Argentina and Uruguay (Concepción- Paysandú, Colonia Elia-San Javier and the Salto Grande interconnections) and two between Brazil and Uruguay (Livramento-Rivera and Pte. Médici-San Carlos).[47]

Transformation of energy sources and electricity exports

One type of interconnection is the conversion of other energy sources (e.g., natural gas) into electricity to then be exported to a neighboring country. This option is an alternative to exporting the primary energy source and also requires complementary investments (in this case, an international transmission network). There is only one instance of this type in Latin America: the interconnection between Argentina and Chile (Central Térmica TermoAndes-Subestación Andes), which ceased operating in 2009.

Most of these interconnections link national systems, except the connection between Venezuela and Boa Vista, the capital of Roraima, Brazil, which is disconnected from Brazil's system; and the connection that supplies electricity to Chile from a thermal power station located in Argentina.[48]

The Southern Cone interconnections were mainly done through private initiatives under contracts (e.g., Rincón Santa María-Garabí and Central Térmica TermoAndes-Subestación Andes), subject to institutional arrangements under the Bilateral Investment Protection Treaty, seeking to facilitate electrical energy trade through contracts. Bi-national dams, in contrast, are by nature an initiative between the two partner countries.

From interconnection to regional integration: SIEPAC

The process of regional integration in Central America took place over various stages and many years. It started with bi-national interconnections between Honduras and Nicaragua (1975), Nicaragua and Costa Rica (1982), Costa Rica and Panama (1986), Guatemala and El Salvador (1986), and El Salvador and Honduras (2002). Nevertheless, aside from these successive bilateral connections, the integration of the national markets did not happen until the creation of the Regional Electricity Market (MER), strengthened by the construction of the Central American Electrical Interconnection System (SIEPAC), which allowed partial or total integration between 2010-2014 (see Figure 5.2). The SIEPAC project consists of 1790 km of 230-kV transmission infrastructure with a nominal transmission capacity of 300 MW (although lower levels of tension are also used within each system).

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47. At times, part of the energy that Uruguay imports from Brazil uses transport capacity from the Argentina system. Exchanges between Argentina and Uruguay also occasionally use Paraguay's transport facilities via the Clorinda-Guarambaré interconnection (CAF, 2013), and exchanges between Argentina and Brazil use the Livramento-Rivera de Uruguay connection (De Castro et al., 2013).

48. The state of Roraima is isolated from Brazil's electricity grid. The Termoandes station (17) was initially not connected to Argentina's grid, until 2011 when it began generating power for the country grid.

References for Figure 5.2

According to CIER (2020), the interconnections over networks with tension higher than 115 kV are as follows:

1. Colombia-Venezuela, Cuestecita-Cuatricentenario, 230 kV 150 MW (60 Hz)
2. Colombia-Venezuela, Tibú-La Fría 115 kV 36/80 MW (60 Hz)
3. Colombia-Venezuela, San Mateo-El Corozo, 230 kV 150 MW (60 Hz)
4. Colombia-Panama, Cerromatoso-S. E. Panama II, 300 kV 400 MW (under study)
5. Colombia-Ecuador, Pasto-Quito, 230 kV 200/250 MW (60 Hz)
6. Colombia-Ecuador, Jamondino-Pomasqui, 230 kV 500 MW (60 Hz)
7. Colombia-Ecuador, Ipiales-Tulcán, 138 kV 35 MW (60 Hz)
8. Ecuador-Peru, Machala-Zorritos, 230 kV 110 MW (60 Hz)
9. Ecuador-Peru, S. E. Chorrillos-S. E. La Niña, 500 kV, (under study)
10. Brazil-Venezuela, Boa Vista-El Guri, 230/400 kV 200 MW (60 Hz)
11. Bolivia-Peru, La Paz-Puno, 230/220 kV 150 MW (50/60 Hz) (under study
12. Peru-Chile, Tacna/Los Héroes-Arica/Parinacota, 220 kV 200 MW (60/50 Hz) (under study)
13. Peru-Chile, Tacna/Montalvo-Arica/Crucero, 500 kV 1,000 MW (60/50 Hz) (under study)
14. Bolivia-Brazil, interconnection under study
15. Bolivia-Paraguay, interconnection under study
16. Argentina-Bolivia, Yaguacua-Tartagal (Juana Azurduy), 132 kV 120 MW (50 Hz) (in development)
17. Argentina-Chile, C. T. TermoAndes -Sub. Andes, 345 kV 633 MW (50 Hz)
18. Argentina-Chile, Rodeo-S. E. Nueva Pan de Azúcar, 400 kV 1,000 MW (in inventory)
19. Argentina-Chile, Río Diamante-Ancoa, 500/220 kV 1,000/400 MW (under study)
20. Argentina-Chile, Santa Cruz-Aysén, 220 kV 200 MW (in inventory)
21. Argentina-Chile, Santa-Punta Arenas, 220 kV 200 MW (in inventory)
22. Argentina-Uruguay, Colonia Elia-San Javier, 500 kV 1,386 MW (50 Hz)
23. Argentina-Uruguay, Concepción-Paysandú, 132/150 kV 100 MW (50 Hz)
24. Argentina-Uruguay, Salto Grande-Salto Grande, 500 kV 1,890 MW (50 Hz)
25. Brazil-Uruguay, Pte. Médici-San Carlos, 500 kV 500 MW (60/50 Hz)
26. Brazil-Uruguay, Livramento-Rivera, 230/150 kV 70 MW (60/50 Hz)
27. Argentina-Brazil, P. de los Libres-Uruguayana, 132/230 kV 50 MW (50/60 Hz)
28. Argentina-Brazil, Rincón S. M.-Garabí, 500 kV 2,200 MW (50/60 Hz)
29. Argentina-Paraguay, Salidas de Central Yacyretá, 500 kV 3,200 MW (50 Hz)
30. Argentina-Paraguay, Clorinda – Guarambaré, 132/220 kV 150 MW (50 Hz)
31. Brazil-Paraguay, Salidas de Central Itaipú, 500/220 kV 14,000 MW (60/50 Hz)
32. Brazil-Paraguay, Foz de Iguazú-Acaray, 220/138 kV 50 MW (60/50 Hz)
33. Argentina-Paraguay, El Dorado-Mcal. A. López, 220/132 kV 30 MW (50 Hz)
34. Arco Norte Brazil-Guyana-Guyana francesa-Surinam (under study)[49]
35. SIEPAC: Guatemala-El Salvador-Honduras- Nicaragua-Costa Rica-Panama, 230 kV 300 MW

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49. The Arco Norte initiative aims to interconnect Guayana, Suriname, French Guyana and the states of Amapá and Roraima, Brazil. Given the situations of these countries and states, there are potential benefits in terms of lower energy costs (Guyana, French Guayana and Suriname), lower prices for end users (Guyana and Suriname) in the long term, supply security and lower emissions, among other benefits, but also multiple social and environmental challenges, above all having to pass through the Amazon (Levy Ferre et al., 2020).

36. Guatemala-Mexico, Brillantes-Tapachula, 400/230 kV 200 MW
37. Guatemala-Honduras, Panaluya-San Buenaventura, 230kV 250MW

A. Brazil-Paraguay, Itaipú (Río Paraná), 14,000 MW
B. Argentina-Uruguay, Salto Grando (Río Uruguay), 1,890 MW
C. Argentina-Paraguay, Yacyretá (Río Paraná), 3,200 MW
D. Argentina-Brazil, Garabí-Panambí (Río Uruguay), 2,200 MW (in inventory)
E. Argentina-Paraguay, Corpus (Río Paraná), 3,400 MW (in inventory)
F. Argentina-Paraguay, Itatí-ItáCorá (Río Paraná), 1,600 MW (in inventory)
G. Bolivia-Brazil, binational hydroelectric development (Río Madera and affluents) (under study)

Participation in value chains

6

Participation in value chains[1]

For decades now, the world economy has been characterized not only by expanding international trade but also by the fragmentation and internationalization of productive processes. Diminishing trade costs have favored this process. Tariff and non-tariff barriers, trade facilitation policies, and transport infrastructure, among other factors analyzed throughout this report, not only influence country and regional trade performance but can also facilitate or limit production integration insofar as they affect the international trade of intermediate goods and services.

Diminishing trade costs have promoted the fragmentation of productive processes.

Productive integration refers to the extent to which production processes in different economies are linked through participation in global value chains (GVC).[2] This participation involves the inputs manufactured in one country being used for the production of other goods in other economies, which are in turn exported to others that produce the final goods. From this perspective, countries can take part in different stages along the value chain for a given product or sector: exports of basic inputs (raw materials), intermediate inputs, or final products. This process of fragmentation of production is fostered by gains from economies of scale and specialization, whereby a country does not need to develop the entire production chain of a good but rather can specialize in the production of a component or part. This process of specialization and participation in production chains explains the significant increase in intermediate goods trade in recent decades that, as seen in previous chapters, has an important regional component since these production chains can benefit from geographic proximity.[3]

As a result of this productive integration, a country's exports usually contain a significant component of foreign value added, much of which is of regional origin. As Graph 1.1 shows, this is the case for countries in East Asia and the Pacific, Europe, and North America, the main factories in the world. This phenomenon is tied to trade in inputs. Participation in these value chains not only involves firms that directly participate in foreign trade, either because they export their products or because they import the necessary inputs for their production, but also domestic companies that are indirectly linked as providers or clients of the exporter or importer firms, respectively. Thus, the

1. The chapter was produced by Lian Allub and Álvaro Lalanne, with research assistance from Ivana Benzaquen and Matías Garibotti.

2. Throughout this chapter a distinction will be made between global value chains (GVC), regional value chains (RVC), extra-regional chains (EVC) and mixed chains. The section entitled «Different types of value chains» in this chapter provides a precise definition of each of these.

3. Johnson and Noguera (2017) document an increase in inputs trade from 6% to 16% of output between 1970 and 2008 for a set of 43 countries.

adoption of quality standards or technical requirements by a company that is part of a GVC can improve the conditions of production for firms that do not participate directly in these chains. The service sector stands out for its role among this set of activities indirectly affected by GVC, which drives product differentiation and greater value added in exports in many cases.

As discussed in previous chapters, production integration between countries plays a significant role in determining the trade volume between them, especially at the regional level, since it is conducive to higher levels of trade in intermediate goods. In this sense, trade barriers and costs are important determinants of trade volumes but so are the regulations that directly impact the establishment of input-output relationships between different economies. Here, regulations on foreign direct investment (FDI) can play an important role, since it is often multinationals (including multi-Latin companies) that promote these value chains between plants that are distributed in different countries. Another key determinant is rules of origin, which state the necessary domestic value added for a product to be eligible for duty-free or reduced duty when traded among FTA partners. If these rules are very strict, the possibility of generating production chains is lost. Finally, countries apply other instruments like temporary imports schemes, or special economic zones to facilitate inputs provision to firms that export their products, also important when it comes to fostering participation in value chains.

This chapter provides a detailed analysis of the role of production integration and participation in global value chains, and how this benefits regional integration initiatives. It first briefly outlines the conceptual framework to characterize GVCs, their determining factors, and their impact on trade and development. Next, it presents evidence of Latin American companies' participation in these production chains and how this is tied to the characteristics of the goods traded. Finally, the chapter delves into key policies for promoting participation in these trade flows and the impact of such policies in terms of improved productivity and welfare for countries in the region.

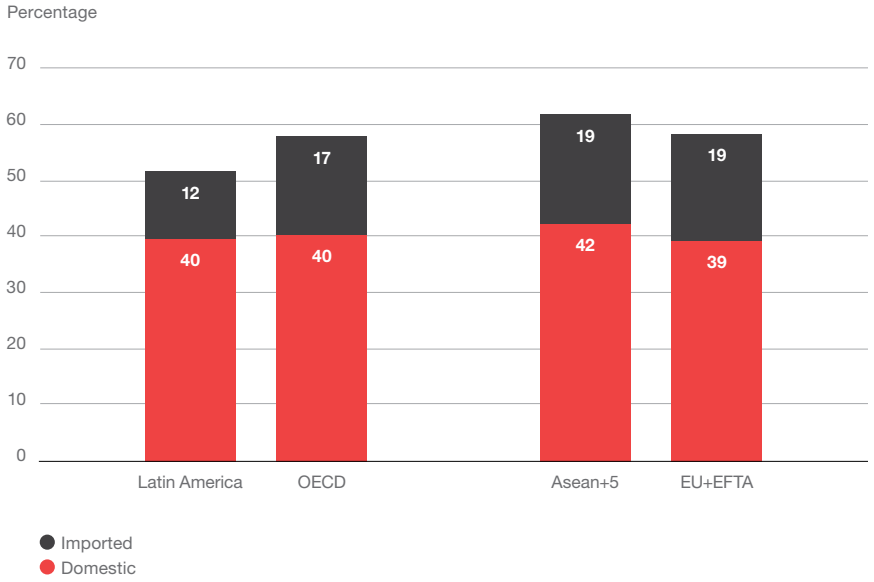
Conceptual framework: value chains and their impact on productivity and trade

The production of a good can be seen as a set of stages involving inputs, whereby value is added at each stage. So, for example, to make bread, flour is needed, which in turn requires from this structure of interconnected stages, where each link is a necessary part of the production process of the final good.[4]

4. Production chains can have a snake configuration, where each stage uses the production from the previous one, as in the example; or as a spider configuration, where inputs converge in an assembly nucleus; or hybrid, which combines both (Baldwin and Venables, 2013).

By definition, a production chain involves the fragmentation of production among different companies tied by supplier-client relations, located either in the same or in different countries. One measure to analyze the level of integration of a country or region with the global economy is the share of imported inputs in the total inputs used in production. This indicator provides an assessment of the degree of fragmentation of production and the level of participation in global production chains. Graph 6.1 shows this index across regions for the year 2014, based on data from the input-output tables in the Global Trade Analysis Project (GTAP) database (Aguiar et al., 2019). The graph shows that Latin America uses fewer inputs in general and significantly fewer imported intermediate inputs than the other regions considered, which is an initial indicator of less fragmentation of production and low integration in regional and global value chains.

Graph 6.1
Use of intermediate inputs, 2014



Notes: The graph shows the fraction of production value corresponding to intermediate inputs for each region, distinguishing domestic from imported components. The simple average is shown for the countries in a region. The OECD region excludes the countries of Latin America. For details on the countries in each region, see Appendix (p. 303).

Source: Authors based on GTAP 10 data (Aguiar et al., 2019).

Different types of value chains

Production chains can also be analyzed based on the trajectory of value added along the different stages of production. If the value added in each stage is composed only of value added produced in the home country, then the production chain is classified as domestic. Regional value chains (RVC) are formed when production incorporates stages that happen in neighboring or in proximity (from the same continent or subcontinent) countries, in addition to integrating domestic stages. Domestic value added may also be integrated with production activities that happen exclusively in countries outside the region, giving rise to extra-regional value chains (EVC). Finally, if the value added is integrated between domestic, regional, and extra-regional activities, these are mixed chains. This analysis perspective that traces the trajectory of value added at each step of production is referred to as forward perspective in the literature.

Forward perspective measures national value added included in final goods produced in other countries, while backward perspective measures foreign value added in the national production of final goods.

It is also useful to analyze production chains from a backward perspective, considering the value of intermediate goods used in the domestic production of final goods that was added by firms in the home country or abroad, either within or outside the region. The value of a final good is the sum of all the value added in each stage of production. The value that is directly incorporated in the producer country of a final good is counted as a domestic chain, while the value added in countries from the same region and then incorporated as input in the final good corresponds to a regional chain, and the value included in inputs originating in countries outside the region is attributed to integration in extra-regional chains. Finally, mixed chains are when regional inputs are added to others sourced from extra-regional origins or vice versa. Figure 6.1 shows the different types of chains according to both perspectives.[5]

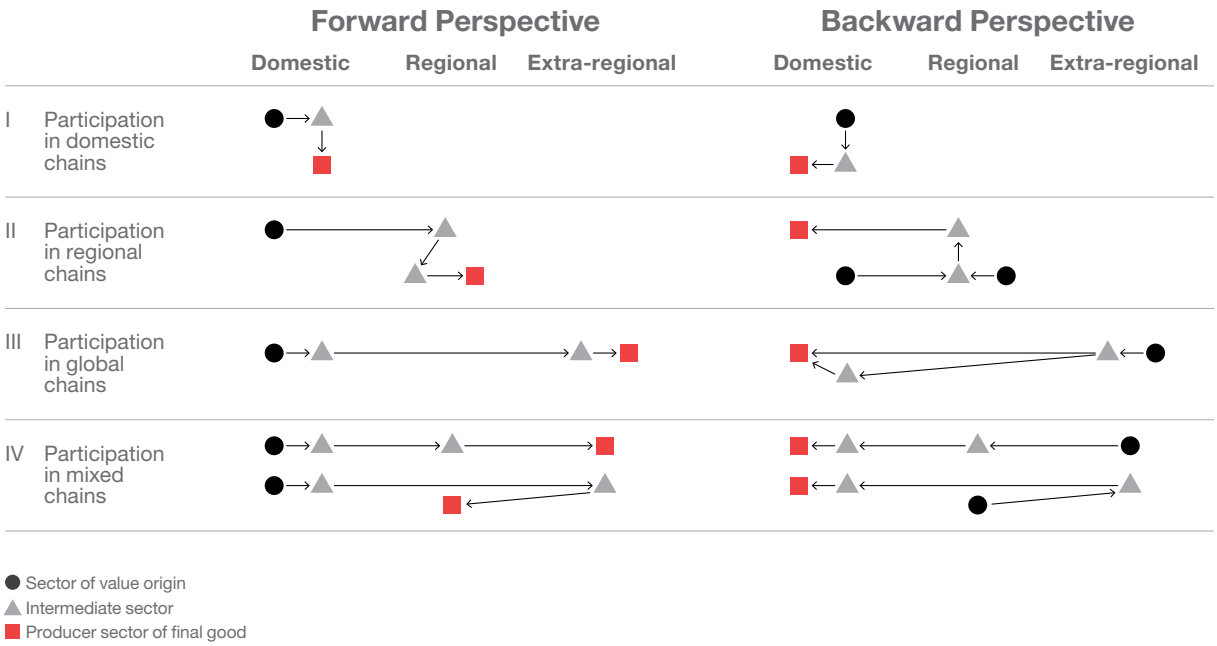
As seen in the figure, the final good in the forward perspective may or may not be produced domestically, because the focus of the analysis is on the sectors providing the value added, either as primary or intermediate inputs. Put another way, this perspective analyzes how much national value added is incorporated in final goods produced in other countries. The backward perspective measures the foreign value added in the production of final goods of one country, i.e., how much of the total value produced in a country corresponds to foreign production.[6] This distinction gives rise to two alternative measures of the value added involved in international trade, which will be shown further on.

5. Participation in regional chains is synonymous with production integration among neighbors, since two or more countries participate in the production of a final good or service. Moreover, participation in extra-regional value chains integrates those countries with world markets without the intervention of a regional partner. In this case, the structures of neighboring countries are not interdependent. For this reason, while it may be cumbersome, it is useful to distinguish extra-regional chains from mixed ones, since the latter do entail some type of interrelation between neighboring economies and with the global economy.

6. As a simple example of a world composed of two countries, A and B, the forward position of country A is the same as the backward position of country B, since the value added of A inserted in the production of B (forward position of country A) is the same as the foreign value added inserted in Country B's production (backward position of country B).

In the first case, it is important to measure what proportion of a country's total value added is exported, while in the second, what is important is how much imported value added is involved in the production of final goods in an economy.

Figure 6.1
Forward and backward breakdown of value added according to the type of chain



Source: Authors.

A country's position in value chains from both the forward and backward perspectives is important because the policy implications can be different. Countries where the production stages tend to be located closer to the final good need classic trade policies of access to markets, flexible rules of origin, and policy regimes favorable to importing inputs. Countries where the production stages are located closer to the beginning of production chains, which in Latin America generally involve a high intensity of natural resources, tend to need policies to differentiate and sophisticate their products and attract foreign investment. In any case, ultimately all the policies reviewed in this chapter apply to all the countries of the region because there is not one type of participation in value chains that is better than another and countries can be located at distinct points in this production process in the different sectors.

Figure 6.1 is useful for describing the integration of production chains, but it only considers the places of production and not final good consumption.

However, trade relations between countries also have an important component of exchange of goods that have already completed the production stage and are bound for consumption or investment. Therefore, international trade in the next section will take into account countries' positions as providers and users of intermediate and final goods.

Clearly, participation in each type of chain will depend on the trade costs faced by an economy. In an exercise for NAFTA (now UMSCA), Antràs and De Gortari (2020) show how the makeup of domestic, regional, and extra-regional value chains is altered by changes in trade costs. Domestic and extra-regional chains are monotonous, i.e., as trade costs rise, participation in extra-regional chains falls and participation in domestic ones increases.[7] Regional chains, however, have an inverted U shape. Starting with a situation without trade, as trade costs fall, participation in regional chains increases at a faster rate than in extra-regional ones. However, at a certain point, participation in EVC begins to grow faster, while it declines in RVC. This is attributable to the fact that physical proximity plays a key role in determining the overall costs of transport. As these costs continue to fall, distance starts to become less important, allowing global providers and consumers to be more competitive.

One important determinant of where production is located and, therefore, participation in RVC or EVC, is where demand is located. If the price of goods is assumed to increase alongside the costs of transport, production is expected to locate close to the final demand for the good, leading to much of the value-added trade taking place at the regional level. This would be similar in the case of goods that require customer service or highly specialized inputs; proximity would again play a fundamental role, thus encouraging regional value chains (Blyde et al., 2014).

Participation in production chains and their impact on development

Participation in international production chains means new sources of gains from specialization, greater division of labor and, as a result, more fragmentation of production. One way of looking at specialization is to measure the length of the chains, i.e., the number of production processes involved in producing a good, and to break down how many of these processes are carried out within countries versus those carried out internationally. More global fragmentation would in general imply a larger number of production stages, meaning longer chains made up of fewer domestic stages and more international ones, either regional or extra-regional.

7. Antràs and De Gortari (2020) divide chains into regional and global, the latter including the extra-regional and mixed chains from the definition used in this chapter. For the sake of simplicity, mixed chains are included within extra-regional chains in the rest of this section.

As will be seen further on, in the context of globalization the countries of Latin America reduced the share of their domestic production stages in global chains while increasing the international stages, but the same did not happen with their regional chains, pointing again to the low level of regional production integration.

The process of production fragmentation is often driven by multinational corporations that find it more beneficial to operate in these countries than to export goods produced from the country of origin. The type of foreign direct investment most associated with value chains is vertical.[8] Vertical FDI aims to take advantage of price differentials and can involve trade of goods within the firm, i.e., a plant operating abroad may establish a stage of the production process in another country, which will then be used by the parent country or one of its affiliates operating in a different country. Again, the costs of trade play a fundamental role in the potential that these multinationals have to exploit this fragmentation and, therefore, the potential countries have to attract them.[9]

These investments by multinational firms can help countries to participate in complex production processes, requiring local inputs from domestic firms. This interaction between domestic and foreign firms can also mean knowledge spillovers that can potentially lead to improved levels of productivity in local firms. This is partly due to the fact that multinationals usually have higher quality standards for the goods in demand, thus improving production processes to meet those standards.

Trade and production integration brings numerous opportunities, including the expansion of consumer markets, suppliers, and greater specialization.

Trade and production integration brings numerous opportunities for participating companies and countries. The possibility of exporting the goods produced expands consumer markets. At the same time, with exportation comes improved products and processes, leading to increased productivity (De Loecker, 2013). Integration also expands the set of potential suppliers, increasing the variety and quality of available inputs, which often enables the production of new goods or quality improvements of the goods produced.[10] Likewise, it attracts FDI, which introduces new products, new demand for inputs, and can generate knowledge spillover to domestic firms. Finally, it allows for greater specialization, leveraging a country's comparative advantages.

8. FDI can also be horizontal. This type of FDI is aimed at producing the final goods in the place of consumption and saving on transportation or internationalization. This way, instead of exporting the final good from the country of origin, it is produced in the destination country.

9. Trade costs not only affect trade of goods, but also the potential countries have—especially small ones—to capture FDI. Low trade costs allow the potential market to expand for these foreign firms and, consequently, the economies of scale that they can exploit (Allub, 2016; Ramondo and Rodríguez-Clare, 2013; Tintelnot, 2017).

10. See Amiti and Konings (2007), Bas and Strauss-Kahn (2015), Goldberg et al. (2010), Grossman and Rossi-Hansberg (2008), Halpern et al. (2015), Impavido et al. (2010) and Topalova and Khandelwal (2011).

Nevertheless, as mentioned previously, several requirements must be met for trade and production integration to move forward: reduced tariff and non-tariff barriers; infrastructure to diminish the time and cost of transport; efficient logistics operators that provide reliable services at competitive costs to allow optimum planning of the production chain; efficient customs operation; harmonized trade regulation and facilitation of inputs supply; deeper consolidation of existing trade agreements to resolve obstacles, such as those imposed by having to deal with numerous rules of origin; and a legal and business environment where contracts can be executed in reasonable time and costs. Finally, properly trained labor to carry out these production processes is essential.

Production integration in Latin America

Building on the concept of production integration and how countries can participate and benefit from it, the next step is to take a detailed look at how the region has performed in this dimension. This section presents evidence of the evolution of productive integration in Latin America. The first section outlines the participation, position, and length of value chain metrics based on input-output tables. Then, it specifies some key aspects for more advantageous integration at the micro-level, in particular, how goods are used at destination and the incorporation of services in exports.

Many metrics of participation in value chains are done with multi-country input-output tables. These use a more sophisticated version of Leontief's techniques (1936) to combine value-added coefficients applied to national and international supply of intermediate inputs used to produce final goods and services. The construction of these tables creates a structure where the value added from one sector and country of origin is incorporated in the final output of another sector-country. If these value added-intermediate inputs-final goods tables are properly partitioned, the production structure of the countries by type and extent of international insertion can be ascertained.[11] To do this, the subsequent subsections incorporate information from the UNCTAD-Eora database containing input-output tables for 189 countries, for 26 sectors in the period 1990-2015 (Lenzen et al., 2012, 2013).[12]

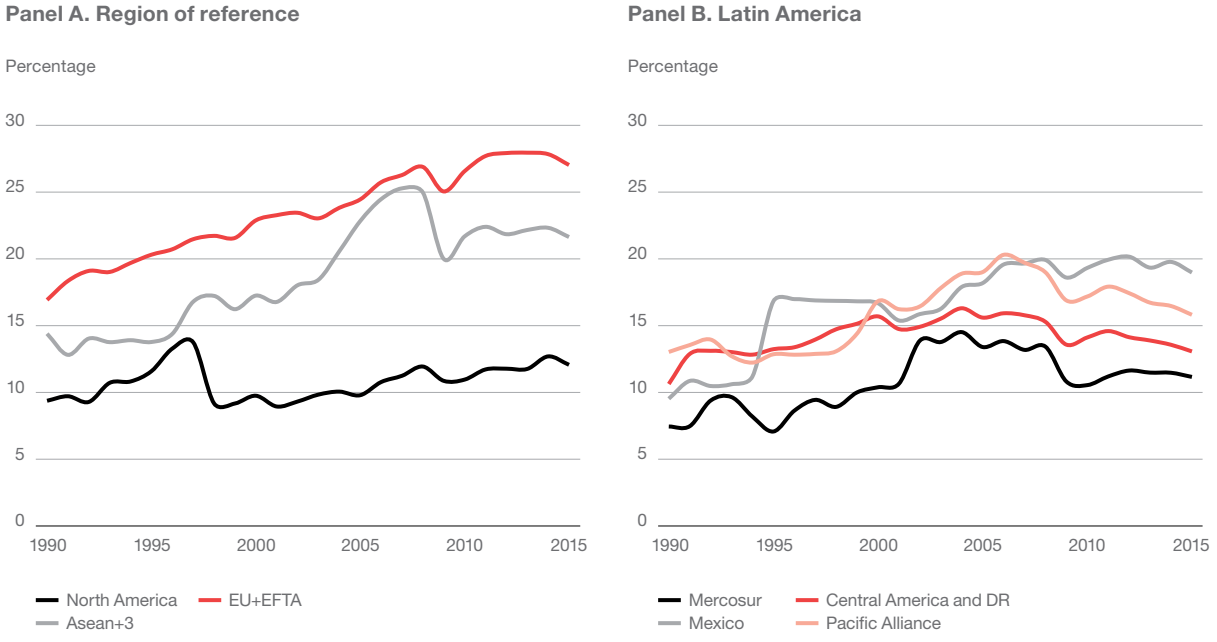
11. See, for example, Johnson (2018), Los et al. (2015) and Los and Timmer (2020).

12. Due to the extent of its coverage in terms of time and geography, this database is used in studies that cover long periods of time, e.g., Caliendo et al. (2015).

Integration in domestic, regional and extra-regional chains

Graph 6.2 shows the evolution between 1990 and 2015 of the proportion of exported domestic value added for each region or country. According to the description in the previous section, this measure is a forward analysis of these production chains.[13] This is a first approximation of a country's level of productive integration with the rest of the world, describing to what extent its different economic sectors are tied to international value chains, regardless of whether these are regional or extra-regional.

Graph 6.2
Value added of foreign trade as a proportion of total trade



Notes: Evolution of participation in activities related to foreign trade in overall value added for Latin America (panel B) and benchmark regions (panel A). For details on the countries included in each region, see Appendix (p. 303).

Source: Authors based on data from Full Eora (https://www.worldmrio.com/eora/).

The regions have had divergent trajectories in terms of international trade. While the countries of Europe and East Asia increased their production involvement with other countries, significantly increasing the participation of foreign trade activities in value added, with indicators in 2015 close to 27% and

13. In terms of Figure 6.1 in the previous section, this is equivalent to considering the integrated value added in regional, extra-regional and mixed chains, as well as exported final goods and services of domestic chains.

22% respectively, the proportion of value added exported by North America fell after the initial increase recorded when NAFTA went into effect in 1994 and held a level of internationalization of approximately 12%.[14]

All Latin American subregions considered increased their portion of exported value added, showing greater international independence.

The evolution of the international integration of Latin America's subregions has been uneven. Graph 6.2, Panel B shows the participation of international trade activities in value added for three Latin American subregions and Mexico.[15] As mentioned in Chapter 1, as of 1990, the countries in LAC had entered a stage of regional and global integration through a series of trade agreements, while unilateral trade openness initiatives were getting underway. In this way, the production structure of these countries slowly became more interdependent on foreign trade.

Among the subregions, while Mercosur did show a significant increase in the proportion of foreign value added between 1994 and 2006, it then fell and remained relatively constant at around 11% until the end of the period, the lowest value among all subregions. In contrast, Mexico made an initial leap when NAFTA was signed, then a more moderate increase until 2015 when it reached nearly 20%, the highest value for the set of subregions or Latin American countries. The Pacific Alliance subregion showed a sustained increase from 1996 until 2006 when it peaked at 20%, but then its share of value added in foreign trade activities began to fall, particularly during the financial crisis of 2008-2009, arriving at 16% by 2015. Central America's performance is smoother but with a pattern similar to the Pacific Alliance, with an increase until 2006 and subsequent fall thereafter, ending up at 13% by mid-2010. In summary, in terms of this indicator of exported value added, Mexico presents the highest levels of openness of the regions analyzed, followed by the countries of the Pacific Alliance, Central America, and finally, Mercosur.

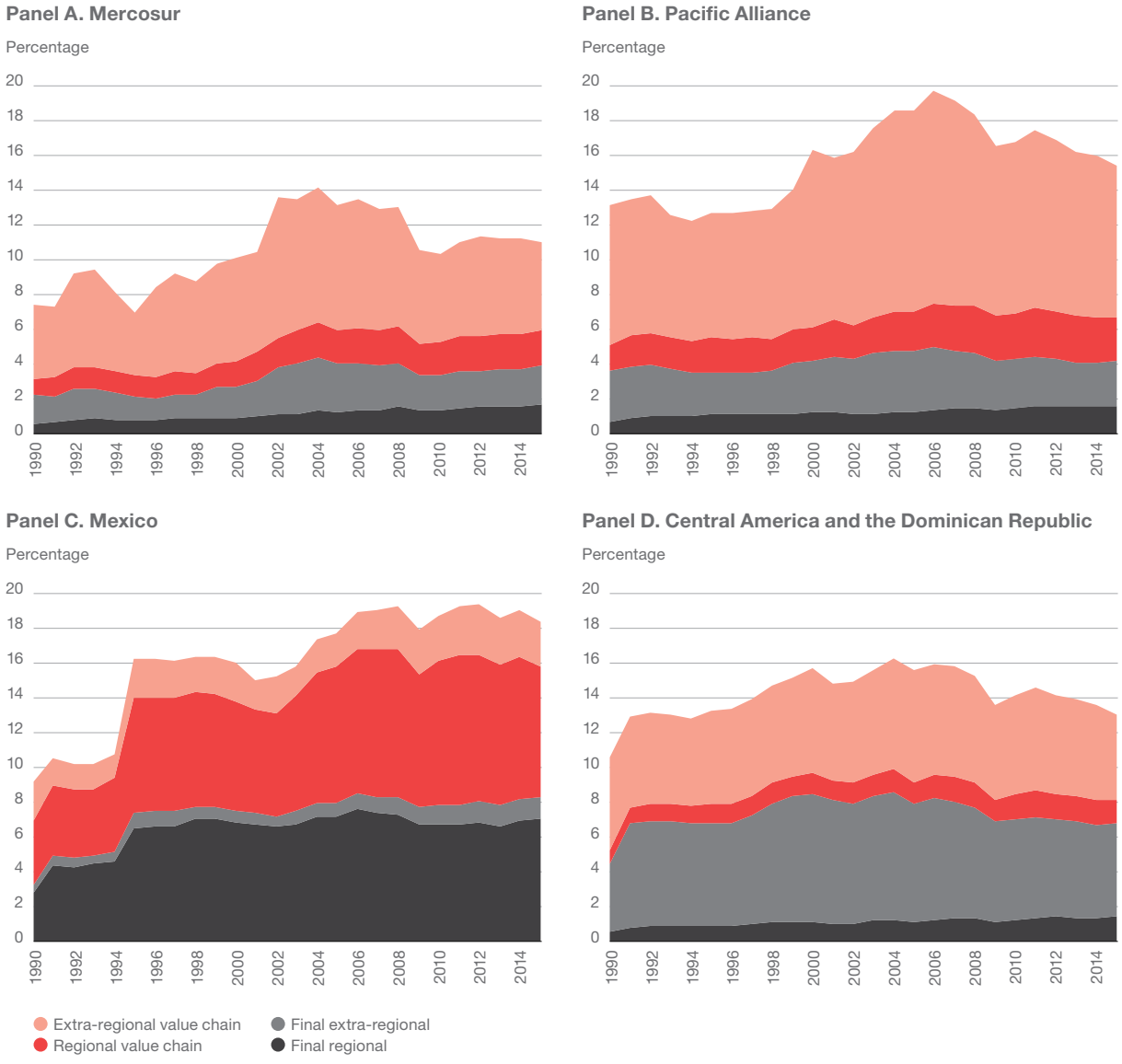
Graph 6.2 shows the value added traded for each region without distinction for destination or type of good. Graphs 6.2 and 6.4 break down this traded value added by destination (regional or extra-regional) and type of good traded (inputs or final goods). Thus, inputs trade in the region is associated with the existence of a RVC; trade in final goods in the region (corresponding to domestic chains, i.e., goods that are finalized in the countries) correspond to the category of regional final good; trade in inputs with countries outside the region would constitute an EVC; and trade in final goods with countries outside the region would be in the extra-regional final goods category. Graph 6.2 shows this breakdown for the four subregions of Latin America described previously.[16]

14. It is worth noting that this participation is different from the openness indicators shown in other chapters. Imports and exports are measured in general in gross production value, and thus include the entire value of the good traded, not only the domestic value added, so the ratios are usually larger.

15. Mexico stands out for its international integration differential as of the signing of NAFTA in 1993 (predecessor to USMCA, which went into effect in 2020).

16. Mixed chains are not shown, considering they represent less than 1% of value added for all years.

Graph 6.3
Share of value added involved in international trade activities in proportion to total value added in Latin American countries and regions



Notes: Evolution of share of activities associated with foreign trade in total value added for each region of Latin America, breaking down by destination (regional or extra-regional) and by type of good traded (final or inputs). For details on countries included in each region, see Appendix (p. 303).

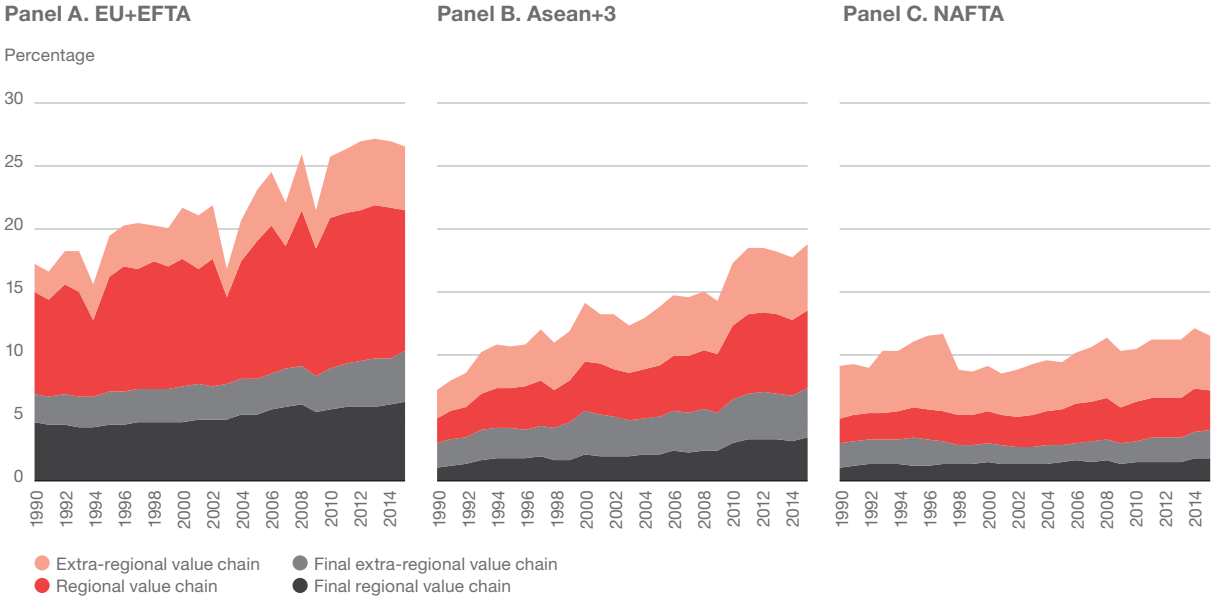
Source: Authors, based on data from Full Eora (https://www.worldmrio.com/eora/).

The pattern arising from this breakdown is clear. On the one hand, there is Mexico, where the largest part of exported value added is distributed between RVC and regional final goods, both phenomena clearly attributable to Mexico's incorporation in NAFTA. On the other, there is Mercosur and the Pacific Alliance

subregion, where the largest portion of exported value added is in EVC, attributable to exports of basic inputs to global destinations; while in second place, there are three other categories with low levels of exported value added (RVC, final regional and extra-regional goods). Finally, Central America shows a high, consistent level of participation in EVC and extra-regional final goods, indicating the importance of integration in this subregion with North America, as well as the low share of total value added in RVC and regional final goods.[17] Graph 6.3 also shows that the decline in international integration observed in Graph 6.2 for the different subregions of Latin America (except Mexico and, to a lesser degree, Central America) is mainly attributable to the fall in extra-regional activity.

Graph 6.4

Share of value added involved in international trade in proportion to total value added in benchmark regions



Notes: Evolution of share of activities associated with foreign trade in total value added for each region of Latin America, breaking down said share by destination (regional or extra-regional) and by type of good traded (final or inputs). For details on countries included in each region, see Appendix (p. 303).

Source: Authors based on data from Full Eora (https://www.worldmrio.com/eora/).

17. This integration of Central and North America shows an interesting trend of production chains between these two regions that are also in geographic proximity and are taking advantage of that proximity to obtain gains in specialization through trade. Although throughout this report, North America is considered an extra-regional destination for Central America, this trend could change with an increase in trade between these regions and consolidation of trade agreements like the free trade agreement between the Dominican Republic, Central America and the United States (DR-CAFTA) or the different agreements between Mexico and the countries of Central America (except Panama).

Conducting the same exercise for the EU (including the European Free Trade Association (EFTA)) and for Asean+3, a pattern similar to that observed in Mexico emerges, shown in Graph 6.4, with greater integration in regional value chains. In both cases, this is complemented by significant trade in regional final goods (albeit in a lesser proportion in Asia), once again reinforcing the role of regional trade as a driver of international integration.

In summary, in the European Union (together with EFTA), the region with the highest participation in value chains, regional trade and particularly regional value chains is what contributes the most to the value added in foreign trade. A similar composition can be observed in Mexico, a Latin American country that is very integrated with trade in North America. In Asean+3, the increase occurs in all components, although, as in previous cases, with greater participation in regional trade, both in chains and final goods. However, with the exception of Mexico, Latin America, especially the countries of South America, shows low value added participation in international trade activity, and, above all, very low participation in regional value chains.

In regions with a larger share of exported value added in total value added, the contribution of regional trade of intermediate and final goods is large.

Position of Latin American countries based on the type of value chain

Until now the analysis has focused on how countries in the region have evolved in terms of international integration, measured by the proportion of exported value added in production chains at the regional and extra-regional levels. This section aims to analyze whether participation in these chains occurs at the beginning or end of the production process. This analysis requires that the information presented previously on participation in chains from a forward perspective be combined with that from a backward perspective. This analysis sheds light on what types of activities the economies of the region are participating in and how to best design policies that could promote a deeper productive integration. For example, a country located at the end of value chains could benefit from special import regimes for exportation, or from more lax rules of origin to allow it to finalize products and then continue enjoying preferential tariff treatment by partner countries.

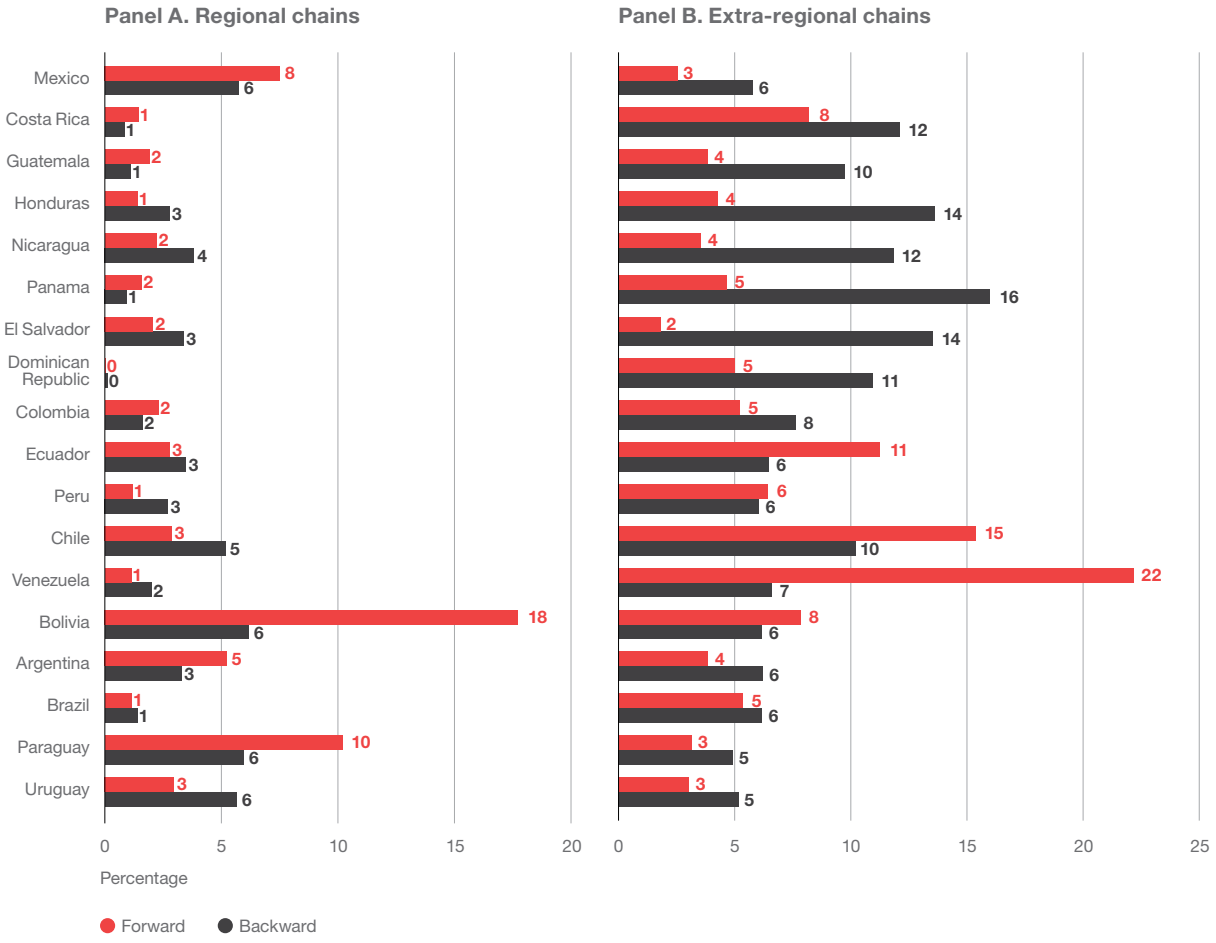
Graph 6.5 combines forward and backward participation in value chains over total gross value added (GVA) for each Latin American country in 2015.[18] Panel A shows the importance of regional chains and Panel B, extra-regional chains. The red bar represents the value added from a forward perspective, i.e., it measures the proportion of value added by a country that is then used as input in the production of other countries. The black bar measures the participation of value added by other countries in the production of final goods as a proportion of a country's gross value added. The difference between the forward and backward levels reflects the integration profile in each type of chain (regional or extra-regional). If the red bar is longer than the black one, the country's participation tends to be forward, i.e., the country is

18. Lalanne (2021) shows the evolution for the period 1990-2015.

more a source of value added used by other economies than a final user of value added provided by other countries.[19]

Graph 6.5

Forward and backward participation in value chains as a percentage of each country's GVA, 2015



Notes: The graph shows forward and backward participation in regional (Panel A) and extra-regional (Panel B) chains as a percentage of each country's gross value added. Forward perspective measures the proportion of a country's value added that is used as input in the production of other countries. Backward perspective measures the foreign value added in the production of final goods in a country.

Source: Authors based on data from Full Eora (https://www.worldmrio.com/eora/).

19. This definition of value chains includes transactions where inputs cross only one border and are consumed in the destination country. Some definitions of value chains exclude this type of transaction (see, for example, Borin and Mancini, 2019). Wang et al. (2017) distinguish simple value chains, where inputs cross only one border before consumption, from complex chains, where they cross more than one. The latter are associated with more global systems of production. In 2015, around 15% of RVC and a third of EVC in Latin America were attributable to complex chains. See Lalanne (2021) for more details on this point and the relationship between both types.

The graph clearly shows that for most Latin American countries, extra-regional chains are more important than regional ones, with the exceptions of Bolivia, Mexico, and Paraguay. As stated, the case of Mexico is due to its strong production integration with the United States and Canada through NAFTA; in the cases of Bolivia and Paraguay, it is attributable to significant energy exports (gas in the former and electricity in the latter) to neighboring countries. It also shows that the countries that participate most in value chains have sharp differences when it comes to the type of integration. On one hand, the countries of Central America have a strong backward trend, i.e., as producers of final products using extra-regional inputs (mainly sourced from North America). On the other, participation by the countries of South America is more forward-leaning, particularly in the countries that export fossil fuels (Bolivia, Ecuador and Venezuela) and mining products (Chile and Peru). A similar but somewhat milder trend can be observed in the Southern Cone countries that export agricultural products extra-regionally (Argentina and Brazil). Box 6.1 analyzes in more detail some of the notable changes in participation in value chains for some of the countries selected.

Box 6.1
Notable changes in participation in value chains

The distinction between forward and backward participation is particularly relevant in some cases where participation changed under different internationalization strategies.

Argentina increased its level of forward participation in the region (going from 2% to 5% between 1990 and 2015 in regional chains, and from 3% to 4% in extra-regional chains (see Lalanne, 2021)). This evolution contrasts with the backward participation it has in trade destined for countries outside the region. Argentina's position thus stands out at the regional level as an input supplier.

Mexico, a country that has in the past been considered an archetypical backward participant due to the strong activity of maquiladoras integrated with North American markets (see De La Cruz et al., 2011; Koopman et al., 2014), has shifted from a backward to a forward regional participation stance as a supplier of inputs to these destinations. In recent years, Mexico has also begun to use more extra-regional inputs in its chains, consistent with the findings in Antràs and De Gortari (2020). This implies that participation in extra-zone chains increases as the costs of trade are reduced, while participation in regional chains has an inverted U shape. It is possible that with the renegotiation of NAFTA (now USMCA), this trend may partially revert and the country may return to its backward position.

Finally, participation by Central American countries is notably backward in nature. The greater degree of integration in extra-regional chains confirms the findings in Chapter 1 of this report in the sense that this subregion presents a trend of more openness, with impacts on regional levels of trade that are aimed mainly at strengthening its relationship with the countries of North America.

It is also worth noting that in Brazil, while it is a significant global exporter of minerals and agricultural products, this flow is not sufficient to put it in a forward position since it is also a heavy user of global inputs, basically for domestic consumption.

In summary, participation in value chains by countries in the region is usually as finalizers of processes in extra-regional chains. The low regional integration in production processes explains the lower levels of participation in value chains, and trade in general, when comparing Latin America to more developed and integrated regions like Europe or Southeast Asia. This could be attributable in part to existing rules of origin in the region, which diminish the benefits of fragmentation of production (CAF, 2020). For countries with high backward participation as product finalizers, the most significant rules of origin are their own, i.e., the ones that they have with partner countries in trade agreements since these determine whether the products they finalize will benefit from existing preferential tariff status when exported to their partners.

For countries with forward participation, or at the beginning of the chain, existing rules of origin with trade partners may prove more relevant, since these determine to what extent partners will be able to trade the goods produced under preferential tariff status in the treaties to which they are parties. An example of this is what happened with Mexico upon entering NAFTA, which forced it to replace inputs from China with others sourced from its partner countries under the treaty. As a result, the rules of origin of Mexico with the U.S. and Canada had an impact on China, the main supplier of inputs for Mexican industrial processes. (This issue of rules of origin and their impact on production integration will be analyzed in more depth in the section on public policies.)

Integration and specialization: value chain length

Greater production integration is tied to shorter domestic stages and longer international stages of production, highlighting country specialization.

One interesting aspect of participation in the region is the length of production chains. The fragmentation of production induces specialization in the most competitive segments. For this reason, countries that increase their integration in chains usually also shorten the length of their domestic stages of production, i.e., they end up having fewer national links in international value chains and longer international links, indicating that countries specialize in the tasks in which they are most productive. Having more value added concentrated in certain links generates greater scale in those tasks, with a positive impact on employment and the productivity of economies. In other words, they participate in fewer stages with a greater number of productive processes. Box 6.2 describes in detail the methodology for measuring the length of value chains.

Graph 6.6 contains four panels showing the change in average forward length of domestic and international stages in participation in regional and global value chains.[20] Panels A and B show the lengths of regional chains. As can be seen, domestic stages of participation in regional value chains in Europe fell in general, while the length of international stages increased,

20. Figure 6.1 provides an example of how to compute the length of production chains. In this figure, the forward perspective of the regional chain has one domestic stage and three regional stages, while the global one has two domestic stages and two extra-regional ones.

reflecting a certain level of specialization in regional integration processes, in line with earlier observations. In contrast, in Latin America, although there is a notable shortening of domestic stages of production, there is also a reduction in the number of international stages, which would indicate a low level of specialization in the countries participating in these regional processes.

Box 6.2
Measuring chain length

By partitioning value added, the length of chains can be broken down according to the place of production for the corresponding link.[a] Forward length of a chain is the average number of times value added is incorporated in production before being incorporated into the final good. This value is one when it is used directly in a final good, two if it is incorporated into an input that is in turn used in the final good, etc. This measure is known as output upstreamness. Backward length of a chain starts with the final good production and counts the average number of stages covered before a country's own value added was incorporated. This measure is known as input downstreamness.[b]

In the exercise shown in Graph 6.6, the total length of a production chain is divided into domestic and international[c] stages of regional or extra-regional chains. Total length reflects a weighted average of the length of each one of the stages: domestic stages finalized domestically; domestic in regional or extra-regional chains; and international in regional or global chains. The weight is the participation of this type of trade in total output.

a. The methodology of Wang et al. (2017) was adapted to accommodate the existence of regional, global and mixed chains. This breakdown is in turn based on previous literature (Antràs et al., 2012; Antràs and Chor, 2018; Miller and Temurshoev, 2017).

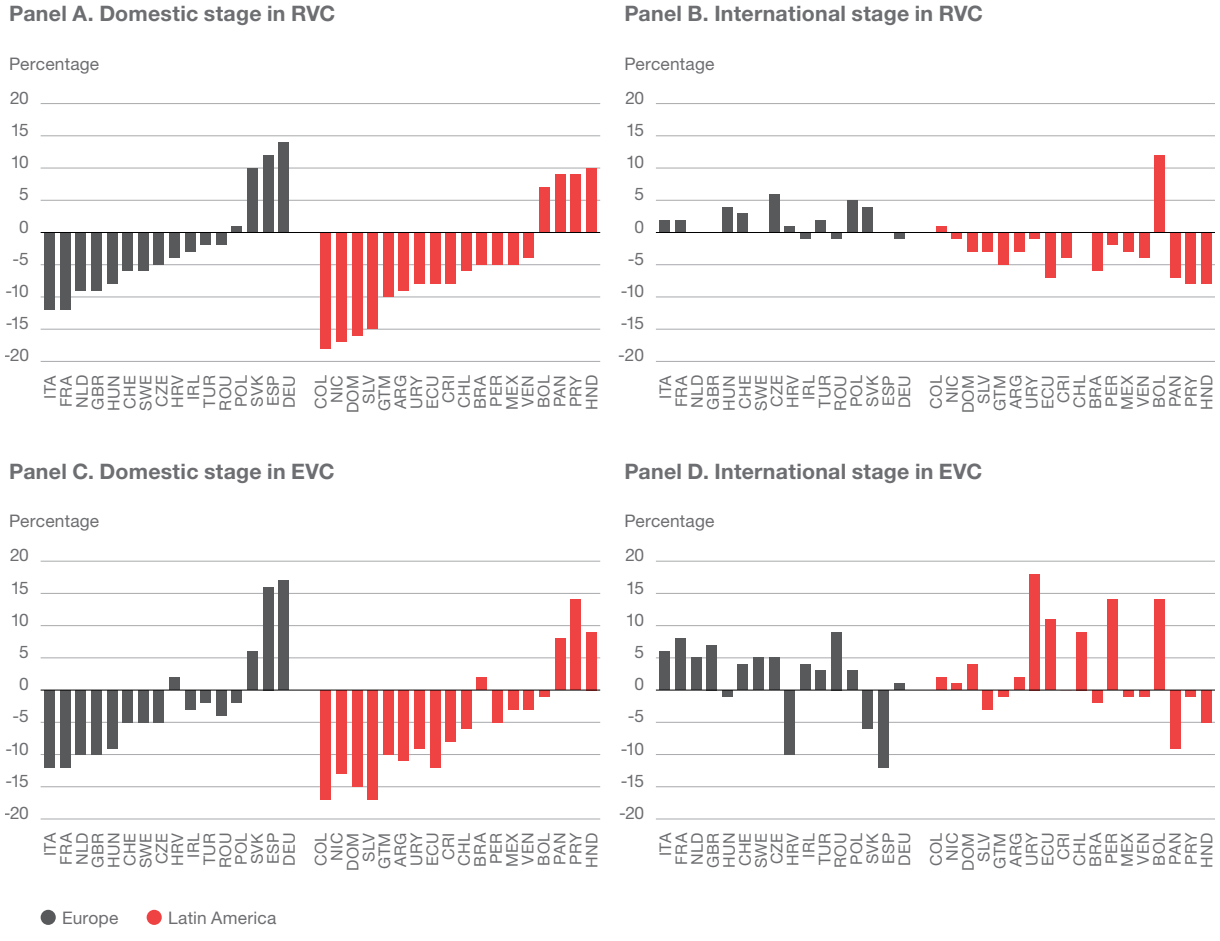
b. Miller and Temurshoev (2017) show that, at the global level, both measures are equivalent. Wang et al. (2017) apply these definitions to subpartitions of the tables, distinguishing domestic from global stages.

c. This is defined at the sector-country level but can be aggregated by country.

Analysis of the lower panels showing participation in extra-regional value chains shows a similar pattern in Europe and Latin America, with shortened domestic stages and longer international stages in general. This pattern, in any case, continues to be more pronounced in Europe than in Latin America.

Graph 6.6

Change in chain length by type and stage, 1992-93 vs. 2014-15



Note: The graph shows the change between both two-year periods for each country in the upstream length of chains, by type (regional RVC or extra-regional EVC) and stage (domestic or international). This length reflects the average number of times value added is counted in production until incorporated in the final good. Countries are abbreviated according to ISO3 classification found in the Appendix (p. 304).

Source: Authors based on data from Full Eora (https://www.worldmrio.com/eora/).

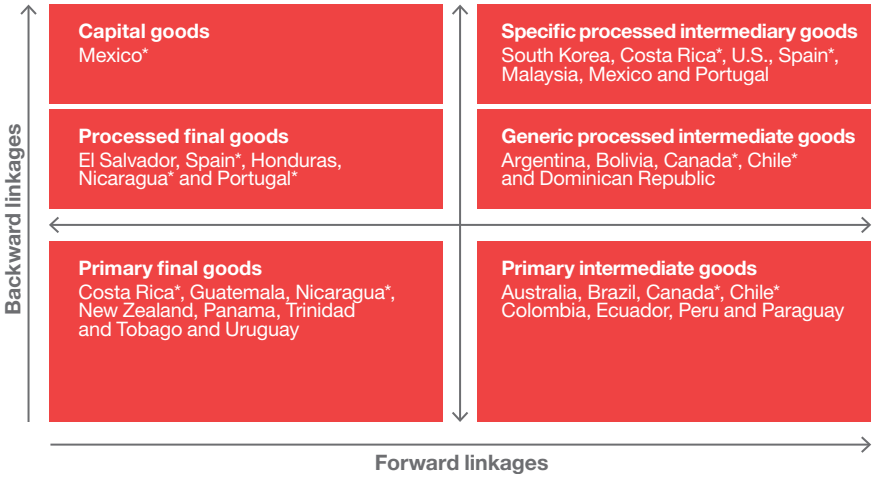
Composition of exports by type of goods and participation in value chains

The previous sections showed aggregate participation in value chains in different countries or regions. Such participation arises from the exportation of different goods by each economy; therefore, in order to better understand the situation and potential for greater production integration, it is essential to analyze the composition of exports from each country and to what extent this export structure facilitates participation in production chains, both forward and backward.

A comparison of this composition of exports from countries in the region to the set of benchmark countries selected helps pinpoint where the better opportunities lie for intensifying production to take maximum advantage of it.

Using the BEC 5 classification,[21] exports can be ordered based on whether their level of manufacturing is sufficient to denominate them as processed or primary. In addition, intermediate goods can be distinguished from final goods. The latter are differentiated according to consumer or capital goods, while processed intermediate goods are distinguished by specific or generic use. Figure 6.2 groups goods into these six categories and also places the countries of the region and benchmark countries[22] in each group according to the main category in which they participate (if there are two significant categories, they are placed in both).

Figure 6.2
Classification of exports by category, 2019



Notes: United Nations BEC - rev. 5 (2016) broad economic categories used. *Indicates countries that appear in more than one category.

Source: Authors based on data from Comtrade (United Nations, 2020).

21. The Broad Economic Categories classification was developed by the UN Statistics Division for the placement and aggregation of products in different classes to facilitate trade flow analysis. In the fifth review of the classification (BEC, rev. 5) published in 2016, the categories were restructured to incorporate the specification dimension (United Nations, 2016). Aimed at improved analysis of value chains, this dimension is intended to establish an official, internationally accepted list of more specific and differentiated intermediate outputs, distinguished from raw materials and generic intermediate goods, that can be associated with homogeneous goods with international benchmark prices.

22. The benchmark countries are developed countries with abundant natural resources, such as Australia, Canada, the United States or New Zealand, a characteristic shared by many countries of this region; developed European countries with strong ties to the region, such as Spain and Portugal; and countries that have achieved development based on their global integration policies, such as South Korea and Malaysia.

Intermediate goods naturally have forward participation in value chains, while final goods, either consumption or capital goods, can correspond to backward participation, where the country imports inputs of either regional or extra-regional origin. Furthermore, with exceptions like the United States and, more recently, China, countries do not participate in many links in a chain, so the production of industrialized goods is generally backward, with significant participation of international providers of different components. In addition, specific intermediate goods usually belong to longer chains and are located closer to the final output than generics intermediates. Participation by these categories in exports is an indicator of tighter participation by countries in GVCs with a strong component of exported value added. In contrast, the integration of primary goods of either final or intermediate consumption that characterizes several countries of the region does not lend to active participation in value chains. It is in this type of goods that countries should exploit their potential for product differentiation to add value to their exports and thus obtain greater benefits from international integration. Exportation of generic intermediate goods can mean a greater degree of insertion, but at the same time present the risk that, as a generic good, the economy could be more easily substituted than if it were a specific good.

The countries of South America normally exhibit a high level of primary goods exports, either intermediate or final, and generic intermediate goods. This composition is similar to that of some developed countries, such as Australia and New Zealand. However, as will be seen in the next section, countries like these last two have a high level of participation in manufacturing goods exports of the services sector, i.e., although they do export primary goods, they generate value based on their incorporation of value added from other sectors, allowing them to differentiate their production, among other things. Furthermore, certain countries in Central America like El Salvador, Honduras and Nicaragua have a high level of participation in exports of final processed goods (mainly related to their insertion in value chains with the countries of North America in textile production). The remaining countries of Central America and Mexico have a higher participation in specific intermediate and capital goods, showing a deeper insertion in value chains. Finally, countries like the United States, South Korea, and Malaysia or the European countries considered in the analysis in Figure 6.2 have a higher participation in specific intermediate and capital goods in their exports, reflecting greater integration in value chains.

In summary, countries can participate in different stages of global value chains, either at the beginning by providing primary, intermediate generic or specific goods, or at the end with specific intermediate inputs or final processed goods. There is no clear relationship between the stage in which they participate and the level of development. What is more important is that countries specialize in the links in which they are more productive and add value based on differentiation, the incorporation of technology, and the development of sectors tied to these internationally integrated sectors.

Participation of services in exported goods

The use of services as inputs in production chains is one way of achieving greater product differentiation in exported goods. These services can range from product design or branding to IT services and automation of processes, or even financial services.[23]

Graph 6.7 shows data on participation of service sector value added in goods exports for a selection of countries, divided into financial and business services, and other services. This division stems from the literature, which identifies the business and financial service sectors as a key input for export development and company performance, especially for developing countries.[24] There is broad heterogeneity within the region, given that in some countries like Bolivia, Colombia, and Costa Rica, services provide over 30% of domestic value added, and in others like Peru, the contribution by this sector barely exceeds 10%. In all the benchmark countries, the service sector contributes more than 25% of domestic value added.

Analysis of the composition of the different service subsectors reveals, once again, broad heterogeneity within the region. Business and financial services contribute over 10% of domestic value added in Chile, Colombia, and Costa Rica, while in Bolivia and Peru, they contribute around 5%. In contrast, in all the benchmark countries, these services provide over 10% of domestic value added in exports, with New Zealand reaching values of close to 25%. This last case can serve as an example to follow for many countries in the region, considering that New Zealand manages to export highly differentiated primary goods derived from its rich natural resources. That differentiation is achieved, at least in part, by adding value to these primary goods from the service sector, especially business and financial services.

The service sector's development may affect the comparative advantages of the different manufacturing sectors.

The development of the service sector can affect the comparative advantages of the different manufacturing sectors. Such development involves the competition of resources with the manufacturing sector, which may increase the cost of inputs for both sectors. One possible consequence is that sectors with low participation of services in their production benefit little from the development of the service sectors but are negatively affected by higher costs, while in sectors that are service-intensive the benefits of more development in this sector more than compensate for the higher cost of inputs (Chor, 2010; Manova, 2008; Manova et al., 2015).[25]

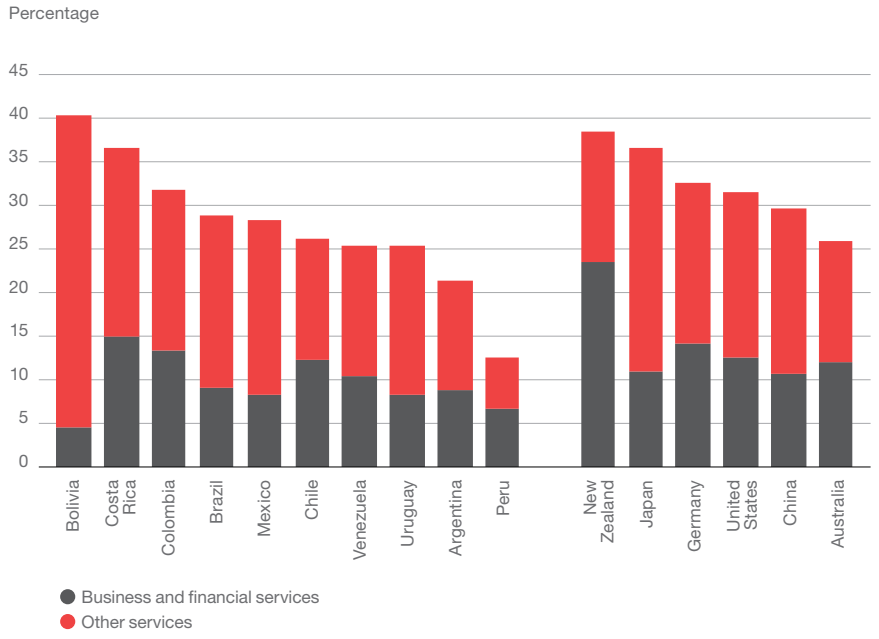
23. Lodefalk (2014) shows that internal and subcontracted services help to increase the intensity of exports, measured as share of exported goods in total sales.

24. See Chor (2010), Manova (2008) and Manova et al. (2015).

25. Sectors that are not service-intensive, according to Liu et al. (2020), are the following: chemical and chemical products; pulp, paper, printing and publishing; coke, refined oil and nuclear; lumber and wood and cork products; rubber and plastics; other non-metallic minerals; basic metals and manufactured metal. Service-intensive sectors are: leather and shoes; food, drink and tobacco; transport equipment; machinery not elsewhere classified (NEC); manufactured goods, NEC; recycling; textiles and textile products; electronic and optical equipment.

Graph 6.7

Service sector participation in exported domestic value added of goods, 2014



Note: The category of business and financial services includes the following: Finance (financial intermediation, except for financing of insurance and pension plans; and financial intermediation auxiliary activities) and other business and technology services (real estate activities; machinery and equipment rentals; computer services and related activities; research and development; and other business activities). Said activities correspond to categories 65, 67, and 70-74 of the International Standard Industrial Classification (ISIC Rev. 3). All other service activities are included in the Other Services category.

Source: Authors based on data from Export of Value Added Databases (World Integrated Trade Solutions, 2021).

In summary, services play an important role in the manufacture and export of goods and, in particular, can help add value to a country's exports. At the same time, they can play a key role in an economy's integration in regional and extra-regional value chains, while also allowing this greater integration to spill over to improved productivity in the domestic economy.

Policies to promote productive integration

As discussed throughout this chapter, productive integration means intensified trade relations between countries and, consequently, depends greatly on their trade costs. Therefore, all the cost-cutting policies discussed in previous chapters aimed at tariffs, trade facilitation, regulatory harmonization, improved infrastructure, greater competition in logistics and transport, among others, will have a positive impact on greater integration. As an example of the role such measures can play, Box 6.3 uses a case study to analyze the importance of technical requirements in the international integration of export companies in two sectors in Argentina.

Box 6.3
The importance of technical requirements in international integration of export companies

Trade in goods is subject to numerous requirements imposed by governments and businesses, mainly in developed countries. These requirements pose a threat for developing countries, because they may be difficult or costly to implement, particularly for small companies with limited production capacity and less sophisticated technology. This could interfere with these businesses' global insertion, as well as intra-regional trade between countries. Such requirements can also be used at governments' discretion as non-tariff trade barriers.

In a recent study, González et al. (2021) look at the prevalence and impact of technical requirements on global integration and intra-regional trade in Latin American countries in their evaluation of two specific sectors in Argentina: blueberries and agricultural equipment. Both cases have numerous technical, public, and private requirements that companies must meet to trade their products in developed countries, while the prevalence and rigor of these same requirements in the countries of the region tend to be less stringent.

They found that technical requirements do not pose major obstacles to international integration. Companies usually have the technical knowledge, infrastructure, or strategies they need to meet them. Nor did they find discretionary application of the requirements operating as non-tariff barriers.

Nevertheless, they identify a framework of action for public policy with efforts aimed at facilitating compliance with the requirements and thereby encouraging global integration and intraregional trade. These actions include: facilitating access to information about requirements and other bureaucratic procedures; providing quality infrastructure for testing; and fostering research to develop new methods of production. Finally, they prioritize the construction and continuity of spaces for public-private interaction with sectoral scope to monitor the evolution of technical requirements in export markets and facilitate compliance by companies in the sector.

Source: Authors based on González et. al (2021).

However, there are policies not yet discussed in this report that are especially relevant for participation in regional and global value chains and production integration in general. This section will explore four of these: rules of origin, foreign direct investment, special import regimes, and policies associated with trade in services.

The role of rules of origin

Inadequate rules of origin can lead to hidden protectionism and inefficiency in the assignment of resources.

Preferential tariff treatment is defined as reductions in import tariffs that countries grant to certain trade sectors either unilaterally (e.g., in the United States' generalized preferential system), or as part of bilateral or plurilateral trade agreements. A key aspect for the implementation of these preferences is to determine what conditions must be met by the goods a country with preferential status produces to be eligible for tariff reduction. As will be shown later, a basic requirement is for the good to have undergone substantial transformation in the partner country or contain a minimum of national content. As such, the main objective of rules of origin is to discourage triangular trade, i.e., to prevent merchandise from third-party countries from benefiting from preferential tariffs between two partners. The countries also establish unilaterally—or within the framework of the WTO—non-preferential rules of origin to determine the provenance of a product in order to establish health and trade defense measures or other trade policy instruments.

Due to the major importance that rules of origin acquired at the Uruguay Round, the WTO promoted an agreement to harmonize these rules so as not to create barriers or unnecessary trade costs. This agreement established that rules of origin must be «transparent, applied in a coherent, consistent, impartial and reasonable manner, and be based on positive criteria» (WTO, 1994, p. 209). Two seminal works on this matter—Krueger (1993) and Krishna and Krueger (1995)—show that rules of origins can turn into protectionist policies and lead to inefficiencies in the assignment of resources.

How is product origin determined?

Three criteria can be used to determine country of origin: i) wholly obtained products; ii) products made exclusively of originating materials; and iii) substantial or sufficient transformation. Wholly obtained products are those found in nature, such as live animals, plants, or minerals extracted in a country. Also falling under this classification are waste and waste products from manufacturing or consumption. In the second case, the product must be fabricated completely in the territory of the countries part of the agreement and be made exclusively of originating materials from those countries.[26]

26. For example, between 2015 and 2017, these two criteria represented 45% and 67% of Uruguayan exports to Mercosur and the rest of South America, respectively (Lalanne, 2020).

Substantial transformation is established based on distinct criteria. The most common is tariff classification, meaning origin is conferred if the good is classified in a chapter, section, or subsection (depending on the norm) that is different from the inputs used for its production. The second possible criterion is value added, which considers that a good is substantially transformed if the value of the exported good exceeds by a certain level the import value of the inputs. Finally, according to the criteria of production or elaboration, regardless of the tariff classification, the good has been the object of specific production processes in its elaboration (e.g., Mercosur's rule of origin for numerous computer goods, which imposes strict regulations on production processes that must take place on the inputs).[27]

Rules of origin and their role in production

The rules of origin can turn into a key determinant of GVC integration because they stipulate the regulatory terms of the relationship that must exist between inputs and outputs in international trade governed by trade agreements. Very strict rules of origin can discourage productive integration under a trade agreement if they require major national transformation and do not allow inputs sourced from other partners under the agreement to be counted as domestic production (see the subsection on accumulation below). These regulations can also cause trade deviation in favor of the countries that belong to an FTA, since exporters may have incentive to replace inputs sourced from third countries with others originating from partners if the rules of origin require very high domestic added value. In other words, they could drive up the cost of inputs for export firms if they have to replace inputs from countries outside the agreement for other ones more expensive inside the agreement, or diminish the benefits of exportation if using inputs from countries outside the agreement means they lose the tariff benefit conferred under the FTA.

On this point, Conconi et al. (2018) analyze the effect of rules of origin on the use of imported inputs on Mexico when it entered NAFTA. The preexisting rules for Canada and the U.S. were then applied to Mexico. The authors found that the use of imported inputs from non-NAFTA countries would have been 45% higher if rules of origin had not existed. Therefore, rules of origin can exacerbate the rerouting of trade originating under the FTA by also rerouting the importation of inputs.

Rules of origin are likewise a determining factor for productive integration in Latin America. While countries in the region have made substantial progress in their trade integration policies, there is still a huge labyrinth of rules of origin that complicate integration and inputs trade in the region. Considering that most bilateral economic relations in the region are regulated by rules of origin defined bilaterally, the possibilities for generating value chains where

27. FTAs usually add some «negative» components to these «positive» criteria to confer origin that would not confer origin on their own. These are referred to as «insufficient processes.»

inputs circulate between more than two countries are limited to those that belong to the same agreement.

The accumulation of rules of origin

Criteria for accumulation of origin must not be too strict if the objective is to strengthen productive integration in the region.

Agreements on rules of origin in general allow accumulation among parties, whereby all the originating inputs from any country party to the agreement can be used by another as if they were national products. In other words, the substantial transformation referred to above is applied only to products from countries outside of the agreement. However, there is also what is known as diagonal accumulation, meaning that products from third-party countries with whom both partners have agreements are accepted as originating products, something that is far from being the rule in the region.

As Mesquita Moreira (2018) showed, there are several ways to establish diagonal cumulation rules. The resulting trade flow is radically different, depending on the type of rule established. For example, a strict diagonal cumulation rule can be set. This establishes the possibility of accumulation in a set of products in which countries have exactly the same rule of origin, are fully liberalized, and have no trade defense measures. In contrast, a principle of general accumulation could be established to buy intermediate goods from countries with agreements, allowing for criteria-revision procedures when triangulation is likely being encouraged. The rules of accumulation can also be restrictive in content, i.e., whether they encompass materials, processes, or both. Felbermayr et al. (2019) showed that only 14% of bilateral relations have margin to use rules of origin to triangulate. Considering that diagonal accumulation involves two production processes, the margin for triangulation is much less than this value, therefore, if boosting production fragmentation in the region is truly the goal, criteria that are not too strict should be established.

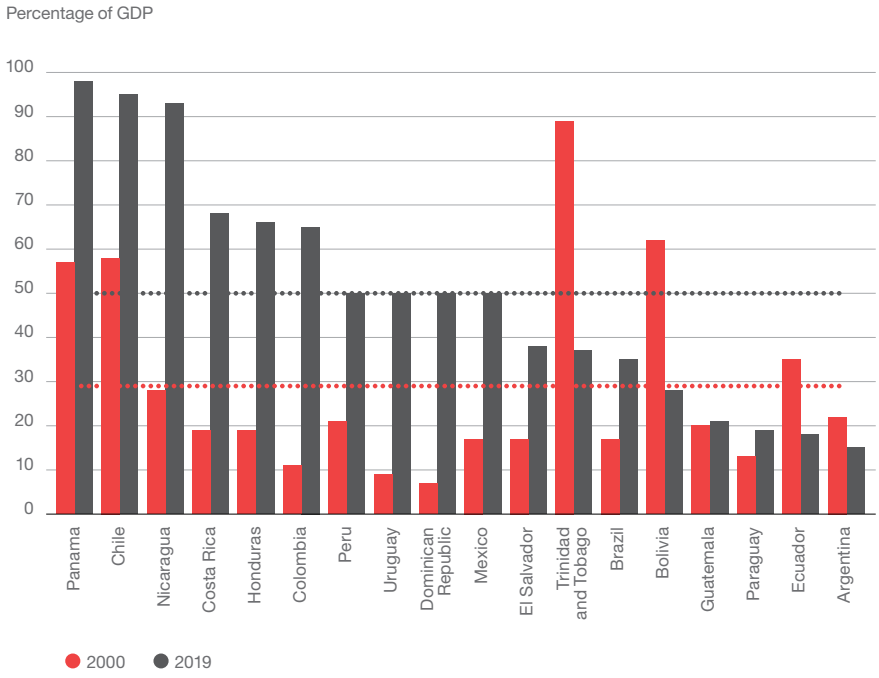
The role of foreign direct investment in productive integration

As mentioned in previous sections, integration processes also involve foreign business activity in the domestic economy. The decision to relocate production can have different motives. Relocation related to GVC participation is generally vertical, meaning a multinational seeks to take advantage of lower costs or availability of certain inputs, leading it to open an affiliate where it can do so.

An analysis of FDI stock in the region shows that it has been uneven, as shown in Graph 6.8. On average, Latin America increased the amount of accumulated FDI in relation to GDP since 1980, particularly since the late 1990s, and went from values of nearly 29% of GDP in 2000 to around 50% in 2019. This trend can be observed in the majority of countries in the region, with the exceptions of Argentina, Bolivia, Ecuador, and Trinidad and Tobago, which showed an increase until the early 2000s, but then flipped most of it. By 2019 these countries presented values below the regional average for

that year and compared to their levels in 2000. In addition, countries like Chile and Panama already had high levels in 2000 and continued to attract foreign investment, thus significantly increasing their stock of FDI by 2019. Another group of countries—Costa Rica, the Dominican Republic, Honduras, Nicaragua, and Uruguay—did not stand out for particularly high levels of FDI in 2000, however, they managed to increase their stock significantly in the last two decades. Finally, countries like Guatemala and Paraguay presented low values and barely increased them in the period studied.

Graph 6.8
Evolution of FDI stock in relation to GDP in Latin America



Notes: Horizontal dotted lines indicate simple average for Latin American countries (included on the graph) for the years 2000 and 2019.

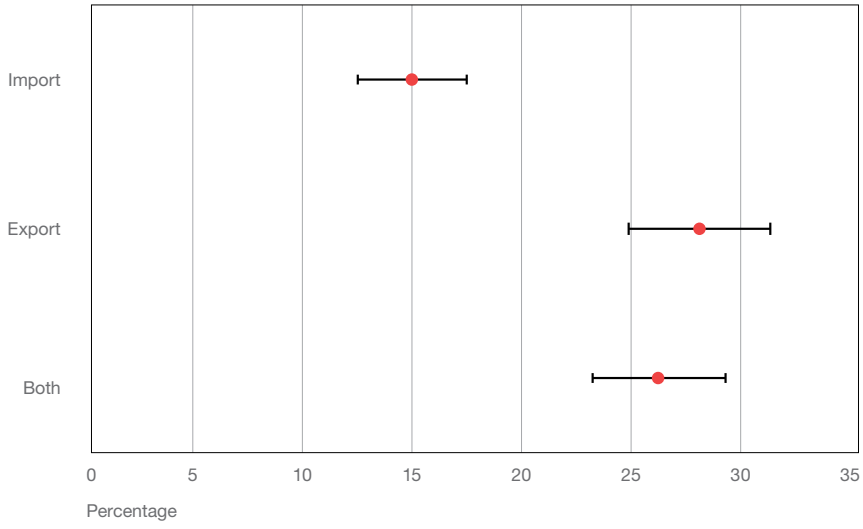
Source: Authors based on data from UNCTAD (2021b).

Interest in attracting FDI is rooted in the potential benefits for growth and development that it can bring. To assess the impact of FDI on firms' international business activity, a comparison is made between the probability of a firm exporting and importing depending on whether it is of foreign ownership or not, using the World Bank's Enterprise Surveys and controlling for a set of variables to make the comparison as precise as possible. Graph 6.9 shows the results of this exercise. In general, a positive difference is found for firms with foreign ownership, both in terms of their probability of importing inputs and of exporting goods and participating in both activities. This would indicate that, if the company is foreign, it is more likely to be

Firms with foreign ownership are more likely to export, import, and engage in both operations simultaneously.

involved in international trade activities and integrated in value chains, even companies operating in the same sector and country with similar capital employed and labor productivity. Therefore, the attraction of foreign companies can be a good instrument for attaining higher levels of trade and production integration.

Graph 6.9
Probability of importing/exporting in Latin American companies with foreign and domestic capital



Notes: The graph shows the average differences between manufacturing companies with foreign and domestic capital for three variables: probability of importing, probability of exporting, and probability of both. Positive values indicate that probabilities are higher for companies with foreign capital. Confidence intervals are at 95%. All available years for Latin America were used (2006-2017). For details on countries and years, as well as methodology, see the Appendix (p. 304).

Source: Authors based on data from Enterprise Surveys (World Bank, 2020d).

Foreign direct investment also impacts growth and development through other channels. First, localization of foreign firms creates opportunities for local businesses to integrate with the production process (Alfaro-Ureña et al., 2019). It can also generate gains in productivity through the reassignment of resources and greater competition. These firms will demand certain conditions in the local economy that will lead to a reassignment of resources from less productive companies to more productive ones, generating a better selection of companies and increasing productivity (Alfaro and Chen, 2018). Furthermore, if the foreign company is a producer of inputs, this can drive competition in these markets, increasing the variety and potentially the quality of available inputs for domestic firms. In a study in Chile, Fernandes and Paunov (2012) found that foreign firms that provide services tended to be more productive than domestic ones, resulting in lower costs and greater productivity in the domestic manufacturing companies that used

these services as inputs. Moreover, this effect was stronger for companies farther away from the technology frontier, and for companies that produce differentiated goods or goods requiring intense research and development, than for leading companies.

Foreign investment can also generate spillover effects on other local businesses, either as buyers or suppliers of related inputs. These effects can promote development in certain sectors, repeatedly transferring specific knowledge related to input or final output, in the case of suppliers. Alfaro-Ureña et al. (2019), in their study on Costa Rica, found that national supplier firms for multinational companies increased their sales, jobs, and net assets. In addition, after a few years, these domestic firms became suppliers for other multinationals. The reasons reported by these companies include improvements in organizational practices, expansion of product scope, and improvements in quality and reputation. Along the same lines, Javorcik (2004) found that increased FDI in backward sectors increased productivity in the domestic sectors supplying inputs to them.

Determinants of foreign direct investment

As with any investment, FDI benefits from stable economic and political environments with legal systems that protect it and allow the earnings obtained to materialize. Not surprisingly, countries that manage to stabilize their macroeconomy and provide a favorable business environment will attract more investment than countries with a different political and economic outlook. Levels of openness that facilitate trade, allowing countries to import the necessary inputs and export production, play an important role in these investment decisions. Equally important are the services provided over existing infrastructure, which make it possible to produce and transport goods easily without the need to incur large logistic or storage costs.

The determinants of FDI are a stable economic and political environment, an efficient legal system, trade openness, quality logistics and infrastructure, and adequate human capital.

Another factor determining the localization of firms and how much an economy can benefit from FDI is the level of human capital. Borensztein et al. (1998) found that FDI can be an important mechanism for technology transfer and growth, as long as the receiving country has a minimum level of human capital.

Continuing with the factors that allow domestic firms to take advantage of FDI flows in the country, Alfaro et al. (2004) found that the development of the financial market plays a fundamental role for greater FDI flows to translate into larger growth. In this sense, Bilir et al. (2019) found that, if the financial markets in the FDI-recipient country are not developed, multinationals taking out loans from local banks can crowd out domestic firms from the local credit market.

As described earlier, part of the benefits of FDI comes from the spillover effects, which could be a reason to subsidize this type of activity. However, as pointed out, foreign investment also affects the allocation of resources and produces efficiency gains that are unrelated to knowledge spillovers. This suggests that policies intended to promote FDI or attract foreign firms

to localize should rather be focused on improving the business environment in that country. As noted in Alfaro (2017), that improvement can be achieved by promoting competition in the domestic markets, developing the financial markets so that domestic firms can benefit from the localization of foreign ones, providing flexibility and retraining workers, and offering legal security. Other relevant initiatives include the planning and fostering of supplier-development programs for domestic companies to become suppliers for multinationals and, finally, taking an open position on allowing access to the required inputs for both local and international businesses. (Javorcik et al., 2015).

Special regimes to promote imports for exporting

Most Latin American countries have special regimes that allow inputs to be imported tax-free on the condition that they are used in the production of goods to export. These regimes are widely used in all the Mercosur countries and, albeit somewhat less so, in the Pacific Alliance. Exporting from customs areas or with special systems are key features of export strategy in Central America and Mexico.

Using the information related to these regimes, the degree of backward integration of the companies using these mechanisms can be analyzed. The so-called drawback in Brazil, temporary imports, and Argentina's in-factory customs regime regularly involve between one-fifth and one-fourth of exports, while Uruguay's Temporary Admission Regime reaches a third of foreign sales. These values are much higher when analyzing regional exports, which tend to be more integrated into value chains than global exports.[28]

This section analyzes information on backward integration of exports from Argentina and Uruguay under both countries' temporary import regimes and Argentina's in-factory customs regime.[29] Using the terminology adopted by Baldwin and López- González (2015), this information is referred to as import to export data.

28. It is important to remember that, while the Mercosur foundational agreements prohibited the use of these instruments in internal trade, an exception to this policy was established while the customs merger was being fine-tuned. However, because various aspects of the common trade policy were not enacted, the countries have continued to use these instruments.

29. The analyses for Argentina were possible thanks to data processing by the Center for Production Studies, Ministry of Production, and for Uruguay, thanks to the integrated data in the sectoral FSDA_1_2018_1_154835 research fund.

The ties between exports and imports were analyzed at the firm and year level for Argentina, and by customs transaction for Uruguay, which provided more detailed information.[30,31]

Table 6.1 shows the estimated percentage of imported inputs contained in total exports for sectors where use of these regimes is high. The data show that, even in countries where backward integration in value chains is not prevalent, there is a significant set of sectors that make heavy use of imported inputs in their exports and the application of these regimes is key in their operations. The trade facilitation and infrastructure policies reviewed in other chapters are essential for these firms heavily integrated into value chains. Moreover, these companies operate in very competitive environments, where any additional supply or export cost may not be compensated by any other factor.

Table 6.1
Percentage of imported inputs in exported value in sectors with high use of special import regimes in Argentina and Uruguay, 2014-2016

Argentina		Uruguay	
Sector	**Percentage**	**Sector**	**Percentage**
Chocolate	37	Rubber and plastics	60
Polyester	63	Automobiles	66
Plastic containers and sheets	36	Leather	31
Rubber and rubber products	26	Oil mixtures	59
Leather	8	Fertilizers	72
Paper and cardboard, coated or printed	28	Detergents	68
Synthetic fibers	46	Steel tubes	65
Steel products	21	Paint	38
Aluminum products	31		
Motors	45		
Automobiles	43		

Notes: Sectors are classified using the World Customs Organization harmonized system (HS). Argentina uses sections 1806, 3907, 3908, 3919, 3920, 3921, 4811, 8407, 8408, 8409, 8410, 8701, 8702, 8703 and 8704, and chapters 40, 41, 54, 73, 76. Uruguay uses chapters 15, 32, 34, 38, 39, 41, 73 and 87.

Source: Authors based on data from the Center for Production Studies (Argentine Ministry of Production, 2019) and the National Customs Office, Uruguayan Ministry of Economy and Finance.

30. In both countries, the companies that use these regimes import inputs under a special regime and then, when they export, indicate what import transactions are affected by these exports according to an input-output ratio approved by the regulatory agency.

31. Since not all companies (nor all operations in a company) use these regimes, sectors that make more generalized use of these instruments were chosen to illustrate the potential impact of this source.

Detailed information on imported and exported products, destinations, and origins can help to describe countries' participation in value chains in a way that goes beyond the typical assumptions of homogeneity used to build input-output tables (De Gortari, 2019). Furthermore, it can more accurately detail the idiosyncrasies of the links between companies from different countries based on trade in value chains. In this sense, it would be desirable to have regional input-output tables that take into account the duality between companies that are more integrated into international trade and those with more emphasis on the domestic economy (Koopman et al., 2012). This would require better compatibility between I2E information and input-out tables.

Policies related to trade in services

In recent decades, especially with the technology advances that have facilitated telecommunications and the possibility of working in real time from different points on the planet, there has been an increase in trade in the service sector, traditionally considered not tradable. As explained in previous sections, the service sector can contribute significantly to the value added of different goods and, therefore, be a key factor in the possibility of developing regional and global production chains. For this to happen, it is essential that policies promote trade in services to achieve greater production integration.

As discussed in Chapter 3 of this report, economic regulation is extremely important when it comes to service sector trade analysis, because it generates the framework of rules for economic activity to take place. Therefore, convergence of regulations promotes trade in services for the firms that produce and others that use services in their production or as final consumers thanks to the simplification of the regulatory framework that each country must meet. This section discusses the level of trade restriction on services in general—using the OECD's STRI index[32]—in addition to relevant aspects for sectors not covered in this chapter.

Latin America imposes greater restrictions on service trade than the OECD. Mexico and Brazil are the economies with the highest level of restrictions, while Chile has the least.

The aggregate level of restrictions for all sectors shows that the average for the region (0.28) is higher than the OECD average (0.25), indicating more restrictions on trade in services in general. The biggest differences in terms of restrictions are in the dimensions of entry of foreign businesses and regulatory transparency. In the region, Brazil and Mexico, with values of 0.34 and 0.46, are the economies with the highest level of restrictions, while Chile (0.20) is the country with the lowest.

Our analysis of the level of restrictions by sector shows that Latin America has lower restrictions than the OECD in sectors related to professional services, such as accounting, engineering, architecture, or legal; however, it has heavier restrictions in some key sectors for productive development, such as telecommunications and financial services, considering both commercial

32. Chapter 3 explains in more detail the five types of regulatory restrictions affecting trade according to the classification created by the OECD and where Latin America falls in this classification.

banking and the insurance sector. Again, the restriction on allowing entry to foreign firms and the lack of regulatory transparency are the dimensions that explain why the region lags in these sectors.

In summary, the countries of Latin America show, in general, higher levels of restrictions on trade in services than the OECD average. Specifically, the most significant restrictions are those related to allowing entry to foreign firms and regulatory transparency. While these restrictions apply to various activities, they are particularly salient in the telecommunications and financial sectors. Therefore, these countries should advance in policies that contribute to increased regulatory transparency and the presence of foreign firms, thus reducing the existing restrictions on trade in services and promoting trade in the sectors that are so important for productive integration and economic development in these countries.

Keys to achieving greater productive integration in Latin America

1. The process of production fragmentation that fostered trade in inputs was a major driver of growth in global trade in recent decades.

2. Participation in global value chains (GVC) is largely determined by regional inputs trade, i.e., by participation in regional value chains (RVC).

3. Except for Mexico, the countries of the region did not show dynamism in their integration in RVC, concentrating their participation in extra-regional chains (EVC). Mexico's dynamism was driven by its participation in NAFTA, which promoted its regional integration with Canada and the United States.

4. Latin American countries, in general, have a backward-biased participation in extra-regional value chains, meaning they are finalizers of production processes in these chains. However, countries like Bolivia, Chile, Ecuador, and Venezuela have more prevalent forward participation based on their mineral exports (energy and non-energy).

5. The limited fragmentation of production in the region means less specialization. In comparison to Europe, where domestic production stages are shorter and international stages longer, Latin America does not show such a clear pattern.

6. The countries of South America participate in value chains mainly as suppliers of primary intermediate and final goods and generic processed intermediate goods, while Central American countries, from their backward integration in value chains, have a high participation in processed final goods and primary final goods.

7. Policy can play a fundamental role in promoting productive integration. On one hand, traditional trade policy and transport infrastructure that diminishes trade costs are highly relevant when analyzing processes that involve crossing country borders numerous times. On the other, rules of origin that facilitate the accumulation of production processes in various countries, policies that allow imported inputs for export—improving the production environment, attracting foreign investment, and promoting regulatory transparency—can increase the benefits of production fragmentation and consequently promote productive integration in the region.

8. Attracting foreign direct investment can be a tool for increasing participation in GVC since these companies show a higher probability of participation in foreign trade activities. These companies can also interact with domestic firms as buyers or suppliers of inputs for production, which can generate spillover effects and ultimately lead to aggregate productivity gains. To attract such investment does not require specific sector subsidies but rather improvements to the business environment.

Appendix

Graph 6.1 Clarifications

The following countries and territories are considered based on GTAP 10 data for 2014:

Latin America: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, Venezuela.

OECD: Germany, Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxemburg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

Asean+3: Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Philippines, Singapore, South Korea, Thailand, Vietnam.

EU+EFTA: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxemburg, Norway, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.

Graph 6.2, Graph 6.3, and Graph 6.4 Clarifications

The following countries and territories are considered using information from the Full Eora database (https://www.worldmrio.com/eora/), with the exception of those outside of Latin America with a VAB lower than 0.05% of world VAB for the entire period.

Mercosur: Argentina, Brazil, Paraguay, Uruguay.

Central America and Dominican Republic: Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, Panama.

Pacific Alliance: Chile, Colombia, Ecuador, Peru. North America: Canada, United States, Mexico.

EU+EFTA: Germany, Austria, Belgium, Bulgaria, Croatia, Denmark, Slovakia, Slovenia, Slovakia, Finland, France, Greece, Hungary, Ireland, Italy, Luxemburg, Norway, Netherlands, Poland, Portugal, United Kingdom, Czech Republic, Romania, Sweden, Switzerland.

Asean+3: Burma, China (including Hong Kong and Taiwan), South Korea, Philippines, Indonesia, Japan, Malaysia, Singapore, Thailand, Vietnam.

Graph 6.6 Clarifications

The countries included in the analysis are listed below:

Table A 6.1
ISO3 code reference for countries included in the analysis

Country	ISO3 Code	Country	ISO3 Code
Italy	ITA	Nicaragua	NIC
France	FRA	Dominican Republic	DOM
Netherlands	NLD	El Salvador	SLV
United Kingdom	GBR	Guatemala	GTM
Hungary	HUN	Argentina	ARG
Switzerland	CHE	Uruguay	URY
Sweden	SWE	Ecuador	ECU
Czech Republic	CZE	Costa Rica	CRI
Croatia	HRV	Chile	CHL
Ireland	IRL	Brazil	BRA
Turkey	TUR	Peru	PER
Romania	ROU	Mexico	MEX
Poland	POL	Venezuela	VEN
Slovakia	SVK	Bolivia	BOL
Spain	ESP	Panama	PAN
Germany	DEU	Paraguay	PRY
Colombia	COL	Honduras	HND

Source: Authors.

Graph 6.9 Clarifications

The following Latin American countries are considered using data from the World Bank Enterprise Surveys database: Argentina (2006, 2010, and 2017), Bolivia (2006, 2010, and 2017), Brazil (2009), Chile (2006 and 2010), Colombia (2006, 2010 and 2017), Costa Rica (2010), Ecuador (2006, 2010, and 2017), El Salvador (2006, 2010, and 2016), Guatemala (2006, 2010 and 2017), Honduras (2006, 2010, and 2016), Mexico (2006 and 2010),Nicaragua (2006, 2010, and 2016), Panama (2006 and 2010), Perú (2006, 2010, and 2017), Paraguay (2006, 2010, and 2017), Dominican Republic (2010 and 2016), Uruguay (2006, 2010, and 2017) and Venezuela (2010).

In terms of the variables used, firms are defined as follows: with foreign capital, when foreign participation is greater than 10% of total capital; otherwise it is defined as a firm with domestic capital; importer, when using imported inputs; exporter, when exporting more than 10% of total sales; importer/exporter, when both occur simultaneously.

Differences are estimated using ordinary least squares (OLS), controlling for the following individual company characteristics: sector, country, year, capital (defined as the replacement cost of machinery), and total productivity of factors.

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Over the last 30 years, most Latin American countries have unilaterally and multilaterally implemented trade liberalization policies within regional and extra-regional trade agreements, resulting in a reduction of tariff and non-tariff barriers. The results were somewhat disappointing. Trade and investment raised modestly, not matching the expectations of more substantial gains on growth and welfare. One reason for this is that trade liberalization did not generate high and sustained increases in intraregional trade.

This report explores the hypothesis that the low participation of Latin America firms in international trade flows is partly due to the limited use of regional trade as part of a strategy of global export expansion. This hypothesis focuses on the feedback between regional and global openness, or what has been called «open regionalism.» To achieve greater regional and global integration, the report proposes initiatives in three specific areas: trade facilitation, physical infrastructure, and productive integration.

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