Intra and Extra-Regional Trade Costs: A Comparative Approach to Latin American Performance

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Abstract

The world expansion of trade in manufactured goods has been more dynamic than production over the last 25 years. The greater trade openness was due more to the growth of extra-regional trade than to intra-regional trade. Regions and trade agreements performed heterogeneously. The estimation of a structural gravity model specifies how different mechanisms of trade liberalization complemented each other, through the reduction of Most Favored Nation tariffs, the expansion and deepening of existing plurilateral agreements, and the incorporation of new deeper agreements. The contribution derived from the reduction of MFN tariffs stands out, followed in importance by the component of preference for openness and trade facilitation. The contribution of the preferential channel via preferential trade agreements has been more important for extra-regional than intra-regional trade. For Latin America, heterogeneity is the fundamental characteristic, the protectionism of Argentina and Brazil, to a better openness performance of the countries of Central America and the Caribbean, and the members of the CAN with an intermediate behavior. Mexico, Colombia, Chile, and Peru, economies from different regions, are the most open in Latin America. The concept of open regionalism is highlighted: without non-discriminatory trade openness, there is no regionalism that can significantly reduce trade costs.

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1. Introduction

Trade tends to expand between economies that are geographically close, and it is therefore natural that integration initiatives should first follow a regional pattern. Initiatives include the preferential reduction of tariffs between member countries, but also other disciplines and policies that reduce trade costs, such as elimination of non-tariff or "technical" barriers, trade facilitation measures (e.g. simplification of customs and border procedures), investments in physical infrastructure to leverage the advantages of proximity, regulatory harmonization on trade in services, and public procurement, among other.

In this manner, geography shapes the existence of "natural blocks" where different integration measures reinforce each other, favoring trade and productive integration, partially offsetting the possible costs of trade diversion that tariff preferences could imply.[1] This is why the boom in trade and globalization during the last 30 years has been in part driven by regionalization. At the same time, the opening up to trade has led to an intensification of extra-regional trade, both within and outside preferential relations.

We describe how trade is regionalized for the world economy, with special attention to the case of Latin America (LA) and the regions within it. The case is of interest given its comparative poor performance and the high heterogeneity among regions and countries. The regionalization of trade is present in the new waves of specialization.[2] We first characterize trade dynamics using indicators of openness and geographical orientation. CEPII's BACI database is used, which

[1] The literature on natural blocs is extensive both theoretically and empirically. Seminal works by Krugman (1989, 1991) develop the basic mechanisms of openness and protection associated with preferential agreements at the regional level. An early contribution to the empirical literature was the book by Frankel (1997), where a test of both hypotheses is specified. The central point that differentiates the results in terms of welfare is the relative magnitude of regional trade costs *vis-à-vis* extra-regional ones.

[2] This includes the emergence of Global Value Chains (GVCs), which, as illustrated by Johnson & Noguera (2012), manifests more intensely in intra-regional trade. In the case of LA, not only is intra-regional trade very small, but GVC trade is negligible (Allub & Lalanne, 2021).

provides bilateral international trade flows for the period 1995-2016 (Gaulier & Zignago, 2010), and comparable information on domestic trade is added from other sources (Moncarz et al., 2021).

The evolution of trade costs is studied using a structural gravity model (SGM) for bilateral trade, applying recent innovations in estimation methods (Yotov et al., 2017; Larch et al., 2019; Yotov, 2021). Following Baier et al. (2019) the effect of preferential trade agreements (PTAs) on trade is assumed to be heterogeneous, establishing a novel mechanism associated with the accumulation of bilateral relationships that are liberalized by PTAs of the exporting and importing countries. In this regard, an important contribution is to incorporate alternative mechanisms of trade policy influence. Both the evolution of Most Favored Nation (MFN) trade policy and preferential trade agreements are considered, making use of new databases.[3]

Our results provide an innovative description of the way in which trade costs evolved in the last decades. The analysis considers the size of the economies, their multilateral location (resistances), and trade costs (both non-discriminatory and preferential). To assess the relative magnitude of their contributions, we apply a methodology that allows breaking down different effects in a multiplicative model like the SGM.

The descriptive analysis shows that between 1995 and 2016 the world has experienced an increase in the importance of international trade, which was channeled to a greater extent through an increase in extra-regional trade. We find that the channels of preferential and non-discriminatory liberalization worked together to explain the increase of trade in manufactures, although heterogeneity among regions and trade agreements is important. South America's poorer performance stands out clearly, especially due to the behavior of its two main economies, Brazil and Argentina, while the contribution of trade policy has

[3]For applied tariffs we use data from Teti (2020), to whom we are especially grateful. Information on preferential trade agreements comes from Gurevich & Herman (2018), which was enhanced with data from the Latin American Integration Association (LAIA).

been more important in Chile, Colombia and Peru. For Central America and the Caribbean countries and Mexico trade liberalization policies show a greater contribution.

The paper is organized in four sections after this introduction. The next section presents a general description of the data at the regional level. The third section, uses the SGM to estimate the different components of trade costs, associating them with trade policy variables. A fourth section breaks down the effects of each component on international trade. The last section concludes.

2. Openness performance and the orientation of trade

This section presents selected stylized facts describing differences across regions and countries in their openness performance, both as exporters and importers, as well as on the regional orientation of their trade relations.

This description is based on a new database of manufacturing production, expenditure and bilateral trade among 112 countries, grouped into 9 regions, over the period 1995-2016.[4] The sample of countries represents more than 94% of world trade in this sector.[5]

Each transaction is classified according to its origin and destination. Domestic trade occurs when the country of origin is also the destination country, and the rest is international trade. The latter is divided into "intra-regional trade" when the two different countries belong to the same geographical region, and the rest is "extra-regional trade".

[4] Manufactures are defined as Sector D of the International Standard Industrial Classification (revision 3). Further details on the data are given in Online Appendix A.

[5] The list of countries, their regions, and trade coverage rates are reported in Online Appendix B.

2.1. Comparing world's regions

The world increased its manufacturing production at a cumulative annual rate of 4.8% in the period 1995-2016 (see Table 1) with a dynamic characterized by trade openness. While international trade grew at a rate of 5.5%, domestic trade grew at 4.7%. Manufacturing expanded led by international trade. The rate of openness to trade increased by about 3 percentage points (pp), from 21% in 1995 to 24% in 2016.

[Table 1 about here.]

In global terms, there was a contraction in regional integration and, therefore, an increase in the extra-regionalization of trade. The degree of intra-regional integration in manufacturing fell by almost 7pp worldwide (see Table 2). Although the process has not been homogeneous among the different regions, while Southeast and East Asia (SEEA) regionalized trade, the opposite occurred in Europe (EUR).

[Table 2 about here.]

2.2. Regional openness

World manufacturing production exhibits a high degree of concentration. In the year 2016, 52.6% of world manufacturing production came from SEEA, 18.6% from EUR and 15.3% from North America (NAM). Openness to international trade is heterogeneous among regions (see Figure 1). EUR is the region with the lowest proportion of internal trade (52%), while SEEA, South America (SAM), and the region made up by Central Asia, Eurasia and South Asia (CSEA) are the three regions with the highest ratio (84%, 83%, and 83% respectively). In EUR the higher rate of openness to trade is related to the higher degree of regional economic integration.

[Figure 1 about here.]

In 2016 SAM accounted for 3.3% of production and 3.5% of consumption of world manufacturing products. Table 1 shows that the region's production grew by 4.2%, below the world's growth level (4.8%). Both domestic trade (4.1%) and international trade (5.1%) were less dynamic than the world average (4.7% and 5.5%, respectively). Table 2 shows that regional trade integration decreased by 5pp, meaning that trade expansion was towards the rest of the world. Trade openness is low, 17%, while the world average is 24%, and its expansion is among the lowest in the world. Thus, SAM is one of the regions with the most closed, poorly integrated and less dynamic economies.

CAC represents a marginal proportion of world production (0.3%). Nevertheless, it showed significant dynamism in production throughout the period, with growth in domestic trade (4.9%), but especially in exports (6.8%) compared to the world average (4.7% and 5.5%, respectively). CAC is one of the most open regions in the world. It increased its production openness by 5.4pp, from 22% in 1995 to 29% in 2016. The regional orientation of exports increased by 9.8pp, and the regional integration indicator did so by 7.9pp, in both cases the most significant advances worldwide.

NAM includes only three countries, Canada, the United States, and Mexico, but accounts for 5.3% of world production and 16.7% of spending. NAM has lower growth rates than the world average in production, consumption, exports and domestic trade. It only shows greater dynamism in relation to the world average in the case of imports. However, openness of production and spending increases, and the regional orientation of exports increases by 6.2pp. Contrarily, imports oriented to the region decreased by 3.8pp, making the regional integration indicator to stagnate (growing only by 0.2pp). For NAM, the opening to regional exports stands out, increasing in 13.9pp. The region is characterized as an engine of global spending due to its dynamism in extra-regional imports and the strong regional orientation of its exports.

2.3. Intra and extra-regional trade

Total manufactured exports amounted in 2016 to 10.712 billion USD, distributed evenly between intra-regional and extra-regional trade. Three hub regions accounted for almost 90% of global exports: EUR (38%), SEEA (35%), and NAM (16%).

As shown in Figure 2, the two regions with the highest proportion of intra-regional exports are EUR with 67% and NAM with 50%. The total world intra-regional trade in manufactures during 2016 is almost exclusively explained by trade within the three main hubs (97%), where the EUR countries account for 51pp, SEEA countries for 30, and NAM countries for 16.

[Figure 2 about here.]

As for extra-regional trade, most of it is also among the EUR, NAM and SEEA regions. The main exporting region to the rest of the world is SEEA, with 39,9% of total extra-regional trade. NAM and EUR are the main world buyers (27.6% and 25.5%), especially of exports from SEEA (15.7% and 12.2% respectively).

Figure 3 shows the relationship between trade openness and regional orientation for regions as exporters (panel a) and as importers (panel b), focusing at the two extreme periods 1995 and 2016. Arrows show the net movement between the two years, and dotted lines mark the global average of each indicator in 2016. From the point of view of exports, the world moved towards greater globalization, characterized by openness of production and extra-regionalization of trade. The latter movement was heterogeneous across regions, extra-regionalization being intense for EUR, intermediate in the case of SAM, and very weak for SEEA; while NAM and CAC followed a strong regionalization.

[Figure 3 about here.]

The regions of interest show disparate behaviors. The performance of SAM is similar to the world average, with a reduction in regional integration and a moderate increase in openness. It is among the regions closest to the origin, being one of the lagging regions in the global context and with the lowest dynamics. CAC and NAM showed significant rise of openness in production, increasingly based on exports to regional destinations. In the case of NAM the degree of regional integration increased a bit more slowly, but from a higher starting point, second only to EUR.

Panel b of Figure 3 compares openness of consumption and regional orientation of imports. SAM and CAC have a behavior similar to that described in panel a. Meanwhile, NAM significantly increased its consumption openness, but it was based on an increase in trade with the rest of the world and led to a reduction in the regional orientation of imports.

2.4. Latin America's performance by country

The same indicators of openness and regional orientation are used now to characterize countries' performance. Brazil is the main producer of manufactures in the region (34,7%), followed by Mexico (23.7%) and Argentina (11.4%), over a total of 2,158 billion USD in 2016. Average production openness in the region is 28%, where the openness of the NAM and CAC economies stands out. Mexico has an openness of 66% and, as shown in Table 3, it experienced a notable increase during the period under analysis (32.3pp). The country's degree of regional integration in 2016 amounted to 72%, although it showed a reduction over time of 8pp. The main reason for its lower degree of integration is the decrease in imports of regional origin relative to extra-regional imports (mainly from China), since exports remained relatively constant over time. Other CAC economies, such as El Salvador, Haiti, and Nicaragua, show significant rates of openness in production and consumption, all over 30%. Their greater openness and extra-regional orientation is mainly due to the trade links with the United States, which belong to NAM.

[Table 3 about here.]

SAM countries are generally less open, although Chile, Bolivia, Peru and Uruguay stand out for their openness, all with an openness index above 20%. There are important differences among these countries: Chile, Peru and Uruguay, increased their production with a bias towards extra-regional markets (reducing their regional integration indicators), while Bolivia increased its trade with the region at a higher rate than the average for LA (6.9pp versus 2.8pp). The remaining large economies, such as Argentina, Brazil and Colombia, have the lowest openness rates in the region (less than 18%), and the meager openness was accompanied by a reduction in regional integration (Argentina by 4.1pp, Brazil by 3.4pp, and Colombia by 8.5pp). These economies, which account for 55% of LA's manufacturing production (increasing to 75% within SAM), can be categorized as closed, not very dynamic, and not very focused on the region.

Figure 4 relates trade openness and regional orientation of trade, with the area of the spheres representing the size of trade for each exporting flow (panel a) and importing flow (panel b). The average of each indicator for LA is represented by the dotted lines, and colors identify countries' regions.

[Figure 4 about here.]

LA is more integrated in terms of exports than imports. The regional orientation of exports in 2016 was 56%, while for imports it reached 36%.

Mexico is the economy with the greatest integration with its region (NAM), while the other economies diversify their destination markets, with a regional orientation of exports below 50%. For the other two regions considered, CAC economies are smaller and more open, while the large SAM economies mentioned before (Argentina, Brazil and Colombia) are less open and less intra-regionally integrated. Chile and then Uruguay are the most open economies, in the case of Chile with a greater orientation towards the rest of the world.

Regional integration in LA increased by 2.8pp between 1995 (42%) and 2016

(45%), although performance is dissimilar among the three regions considered. CAC countries account for the highest degree of regional integration, as they generally increased their trade links. Meanwhile, SAM countries show the opposite behavior (except for Bolivia), reducing their participation in the regional market.

LA is not a homogeneous region. Throughout the period analyzed, differences can be observed among its sub-regions and countries, both in the levels of the variables considered and in their dynamics. On the one hand, CAC, which is made up of small economies, has shown a strong dynamism in its external sector, with a growing weight of intra-regional trade, but this has not meant a fall in its openness to the rest of the world. At the opposite extreme is SAM, which, influenced by the weight of its larger economies, has moved in a similar direction to that of the rest of the world, but has shown less dynamism, which has led it to lag behind in terms of trade openness. However, within SAM it is possible to find some economies that showed greater dynamism, with an increase in their levels of trade openness, especially towards extra-regional markets. Finally, Mexico, whose performance is strongly influenced by its trade relationship with the United States, exhibits a significant trade openness, with an almost unchanged export orientation, while at the same time an extra-regionalization of its imports led by its imports from China.

3. Parametric analysis of trade barriers

In this section a parametric application is carried out by estimating a SGM using the most current techniques (Yotov et al., 2017; Larch et al., 2019). As specified by the various theoretical models that micro-found the gravity equation, the own market is a destination for domestic production that needs to be taken into account (Eaton & Kortum, 2002; Anderson & van Wincoop, 2003). However, domestic trade is rarely considered. As shown by Vaillant et al. (2019) the omission of these observations significantly affects the results, and an unbiased estimate of trade costs requires information on domestic trade. Unavailability of comparable data between trade statistics (in Gross Value of Production) and domestic statistics (in Value Added) leads to a frequent omission of this valuable information.[6]

3.1. The structural gravity model and trade policy

We obtain an estimate of the bilateral proximities in each period (ϕ_{ijt}) without requiring any symmetry assumption.[7] In addition, the particular geography of the countries is included in the form of multilateral resistances as sellers (Ω_{it}) and as buyers (Φ_{jt}). These resistances are aggregations of the proximities to all markets, appropriately weighted by each market's ability to sell or buy. The supply capacity of an origin (S_{it}) is obtained by dividing its total supply ($Y_{it} = \sum_j X_{ijt}$) by its total proximity as a seller to all markets (Ω_{it}). The demand capacity of a destination (M_{jt}) is obtained by dividing its total expenditure ($E_{jt} = \sum_i X_{ijt}$) by its total proximity as a buyer to all markets (Φ_{jt}).

The SGM is specified in a system of three equations for the bilateral flows and the pair of multilateral resistances:

$$X_{ijt} = \frac{S_{it} M_{jt}}{Y_t^w} \phi_{ijt} = \frac{Y_{it} E_{jt}}{Y_t^w} \frac{\phi_{ijt}}{\Omega_{it} \Phi_{jt}}, \tag{1a}$$

$$\Omega_{it} = \sum_l \frac{E_{lt}}{Y_t^w} \frac{\phi_{ilt}}{\Phi_{lt}}, \tag{1b}$$

$$\Phi_{jt} = \sum_l \frac{Y_{lt}}{Y_t^w} \frac{\phi_{ljt}}{\Omega_{lt}}. \tag{1c}$$

[6] See Yotov (2021), who summarizes the 15 reasons why internal trade should be taken into account when estimating the gravity model.

[7] The term "proximities" refers to the fact that the closer two countries are to each other, the more they will trade. Proximities are typically between zero and one, since they are measured relative to the proximity that each country has to its own market. They are an inverse function of trade costs through the effect of trade elasticity: $\phi_{ijt} = (1 + t_{ijt})$, where t_{ijt} are trade costs.

To identify the determinants of proximity (inverse trade costs), a distinction is made between permanent effects (ϕ_{ij}) and those that change over time ($\tilde{\phi}_{ij}$). The latter are fundamentally linked to countries' trade policy interventions, and the most usual way to capture them is using a discrete variable that signals the cases in which a given pair of countries has a preferential trade agreement (PTA). We define such a variable considering only the cases of deep agreements, which include Free Trade Areas (FTA), Customs Unions (CU), and Economic Unions (EU).

3.2. The preference for openness

From a political economy approach, the growing influence of the export sectors rises the incentives towards opening trade policy. Higher levels of openness, often manifested in the signing of PTAs, can also entail other complementary trade policies, such as trade facilitation, special regimes, or foreign direct investment facilitation policies, among other.[8]

We propose that one way to proxy the preference for openness is using the number of liberalized bilateral relations (NLBR) that each country has as a consequence of signed PTAs. As can be seen in Table 4 and Figure 5, a stylized fact is that countries that have a higher NLBR exhibit higher levels of trade openness. This association is more evident in the case of export orientation and

[8]A landmark in the literature on preferential liberalization is Baldwin's (1993) "domino theory of regionalism", showing how signing trade agreements alters the incentives of lobbies that favor international trade, even in countries that are not part of those agreements. This phenomenon leads some countries that are not among the original members to want to join the agreements. Baldwin (2006) also models the impact that trade barriers themselves have on the partner's market access as a result of reciprocal trade liberalization. Exporters can gain better access to the partner's market if the country lowers its barriers. This process, which Baldwin calls the "juggernaut effect", results in a liberalization path that deepens as tariffs are reciprocally reduced. A similar argument is suggested by Krishna & Mitra (2005), which they call "reciprocal unilateralism". A large country can open the markets of other countries, or succeed in including a new agenda of trade agreements, if the opening of its own market changes the political balances of the other countries by favoring the exporting sectors of the latter. The result, again, is a more open equilibrium.

seems to become stronger over time.

[Table 4 about here.]

[Figure 5 about here.]

3.3. Modeling proximities

With the purpose of enriching the measurement of trade policy effects, we consider four mechanisms through which trade policy influences observed trade, splitting the direct effects of PTAs ($\tilde{\phi}_{ijt}^{PTA}$) from other preferences granted under non-PTA frameworks ($\tilde{\phi}_{ijt}^{OPR}$), from non-discriminatory trade-opening measures ($\tilde{\phi}_{ijt}^{ND}$),[9] and from the degree of trade complementarity between exporter i and importer j ($\tilde{\phi}_{ijt}^{TC}$):

$$\phi_{ijt} = \phi_{ij}\,\tilde{\phi}_{ijt} = \phi_{ij}\,\tilde{\phi}_{ijt}^{PTA}\,\tilde{\phi}_{ijt}^{OPR}\,\tilde{\phi}_{ijt}^{ND}\,\tilde{\phi}_{ijt}^{TC}\,. \tag{2}$$

Regarding PTA effects, it is important to note that each new agreement modifies the relative costs of trade with different origins (including one's own), resulting in substitution effects known as "trade diversion" and "trade creation". The latter occurs when the domestic expenditure switches from domestic production to imports from a country in the newly signed agreement. Trade creation effects can only be accounted for if the estimation database includes domestic transactions.

It is now widely accepted that PTA effects are heterogeneous according to different country characteristics (Baier et al., 2018). Our model captures two different sorts of heterogeneity in PTA effects. Following Vaillant et al. (2019), we specify a model that admits heterogeneity with respect to bilateral proximities. Higher NLBR levels could increase the effect of an additional PTA for

[9]Non-discriminatory trade opening measures consider both classical tariff reduction and any other measure involving trade facilitation on an MFN basis.

the exporter, through the expansion of export capacity (e.g. learning in the use of agreements, changes in specialization), also revealing a greater preference for openness. On the importer side, a higher NLBR means that the real impact of a preference given to new PTA partners is lower, and then the PTA effect should also be lower. This sources of heterogeneity are captured through interactions of the PTA dummy with the NLBR of the exporter and the importer.

A second important source of heterogeneity in PTA effects comes from the margin of preference the agreement grants (MP). The effect of a PTA with total liberalization will not be the same as one that has just been established and still has low preference margins. Thus, the PTA variable will also be interacted with a variable capturing the MP.[10]

Trade preferences other than those granted within deep preferential agreements need also to be considered. These include non-reciprocal discriminatory tariff preferences, as in the case of the Generalized System of Preferences, or partial reciprocal preferences between developing countries. Differences in the preference margins are also important in this case, so a dummy variable signaling the cases of other preferences granted will also be interacted with the MP variable.

Non-discriminatory trade liberalization measures involve reducing the border effect on an MFN basis, affecting the substitution between domestic and international trade. Therefore, their effects can only be captured based on information that includes domestic trade, which allows measuring unilateral openness through dummy variables that signal domestic trade cases (in this sense these dummies vary across country-pairs).

As a direct measure of non-discriminatory trade policy, information on MFN tariffs for each importing country j will be used. Direct measures of trade facil-

[10]The margin of preference is defined as $MP_{ijt} = 1 + mp_{ijt} = 1 + \frac{\tau_{ijt}^{MFN} - \tau_{ijt}^{a}}{1+\tau_{ijt}^{a}} = \frac{1+\tau_{ijt}^{MFN}}{1+\tau_{ijt}^{a}}$, where τ_{ijt}^{MFN} refers to the MFN tariff applied by country j in year t, while τ_{ijt}^{a} is the tariff applied by country j to imports from country i in year t.

itation policies are now being tracked through specific indicators (OECD, 2019; GATF, 2020). However, they are not available for the period under analysis.[11] Consequently, the strategy used is to construct an indirect measure. For this purpose, the product between the NLBR levels of the two countries in each pair is used. This effect attains all bilateral relations, regardless of whether a PTA exists or not. The main idea is that PTAs have the effect of cleaning up the countries' trade policies, not only through tariff liberalization, but also as a means of identifying and eliminating other barriers.

Finally, trade complementarity measures the degree of matching between the specific products sold by i and bought by j.[12] The literature justifies the inclusion of this variable in aggregate gravity models (Deardorff, 1998). It has been pointed out that the low level of intra-regional trade in LA is the result of very similar productive structures and trade specialization patterns. The inclusion of a complementarity variable, TC, seeks to control for this kind of effect.

3.4. Estimation method and empirical form

The empirical application of the structural gravity model faces two information problems. First, there is a high proportion of trade flows equal to zero, censored observations in which there is no trade between two countries (or their value

[11]Two lines of work in the literature include a measurement of the effect of trade facilitation variables using gravity models. Martínez-Zarzoso & Chelala (2020) include a variable capturing foreign trade Single Window policies. They perform a two-stage procedure, the first stage specified using it, jt and ij fixed effects. In the second stage they use trade facilitation variables (it and jt) as determinants of the fixed effects. Trade facilitation variables are it and jt because they omit domestic trade observations, ignoring the fundamental substitution produced by trade facilitation. A second strategy is proposed by Moïsé et al. (2011) and Moïsé & Sorescu (2013), who have a very rich database on trade facilitation, but restricted to a set of OECD countries in 2011 (and add developing countries for 2013). They use data at the sector level, but they also omit domestic trade, being unable to split trade facilitation effects from the it and jt fixed effects. They solve this problem using the ijt geometric average of the two countries facilitation variables. None of the approaches respect the SGM, the exclusion of internal trade preventing an adequate estimation of trade facilitation effects.

[12]Further details on complementarity computations in Online Appendix C.

is so small that the agencies that compile the statistics approximate them to zero). Second, information on domestic trade is often missing, as sales of own production in the domestic market are excluded from most international trade databases. Since domestic trade is usually more important than any bilateral trade flows, this can be seen as a country-specific truncation in the right tail of the distribution of traded values.

The zero trade flow problem has received two different solutions in the literature. Helpman et al. (2008) proposed a micro-founded model with heterogeneous firms, developing a two-stage estimator where the first stage provides information on the extensive margin and this information is used in the second stage. In contrast, Santos Silva & Tenreyro (2006) use a pseudo maximum likelihood Poisson (PPML) estimator in levels, which is consistent in the presence of heteroskedasticity and provides an alternative to Helpman et al. (2008) to consider zero-trade observations. Fally (2015) shows that the inclusion of exporter and importer fixed effects makes the Santos Silva & Tenreyro (2006) estimator satisfy the general equilibrium conditions of the structural gravity model, as derived in the seminal paper by Anderson & van Wincoop (2003).

Empirical evidence reveals that countries exhibit much heterogeneity in terms of the relationship between domestic trade and total production or consumption of tradable goods. In a pioneering contribution, Arkolakis et al. (2012) raise the theoretical relevance of this share, showing that several microfoundations of the gravity model lead to a common expression for the gains from trade, which can be expressed as a reduced form that depends on that share.

Two families of empirical approaches emerged after the structural gravity model became standard. One controls for import and export capacities using fixed effects, while the other is based on a calculation of each country's inward and outward multilateral resistances (MRs). Fixed effect estimations have become standard in the context of the increasingly used Poisson estimator (Santos Silva & Tenreyro, 2006). Following the nonlinear estimator of Anderson & van Wincoop (2003), Head & Mayer (2014) propose the Structurally Iterated Least

Squares (SILS) method, which allows estimating MRs. SILS uses the structure of the gravity model to obtain bilateral proximities, which are used to find a fixed-point solution to equations (1b) and (1c). The resulting MRs are then used to obtain a new estimate of the proximities in equation (1a), and the iteration continues until convergence. In our case, we use a combination of both approaches recently proposed by Larch et al. (2019) in the context of panel data.

Larch et al. (2019) develop a procedure to overcome the computational restrictions that may arise from the inclusion of bilateral or origin-destination fixed effects, especially when the sample includes a large number of countries.[13] The method also makes it possible to divide trade restrictions into a permanent and a variable component. As defined in section 2, total proximity (ϕ_{ijt}) is divided into a permanent (ϕ_{ij}) and a time-varying component($\tilde{\phi}_{ijt}$), which is influenced by the trade policy of the countries. The impact of these variables is identified by means of a vector b, so that the stochastic version of equation (1a) can be expressed as:

$$X_{ijt} = \frac{Y_{it}E_{jt}}{Y_t^w}\frac{\phi_{ij}\exp\left(b'w_{ijt}\right)}{\Pi_{it}^{1-\sigma}P_{jt}^{1-\sigma}} + \varepsilon_{ijt}. \tag{3}$$

The method is iterative as in (Head & Mayer, 2014) and at each step a new PPML estimate is obtained. Using the orthogonality conditions of the PPML estimator, Larch et al. (2019) estimate the following system:

$$0 = \sum_i \sum_j \sum_t \left[X_{ijt} - \frac{Y_{it}E_{jt}}{Y_t^w}\frac{\phi_{ij}\exp\left(b'w_{ijt}\right)}{\Pi_{it}^{1-\sigma}P_{jt}^{1-\sigma}}\right] w_{ijt}, \tag{4a}$$

$$\Pi_{it}^{1-\sigma} = \sum_j \frac{E_{jt}/Y_t^w}{P_{jt}^{1-\sigma}}\phi_{ij}\exp\left(b'w_{ijt}\right), \tag{4b}$$

[13] In our case, with a sample of 112 countries, and assuming asymmetric permanent costs, we need to estimate 14,432 origin-destination effects (fixed effects when $i = j$ are normalized to 1).

$$P_{jt}^{1-\sigma} = \sum_i \frac{Y_{it}/Y_t^w}{\Pi_{it}^{1-\sigma}} \phi_{ij} \exp\left(b' w_{ijt}\right), \tag{4c}$$

$$\phi_{ij} = \frac{\sum_t X_{ijt}}{\sum_t \frac{Y_{it} E_{jt}}{Y_t^w} \frac{\phi_{ij} \exp\left(b' w_{ijt}\right)}{\Pi_{it}^{1-\sigma} P_{jt}^{1-\sigma}}}. \tag{4d}$$

From a set of initial conditions on the proximities and the multilateral resistances (usually assuming a world without trade frictions, where $\Pi_{it}^{1-\sigma} = P_{jt}^{1-\sigma} = \phi_{ij} = 1$), a solution for $\widehat{b}$ is found using the PPML estimator in equation (3). Then the system given by equations (4b) and (4c) is solved, obtaining the multilateral resistances. Finally, the permanent proximities are obtained using equation (4d). The method involves an iterative procedure, until convergence is achieved, where in each iteration the values of $\Pi_{it}^{1-\sigma}$, $P_{jt}^{1-\sigma}$, and ϕ_{ij} from the previous iteration are used to obtain a new estimate of the vector $\widehat{b}$. Empirically, permanent trade costs are identified using bilateral fixed effects, and can be assumed symmetric or asymmetric.

Based on the above discussion, this paper proposes the estimation of the following functional form of bilateral trade flows:

$$\begin{aligned} X_{ijt} = \exp \{ & \psi_{it} + n_{jt} + \mu_{ij} + \alpha_1 \left[PTA_{ijt} \times NLBR_{it}\right] + \alpha_2 \left[PTA_{ijt} \times NLBR_{jt}\right] \\ & + \alpha_3 \left[PTA_{ijt} \times \ln\left(MP_{ijt}\right)\right] + \beta \left[OPR_{ijt} \times \ln\left(MP_{ijt}\right)\right] + \gamma_1 \ln\left(MFN_{ijt}\right) \\ & + \gamma_2 \left(NLBR_{it} \times NLBR_{jt}\right) + \delta TC_{ijt} \} + \varepsilon_{ijt}, \end{aligned} \tag{5}$$

where ψ_{it}, n_{jt}, and μ_{ij} are, respectively, origin-time, destination-time and origin-destination asymmetric fixed effects, i.e. $\mu_{ij} \neq \mu_{ji}$.

While origin-destination fixed effects control for permanent proximities $\phi_{ij} = \exp\left(\mu_{ij}\right)$, the variable proximity $\tilde{\phi}_{ijt}$ is broken down into the four mechanisms detailed before. The effect of a PTA between i and j, which allows for two sources of heterogeneity:

$$\begin{aligned} \tilde{\phi}_{ijt}^{PTA} = & \exp \{ \alpha_1 \left[PTA_{ijt} \times NLBR_{it}\right] + \alpha_2 \left[PTA_{ijt} \times NLBR_{jt}\right] \\ & + \alpha_3 \left[PTA_{ijt} \times \ln\left(MP_{ijt}\right)\right] \}; \end{aligned}$$

the effect of other trade preferences, which are heterogeneous according to the margin of the preference:

$$\tilde{\phi}_{ijt}^{OPR} = \exp\left\{\beta\left[OPR_{ijt} \times \ln\left(MP_{ijt}\right)\right]\right\};$$

the effect of non-discriminatory trade liberalization and facilitation:

$$\tilde{\phi}_{ijt}^{ND} = \exp\left\{\gamma_1 \ln\left(MFN_{ijt}\right) + \gamma_2\left(NLBR_{it} \times NLBR_{jt}\right)\right\};$$

and an homogeneous effect of trade complementarity:

$$\tilde{\phi}_{ijt}^{TC} = \exp\left\{\delta TC_{ijt}\right\}.$$

3.5. Estimated elasticities

Table 5 reports the results corresponding to five different specifications. Column (5) contains the results corresponding to equation (5). As a robustness exercise, columns (1) to (4) report the results corresponding to alternative specifications. Estimations were performed using a spaced time sample, leaving five-year gaps between included time periods, following Cheng & Wall (2005). Robustness to the windows length is shown in Online Appendix D.

[Table 5 about here.]

Focusing on column (5), results show the expected signs: the effect of a trade agreement increases as the exporting country has a greater number of preferential relations (α_1 is positive), while it decreases with the number of preferential relations of the importing country (α_2 is negative). The first result implies that the more open an economy is, the greater its export capacity, and the greater the possibilities of taking advantage of the market access gains that the new agreement provides. On the other hand, the more open the importing country, the smaller the differential market access advantages granted to new partners, and therefore the smaller the effect produced by a new PTA. Finally, the effect of an agreement is greater the higher the margin of preference granted (coefficient α_3 is positive).

The effect of the MFN tariff on trade costs is a key parameter, since it allows identifying the elasticity of substitution ($\gamma_1 = -\sigma$), which is necessary for the calculation of trade costs in *ad-valorem* equivalents. The estimated elasticity is 5.9, very close to the 6.13 that Head & Mayer (2014) report as the average elasticity across structural model estimates.

As argued before, the NLBR helps capturing the non-discriminatory multilateral effect of PTAs. In addition to the preferences themselves, PTAs also imply changes that "cleanse" trade policy of other trade-hindering instruments. Moreover, the NLBR reveals a country's preference for trade openness, and how exporters' interests manage to prevail over the interests of import-substituting sectors. In this sense, they capture the trade preference effect that globalization variables had already identified in other studies. The difference is that, instead of being captured as a general trend common to all countries, they capture the country heterogeneity with which the phenomenon expresses itself. As can be seen from Table 5, estimations of coefficient γ_2 are positive and statistically significant.

Regarding preferences other than PTA, their effect is a positive function of the level of preference margins granted, since the estimation for β is positive. Finally, the estimated effect of trade complementarity has the expected positive sign ($\delta > 0$).

4. Breaking down changes in trade costs and trade

After estimating a SGM that is flexible enough to capture the different channels through which trade policy is expected to affect bilateral traded values, it is possible to use it to compare regions' behaviors and performances. This section seeks to describe how different regions or agreements have shaped their trade policy both within the region a towards third-parties, and how the corresponding traded values have evolved over time. The observed effects of different liberalization strategies in each region are also evaluated.

4.1. Regional biases in trade liberalization

Trade barriers not only have the effect of affecting the geographical structure of international trade flows, but also the weight of domestic transactions *vis-à-vis* international trade. In order to provide an approximation of the levels and evolution of such barriers, we will make use of the indicator proposed by Agnosteva et al. (2014) called Constructed Interregional Bias (CIB). The CIB is defined as the ratio between the Constructed Trade Bias (CTB) of an economy in relation to its trading partners divided by the value of the CTB of the economy itself. Analyzing from the perspective of an importing country j, we have:

$$CIB_{ijt} = \frac{CTB_{ijt}}{CTB_{jjt}}, \tag{6}$$

where $CTB_{ijt} = \widehat{X}_{ijt} / \left(Y_{it}E_{jt}/Y_t^w\right)$ is the ratio between the trade predicted by the SGM and the trade that would be observed in the absence of trade barriers. As shown by Agnosteva et al. (2014), it is possible to obtain a consistent aggregation of the CTB and CIB indicators for a given country in relation to a set of trading partners. In our case, the interest is in distinguishing between intra (R) and extra-regional (E) origin of imports:

$$CIB_{jt,R} = \frac{CTB_{jt,R}}{CTB_{jjt}} = \frac{\sum\limits_{i \in R} \frac{Y_i}{\sum_{i \in R} Y_i} CTB_{ijt}}{CTB_{jjt}}, \tag{7a}$$

$$CIB_{jt,E} = \frac{CTB_{jt,E}}{CTB_{jjt}} = \frac{\sum\limits_{i \in E} \frac{Y_i}{\sum_{i \in E} Y_i} CTB_{ijt}}{CTB_{jjt}}. \tag{7b}$$

$CIB_{jt,R}$ measures the average proportion by which trade proximity directly and indirectly increases j's imports from partners belonging to R relative to the effect on their own domestic trade. A similar interpretation corresponds for

$CIB_{jt,E}$, although for imports in j from partners not belonging to the same region. For the purpose of easing interpretation we use a transformation of $CIB_{jt,R}$ and $CIB_{jt,E}$:

$$T_{jt,R} = \left[CIB_{jt,R}^{1/(1-\sigma)} - 1\right] \times 100, \quad (8a)$$

$$T_{jt,E} = \left[CIB_{jt,E}^{1/(1-\sigma)} - 1\right] \times 100. \quad (8b)$$

Equations (8a) and (8b) can be interpreted as the ratio of the normalized average trade costs of importing from a given set of origins relative to the normalized costs associated with domestic transactions.

Figure 6 shows that countries impose higher trade barriers on imports from outside their region than on intra-regional imports, which reflects the fact that most integration initiatives have a regional scope (although this has been changing in the last wave of economic integration processes). Regarding LA regions, the highest extra-regional protection *vis-à-vis* intra-regional protection is observed for CAC, followed by SAM. In the case of NAM, in addition to exhibiting the lowest levels of protection, there is also greater parity in terms of the regional origin of imports.

[Figure 6 about here.]

With respect to the dynamics of protection levels, Figure 7 clearly shows that for most of the economies trade liberalization has been both intra and extra-regional, with few exceptions. Among the latter, the four MERCOSUR economies stand out, experiencing an increase in intra-regional trade costs while at the same time showing a reduction in barriers on imports originating in other regions. Also, it is also clear that those countries that have reduced their intra-regional protection levels the most have also significantly reduced their extra-regional protection.

[Figure 7 about here.]

Finally, Figure 8 replicates Figure 7 using trade agreements instead of regions. Once again MERCOSUR countries stand out, showing an increase in intra-agreement costs, while at the same time there is a very small reduction in barriers to imports originating outside the agreement. For the CAN and CACM countries results show reductions in trade costs regardless of the origin of imports (with the exception of Panama).

[Figure 8 about here.]

4.2. The effects of liberalization policies

The results of the SGM estimation are now used to characterize the influence of non-discriminatory and preferential openness on the dynamics of international trade flows. As a means for breaking down bilateral trade changes, we apply Bennet (1920) additive decomposition of the change in a variable arising from a multiplicative model, such as that of the gravity equation (de Boer & Rodrigues, 2020).

Let us assume that imports in j from i during year t can be expressed as the product of three factors:

$$X_{ijt} = f^1_{ijt} \times f^2_{ijt} \times f^3_{ijt}. \tag{9}$$

Total country j imports in year t are given by:

$$X_{jt} = \sum_{i \neq j} X_{ijt} = \sum_{i \neq j} f^1_{ijt} \times f^2_{ijt} \times f^3_{ijt}. \tag{10}$$

Then, Bennet's decomposition allows expressing the change in total imports in an additive way, which makes possible to aggregate over sets of countries. Between moments t and $t - n$ it holds that:

$$\Delta X_{jt,(t-n)} = \Delta F^1_{jt,(t-n)} + \Delta F^2_{jt,(t-n)} + \Delta F^3_{jt,(t-n)}, \tag{11}$$

where $\Delta F^k_{jt,(t-n)}$ is the contribution of factor k to $\Delta X_{jt,(t-n)}$.[14]

The change in a country's imports is first decomposed into four factors: exporter's supply capacity (S_{it}); importer's demand capacity (M_{jt}); trade liberalization policies ($\tilde{\phi}^{PTA}_{ijt}$, $\tilde{\phi}^{OPR}_{ijt}$, and $\tilde{\phi}^{ND}_{ijt}$); and a residual category including trade complementarity effects ($\tilde{\phi}^{TC}_{ijt}$) together with estimation residuals.

We start aggregating countries at the regional level, and the analysis is performed from the importer's perspective. Thus, the growth rate of each region's imports is divided into the contributions of the aforementioned mechanisms, distinguishing also according to whether the trade is intra or extra-regional. The results are presented in Table 6.[15]

[Table 6 about here.]

World trade more than doubled between 1995 and 2015 (212%), with even contributions of the three main factors: export capacity (63pp), import capacity (68pp), and liberalization policies (77pp). Intra-regional trade grew at a slower rate (174%) than extra-regional trade (260%), and their contributions to the change in total trade were 97.9pp and 114pp, respectively. The contribution of liberalization to the change in world trade was similar when considering intra-regional trade (39.3pp) and extra-regional trade (37.3pp).

The relevance of the effect and its heterogeneity by region is illustrated in Figure 9, showing the contribution of liberalization to the total rate of change of

[14] As an example, for the case of factor 1, and assuming the case of three factors, we have: $\Delta F^1_{jt,(t-n)} = \frac{1}{3}\sum_i \Delta f^1_{ijt,(t-n)} \times f^2_{ij(t-n)} \times f^3_{ij(t-n)} + \frac{1}{6}\sum_i \Delta f^1_{ijt,(t-n)} \times f^2_{ij(t-n)} \times f^3_{ijt} + \frac{1}{6}\sum_i \Delta f^1_{ijt,(t-n)} \times f^2_{ijt} \times f^3_{ij(t-n)} + \frac{1}{3}\sum_i \Delta f^1_{ijt,(t-n)} \times f^2_{ijt} \times f^3_{ijt}$.

[15] The total growth rate of imports in region r, obtained as $tm^T_r = \frac{\Delta m^T_r}{m^T_{r0}}$, is decomposed into the contribution of each mechanism and by type of trade flow: $m^f_{rn} = \frac{m^f_{r0}}{m^T_{r0}} \frac{\Delta m^f_{rn}}{m^f_{r0}}$), where $f = \{R, E\}$ and $n = ec, ic, lib, res$. Then it holds that $tm^T_r = \sum_f \sum_n m^f_{rn}$.

each region. CSEA and Africa (AFR) show a high contribution of liberalization to extra-regional trade, while for EUR and SEEA stand out for the contribution of their liberalization policies to intra regional trade. SAM shows the lowest contribution of liberalization to both types of flow, and CAC has a similar behavior with a slightly higher contribution of liberalization to extra-regional flows.

[Figure 9 about here.]

A similar exercise was performed for the case of the main PTAs, which also have a strong regional correlate, as shown in Figure 10. The three PTAs in LA, which cover most of the countries in the region (MERCOSUR, CAN and CACM including Panama and the Dominican Republic), were compared to the three PTAs that function as "planetary hubs": NAFTA, the European Free Trade Area (EU+) and the ASEAN+3 countries.

[Figure 10 about here.]

On the one hand, at the most protectionist extreme, we find the case of MERCOSUR, where trade policies had a negative contribution regardless of imports coming from inside or outside the agreement. For CAN and CACM, trade liberalization policies showed a greater contribution to extra-agreement trade. In the case of the three global hubs, the predominant contribution of trade liberalization is intra-agreement trade, although some extra-agreement trade effects were found in the case of AEAN+3. Trade grows either due to greater depth of trade between the original partners (NAFTA) or the entry of new partners into these economic spaces. The latter is the case in both the EU+ and ASEAN+3.

Each regional average contains an heterogeneity that is useful to illustrate, so Figure 11 replicates Figure 9 at the country level (for the sake of legibility only the countries in regions associated with the considered PTAs are included). In spite of the within-region heterogeneity, results keep a clear regional sorting of countries, except for a few exceptions.

[Figure 11 about here.]

China excelled in the effects of liberalization policies both on intra and extra-regional trade, while Romania and Vietnam stand out in the impact of trade liberalization on their intra-regional trade and Peru shows a very high contribution of liberalization on extra-regional trade. On a second level, trade openness contributed most to intra-regional trade for a group of the new members of the European Union (Hungary, Czech Republic, Poland, Slovakia, Croatia, Cyprus and Slovenia), as well as some ASEAN+3 countries like Philippines and Thailand. From LA, only Mexico belongs to this group. On the other hand, CAC countries show an important contribution of liberalization policies to intra-regional trade, leaded by Guatemala, Nicaragua, Costa Rica and Honduras. From SAM, only Colombia belongs to this group. Finally, the rest of the SAM countries are the worst performers, in particular the cases of Argentina and Brazil, for which a protectionist reversal was recorded, particularly in the relationship with the extra-regional space.

One result that clearly emerges is that LA is the most heterogeneous region. Figure 12 plots the total contribution of trade liberalization to trade growth against the total growth rate of imports for LA countries. Two of the region's main economies, Argentina and Brazil, show setbacks in terms of trade liberalization, while Peru, Mexico, Nicaragua, Guatemala, Colombia, Chile, Honduras and Costa Rica are at the other extreme among the dynamic countries with a high contribution to trade openness. The result that emerges is that LA's regions are fragmented. On the one hand, there are dynamic economies in trade, and this dynamism is associated with liberalization. Reversely, the economies of the Southern Cone sub-region are characterized by protection (or scarce openness) and low trade growth.

[Figure 12 about here.]

4.3. Channels of liberalization and their effects

We have defined four mechanisms of trade liberalization: the direct effect of preferential trade agreements ($\tilde{\phi}_{ijt}^{PTA}$); the tariff preferences granted outside deep preferential agreements ($\tilde{\phi}_{ijt}^{OPR}$); the Most Favored Nation tariffs ($\tilde{\phi}_{ijt}^{MFN}$) and the interaction between the number of bilateral preferential relationships of the exporter and the importer ($\tilde{\phi}_{ijt}^{NLBR}$). Figure 13 reports the contribution of each of these mechanisms to the change in total imports of each region, distinguishing between trade with countries within and outside the region. Figure 14 replicates this exercise for trade agreements.

[Figure 13 about here.]

[Figure 14 about here.]

Regardless of the trade flow considered, non-discriminatory liberalization mechanisms ($\tilde{\phi}_{ijt}^{MFN}$) and preference for openness ($\tilde{\phi}_{ijt}^{NLBR}$) have been the main drivers of the change in trade flows, while discriminatory liberalization policies ($\tilde{\phi}_{ijt}^{PTA}$ and $\tilde{\phi}_{ijt}^{OPR}$) had a much lower contribution. The second most important channel is the component of preference for openness and trade facilitation reflected by the interaction between the NLBR of exporter and importer ($\tilde{\phi}_{ijt}^{NLBR}$). An exception to this pattern is the case of Europe/EU+, where both the MFN tariff reduction and the preference for openness and facilitation had similar contributions. Another result worth noting is that MERCOSUR is the only case with a negative contribution from changes in MFN tariffs, both on intra-agreement and extra-agreement imports.

The contribution of the preferential channel via PTA has been more important through the change in extra-regional trade than intra-regional, with the exceptions of MAR and, in particular, SEEA and ASEAN+3. Of the two channels reflecting discriminatory liberalization, it is not surprising that the effect of trade agreements shows a greater contribution than that corresponding to tariff preferences granted outside PTAs. In this case, a substitution of the channel associated with other preferences by the preferential channel based on PTAs can be observed.

Focusing on LA countries, the general structure of the results is not altered. Figure 15 breaks down the contribution of the different liberalization channels to the total change in imports for each economy. Once again, the preference for liberalization has the greatest weight in explaining the change in imports, especially through reductions in MFN tariffs. Some substitution of preferences other than PTAs by preferential agreements is also generally observed. It stands out that four countries experienced a negative contribution of non-discriminatory liberalization, through increases in MFN tariffs that occurred in Argentina and Brazil, two of the largest economies in the region, together with Bolivia and Haiti. The cases in which the contribution of the preference for liberalization has a greater weight are CAC countries, Chile, Colombia and Peru from SAM, and Mexico from NAM.

[Figure 15 about here.]

5. Conclusions

LA's poor performance in terms of intra-regional trade is explained by high levels of trade costs. Conditional on physical distance, geographical contiguity and the existence of trade agreements, the remaining intra-regional trade costs are exceptionally high in the case of LA. In the last two decades these costs have not shown any consistent downward trend. However, there is heterogeneity in performance by sub-regions, from the most protectionist extreme of MERCOSUR, to greater opennness in the Central American sub-region, with the CAN countries with an intermediate behavior. The Pacific Alliance countries (Mexico, Colombia, Peru and Chile), located in different geographic sub-regions of the continent, have the highest trade openness indicators.

Our analysis focused on the manufacturing sector and covered a sample of 112 countries that represent more than 94% of the world's trade, allowing a comparative evaluation of regional performance over the period 1995-2016.

First, a descriptive analysis was conducted using production, expenditure and trade data by major regions and at the country level. CAC showed a strong dynamism in its external sector, with a growing weight of intra-regional trade. SAM is at the opposite extreme, influenced by the weight of its larger economies, it has moved in a similar direction to that of the world, but lags behind in terms of trade openness. Within SAM it is possible to find economies that show greater dynamism, with an increase in their levels of trade openness, especially towards extra-regional markets. Lastly, Mexico exhibited a significant trade openness, with an almost unchanged export orientation, while at the same time its imports became extra-regional, especially due to the weight of imports from China.

Then a parametric estimation of the SGM was performed, explaining bilateral trade by three types of effects: market size (exporter supply and importer expenditure), average bilateral costs with all the exporter's alternative destinations and the importer's alternative origins (multilateral resistances), and bilateral trade costs. In addition, a fourth mechanism associated with trade complementarity was added as a control.

Trade costs are broken down into those that do not change during the period of analysis and those that do change. The former reflect the role of factors such as geographical distance, or other fixed characteristics of each pair, which were captured by origin-destination fixed effects. The latter respond to trade policy and are the focus of this paper. Four variables measure the evolution of trade policy affecting variable trade costs: deep preferential trade agreements (FTA, CU and EU); cumulative NLBR in deep agreements; MFN tariffs; and preference margins within and outside PTAs. These variables were used to explain the evolution of trade, and estimated elasticities have the expected signs. Trade increases with lower MFN tariffs of the destination (unilateral openness effect). Trade within deep agreements is higher the higher the preference margin granted by the PTA, the higher the NLBR of the exporter (learning in the use of preferences), and the lower the NLBR of the importer (preference dilution). Extra-agreement trade increases with higher preferences other than PTAs and with higher exporter and importer's NLBR interaction (preference effect for openness and trade facilitation).

To measure the relative magnitude of these effects, we break down the variations in trade into each of the fundamental factors of the gravity model. The combination of the effects associated with changes in output, spending and multilateral resistances explain most of the changes in trade, as expected. However, trade policy has played a very important role during the period, explaining a 36% of the change in trade for the global economy.

One result that clearly emerges is that, within regions, countries have heterogeneous performances. Latin America is a clear example: two of the region's main economies, Argentina and Brazil, have experienced setbacks in terms of trade liberalization, while Peru, Mexico, Nicaragua, Guatemala, Colombia, Chile, Honduras and Costa Rica show the opposite behavior. Their performance in terms of trade growth is associated with their liberalization policies.

At the global level, all the paths of trade liberalization have worked in a complementary manner: the reduction of MFN tariffs (i.e. the multilateral engine); the expansion and deepening of existing plurilateral agreements; and the incorporation of new deeper agreements. The contribution of the preferential channel via PTAs has been more important in promoting extra than intra-regional trade, and this pattern becomes clearer when grouping countries by plurilateral agreement instead of regions. Trade preferences outside PTAs have been replaced by deeper agreements of greater intensity, so that the reduction they manifested was more than compensated by the preferences within PTAs.

There was greater regional integration where all channels of trade liberalization were active. Particularly relevant are the MFN liberalization and trade facilitation channels, which rather than substitutes appear to be complementary to the preferential mode in reducing intra-regional trade costs. The concept of open regionalism is emphasized: without trade openness there is no regionalism that succeeds in reducing trade costs.

Data availability: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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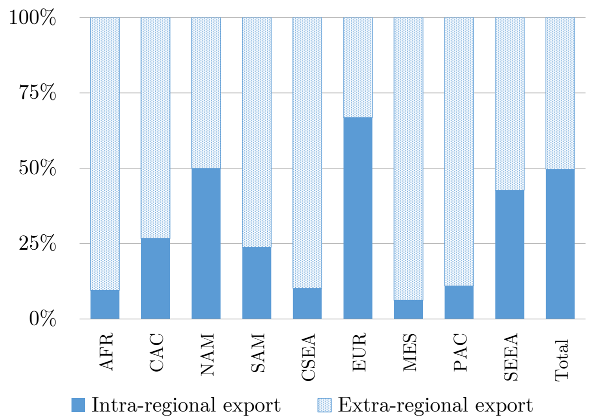
Figures

Figure 1: Composition of Production by region, 2016 (percentage values)

Source: Prepared by the authors using the database of Moncarz et al. (2021).

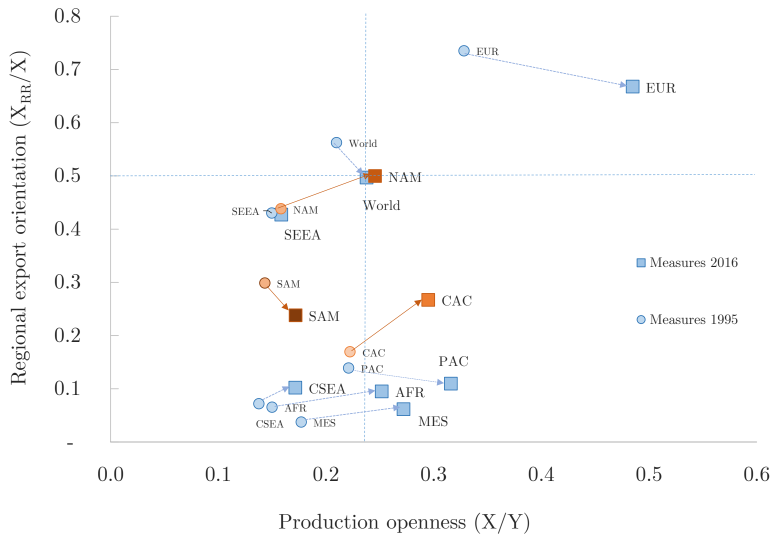
Figure 2: Breakdown of Exports by region, 2016 (percentage values)



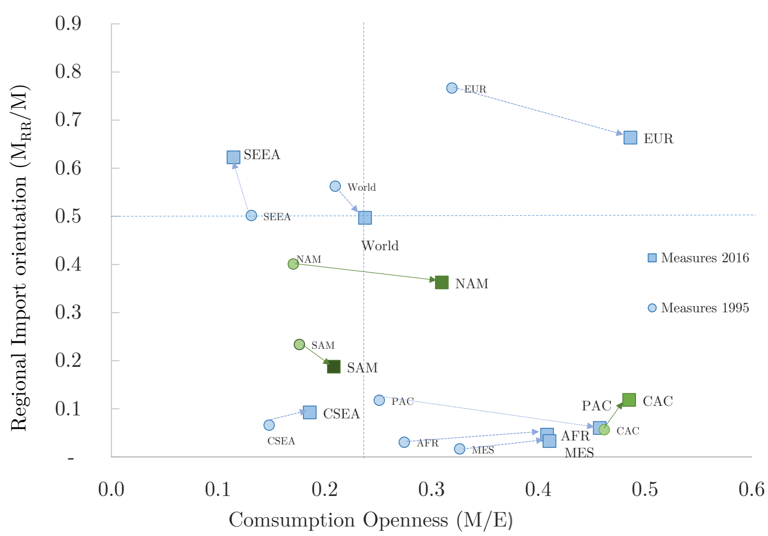
Source: Prepared by the authors using the database of Moncarz et al. (2021).

Figure 3: Trade openness and regional orientation, 2016

(a) Exports and production



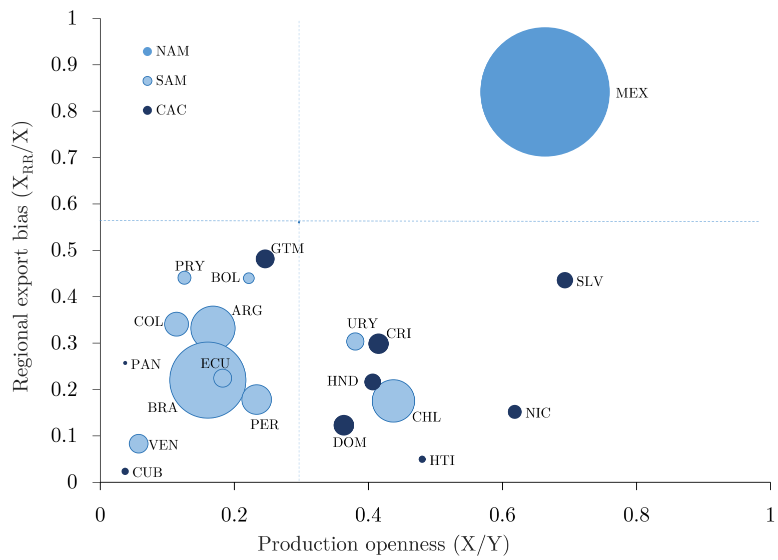
(b) Imports and expenditure



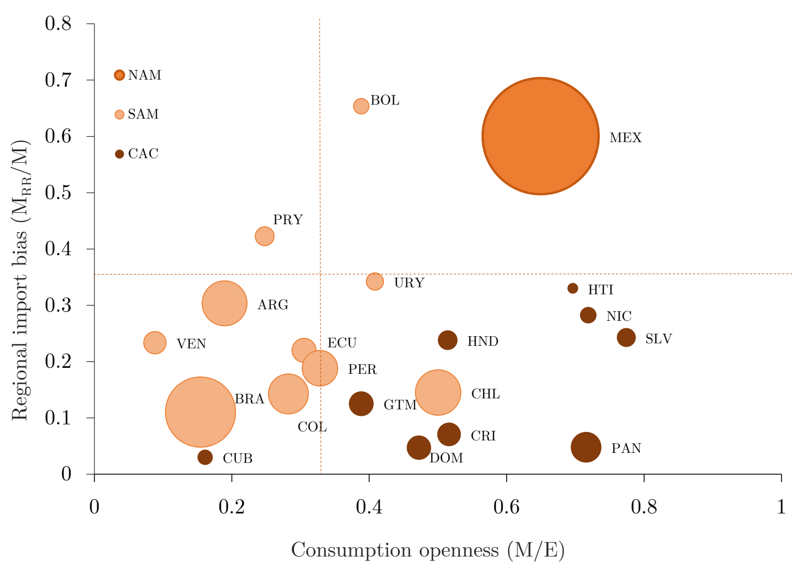
Source: Prepared by the authors using the database of Moncarz et al. (2021).

Figure 4: Trade openness and regional orientation, 2016

(a) Exports and production



(b) Imports and expenditure

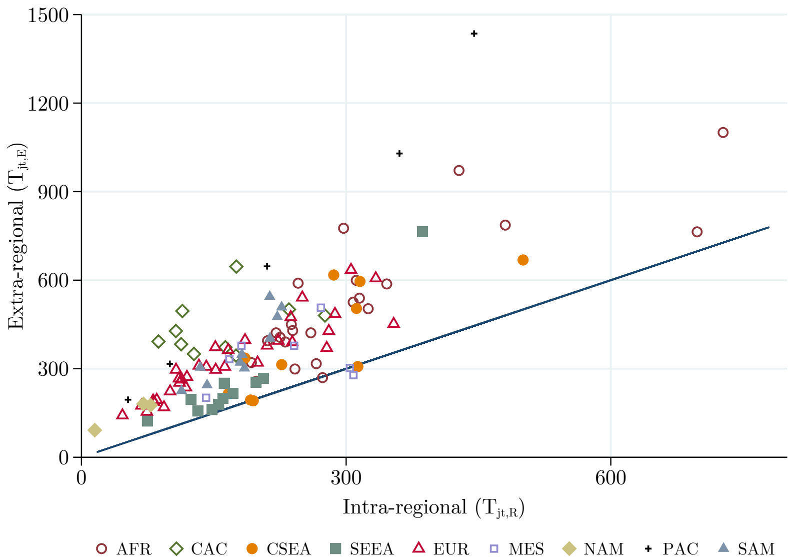


Source: Prepared by the authors using the database of Moncarz et al. (2021).

Figure 5: Openness and number of LBR from PTAs

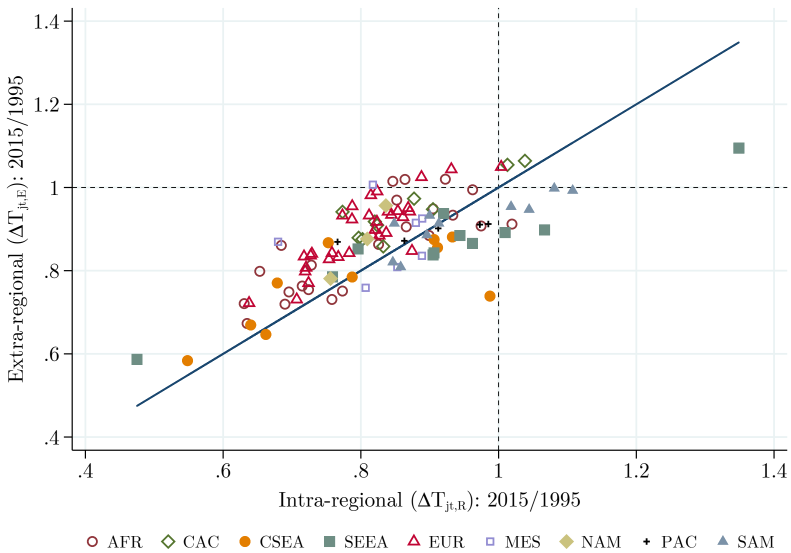
Source: Prepared by the authors using the database of Moncarz et al. (2021).

Figure 6: Intra and extra-regional trade costs in 2015



Notes: Using results from column (5) in Table 5.

Figure 7: Changes in intra and extra-regional trade costs: 2015/1995

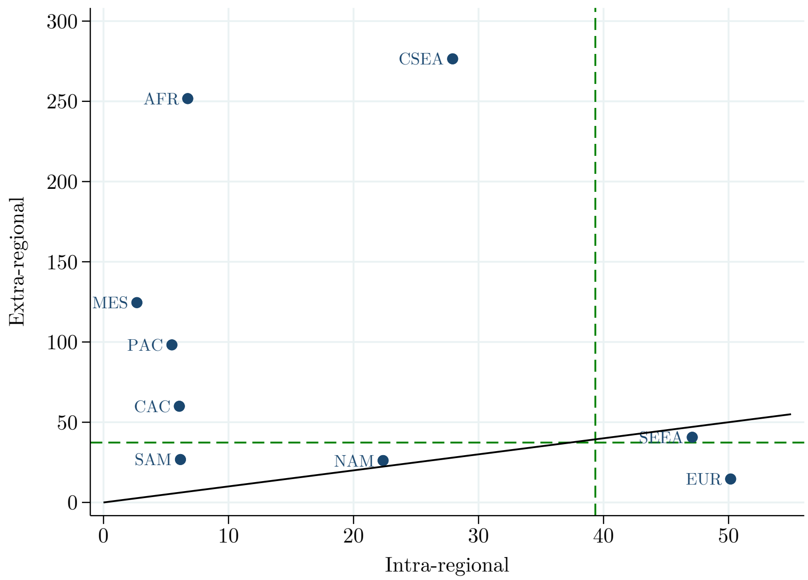


Notes: Using results from column (5) in Table 5.

Figure 8: Changes in intra and extra-agreement trade costs: 2015/1995

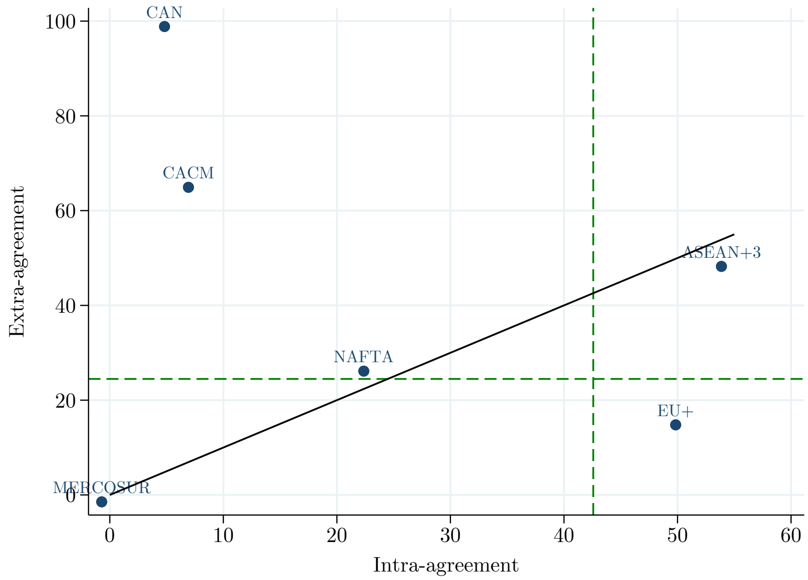
Notes: Using results from column (5) in Table 5.

Figure 9: Contribution of liberalization policies to changes in imports by region, 1995-2015 (%)



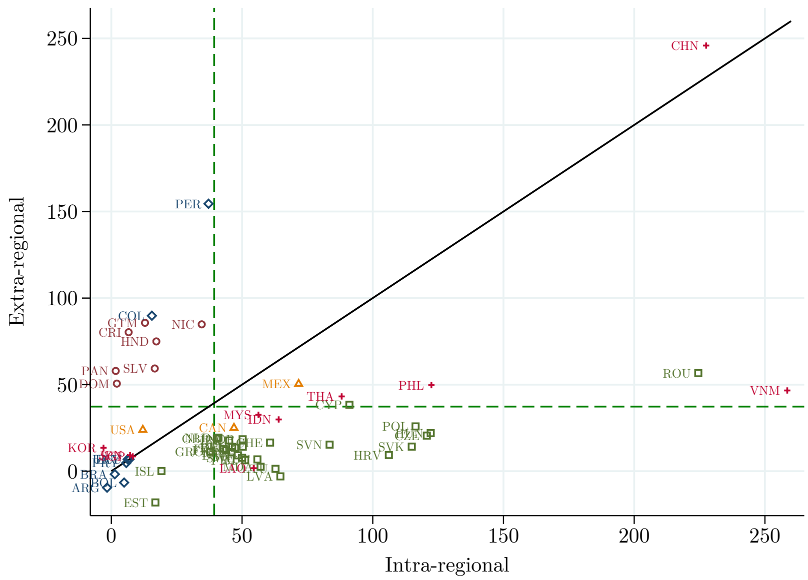
Notes: The dotted lines correspond to world averages. The solid line corresponds to the 45º line. *Source*: Own elaboration using results from column (5) in Table 5.

Figure 10: Contribution of liberalization policies to changes in imports by PTA, 1995-2015 (%)



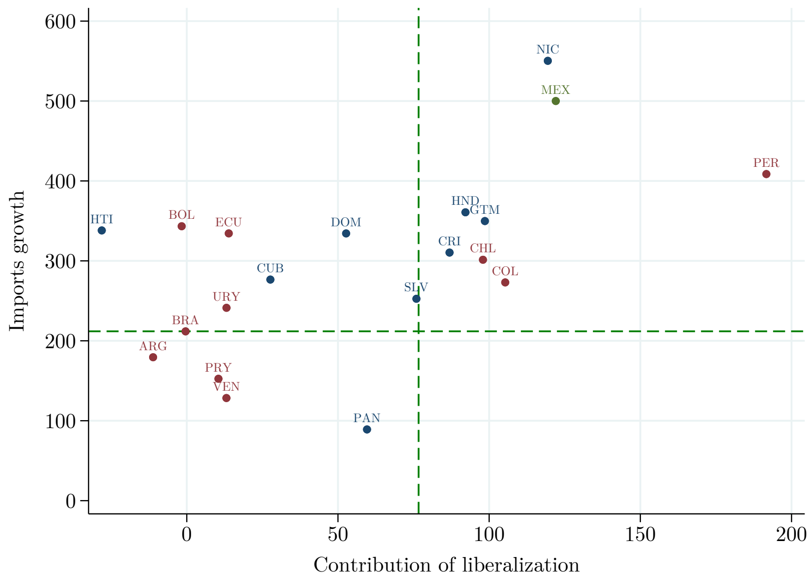
Notes: The dotted lines correspond to world averages. The solid line corresponds to the 45º line. *Source*: Own elaboration using results from column (5) in Table 5.

Figure 11: Contribution of liberalization policies to changes in imports by country, 1995-2015 (%)



Notes: The dotted lines correspond to world averages. The solid lines correspond to the 45º lines. *Source*: Own elaboration using results from column (5) in Table 5.

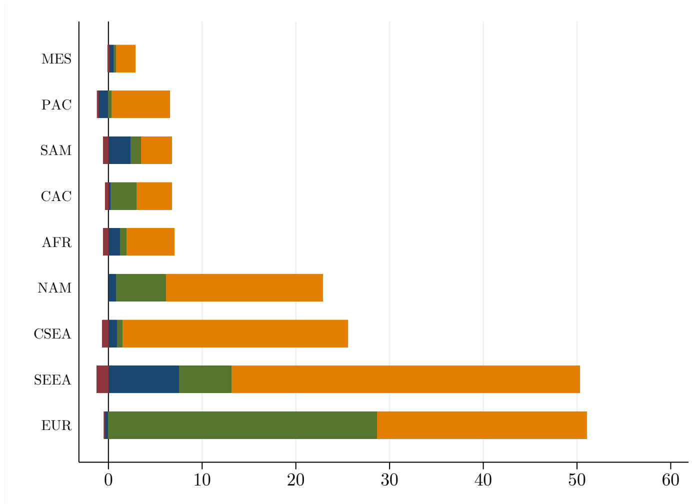
Figure 12: Import growth and contribution of openness policies in LA, 1995-2015 (%)



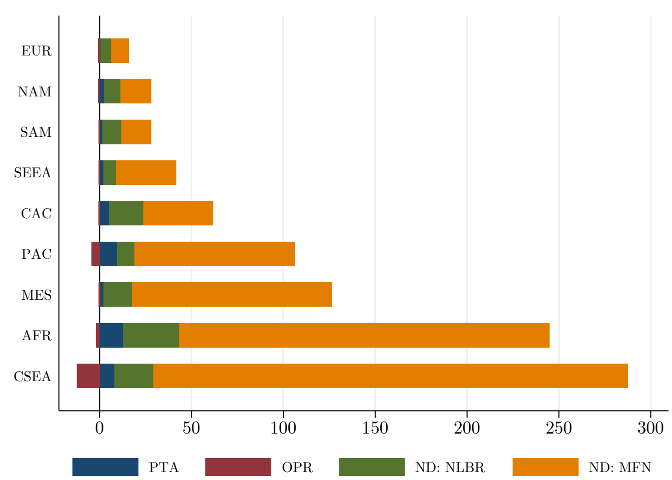
Notes: The dotted lines correspond to the world average. *Source*: Own elaboration using results from column (5) in Table 5.

Figure 13: Contribution of different trade liberalization policies to the change in total imports (percentage change 1995-2015)

(a) Intra-regional trade

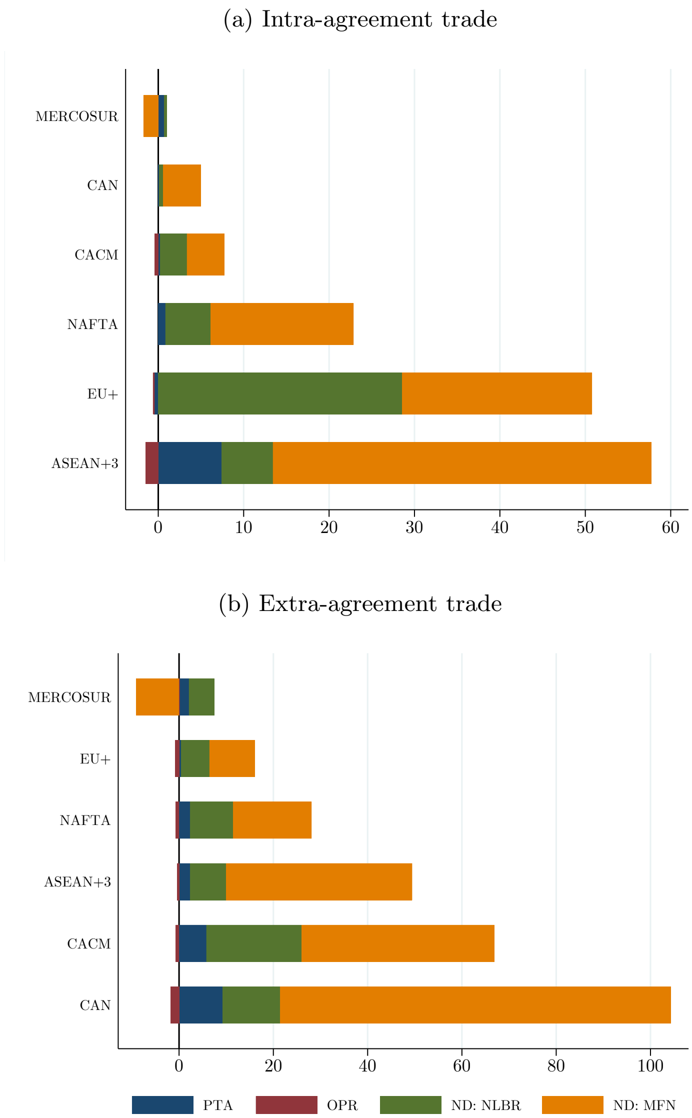


(b) Extra-regional trade



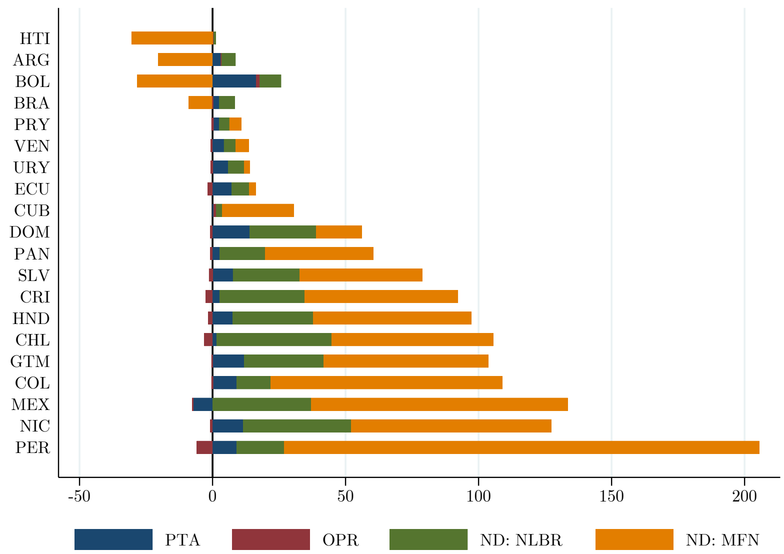
Notes: Regions ordered according to the aggregate contribution of trade liberalization policies. *Source*: Own elaboration using results from column (5) in Table 5.

Figure 14: Contribution of different trade liberalization policies to the change in total imports (percentage change 1995-2015)



Notes: Agreements ordered according to the aggregate contribution of trade liberalization policies. *Source*: Own elaboration using results from column (5) in Table 5.

Figure 15: Contribution of different trade liberalization policies to the change in total imports (percentage change 1995-2015)



Notes: Countries ordered according to the aggregate contribution of trade liberalization policies. *Source*: Own elaboration using results from column (5) in Table 5.

Tables

Table 1: Growth rate of main variables by region, 1995-2016 (percentage values)

Region	Production $Y = X_{ii} + X_i$	Expenditure $E = X_{ii} + M_i$	Exports X_i	Imports M_i	Domestic Trade X_{ii}
AFR	4.6	4.9	7.2	6.9	3.9
CAC	5.4	5.1	6.8	5.3	4.9
CSEA	8.0	8.1	9.2	9.2	7.8
EUR	2.1	2.2	4.0	4.3	0.9
MES	5.8	5.8	8.0	7.0	5.2
NAM	2.6	3.0	4.8	5.9	2.1
PAC	2.4	3.3	4.2	6.3	1.8
SAM	4.2	4.3	5.1	5.1	4.1
SEEA	7.2	7.1	7.5	6.4	7.2
WORLD	4.8	4.8	5.5	5.5	4.7

Notes: Average cumulative growth rate 1995-2016 of variables measured in current US Dollars. *Regions*: Africa (AFR); Central America and the Caribbean (CAC); North America (NAM); South America (SAM); Central Asia + Eurasia + South Asia (CSEA); Europe (EUR); Middle East (MES); Pacific (PAC); Southeast Asia + East Asia (SEEA). *Source*: Prepared by the authors using the database of Moncarz et al. (2021).

Table 2: Variation of main indicators by region, 1995-2016 (percentage points)

Region	Production openness X/Y	Consumption openness M/E	Regional orientation exports X_{RR}/X	Regional orientation imports M_{RR}/M	Regional integration $(X_{RR}+M_{RR})/(X+M)$
AFR	10.2	13.4	3.0	1.6	2.1
CAC	7.3	2.3	9.8	6.2	7.9
CSEA	3.4	3.8	3.0	2.7	2.8
EUR	15.7	16.7	-6.7	-10.3	-8.5
MES	9.5	8.4	2.4	1.7	2.0
NAM	8.7	13.9	6.2	-3.8	0.2
PAC	9.5	20.6	-2.9	-5.8	-5.0
SAM	2.8	3.2	-6.0	-4.6	-5.2
SEEA	0.9	-1.7	-0.3	12.1	4.4
WORLD	2.8	2.8	-6.6	-6.6	-6.6

Notes: Change in indicator value between 1995 and 2016. *Source*: Prepared by the authors using the database of Moncarz et al. (2021).

Table 3: Variation of main indicators by region, 1995-2016 (percentage points)

Region	Production openness X/Y	Consumption openness M/E	Regional orientation exports X_{RR}/X	Regional orientation imports M_{RR}/M	Regional integration $(X_{RR} + M_{RR})/(X+M)$
ARG	3.8	4.5	-12.1	3.1	-4.1
BOL	1.9	-3.5	7.6	8.2	6.9
BRA	4.3	2.9	-0.9	-6.3	-3.4
CHL	11.8	14.8	-2.5	-5.6	-4.2
COL	0.3	3.1	-10.0	-7.3	-8.5
LRC	16.2	12.9	1.8	-0.8	1.3
CUB	-6.4	0.6	1.8	2.7	2.5
DOM	8.3	15.6	12.0	3.4	6.8
ECU	6.9	7.7	-1.9	-6.2	-4.9
GTM	1.7	-4.1	-1.3	0.8	2.2
HND	13.2	9.2	8.3	11.0	10.0
HTI	40.7	42.8	4.9	31.9	24.0
MEX	32.3	35.2	-0.1	-15.8	-8.0
NIC	37.1	30.5	-3.8	-0.3	-2.3
PAN	-6.1	-7.4	9.8	3.6	3.5
PER	8.8	10.2	1.0	-8.2	-4.8
PRY	2.1	-22.0	-19.4	-10.5	-11.2
SLV	44.9	30.2	-4.2	5.5	5.5
URY	9.9	10.4	-26.4	-20.6	-23.4
VEN	-24.8	-24.0	-27.4	4.1	-9.5
Total	10.5	10.6	4.9	0.6	2.8

Notes: Change in indicator value between 1995 and 2016. ISO 3166-1 alpha-3 codes used for countries. *Source*: Prepared by the authors using the database of Moncarz et al. (2021).

Table 4: Correlation between openness and the number of LBR from PTAs

Openness indicator	1995	2016
Exports/Production	0.34*	0.51*
Imports/Expenditure	0.08	0.15

* Statistically significant at 1%.
Source: Prepared by the authors using the database of Moncarz et al. (2021).

Table 5: Elasticities' estimates from SGM

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
PTA_{ijt}	0.1742^{***}	0.0042			
$\text{PTA}_{ijt} \times \text{NLBR}_{it}$			0.0061^{***}	0.0035^{*}	0.0045^{***}
$\text{PTA}_{ijt} \times \text{NLBR}_{jt}$			0.0013	-0.0032^{*}	-0.0034^{**}
$\text{PTA}_{ijt} \times \ln(\text{MP}_{ijt})$		1.4823^{***}	0.5071	1.5150^{***}	1.3942^{***}
$\text{OPR}_{ijt} \times \ln(\text{MP}_{ijt})$		0.9929^{**}	1.6927^{***}	1.2199^{***}	1.5245^{***}
$\ln(\text{MFN}_{ijt})$		-7.1704^{***}	-6.3477^{***}	-5.9741^{***}	-5.9277^{***}
$\text{NLBR}_{it} \times \text{NLBR}_{jt}$				0.0002^{***}	0.0001^{***}
TC_{ijt}					1.6816^{***}
Observations	*58,655*	*58,655*	*58,655*	*58,655*	*58,655*

*** p<0.01, ** p<0.05, * p<0.1.

Note: Time sample spaced using 5-year windows.

Source: Prepared by the authors using the database of Moncarz et al. (2021).

Table 6: Import growth rates by region and contributions by mechanism, 1995-2015 (%)

Region	Change in Imports (%)	Contribution to change in imports			
		Export capacity	Import capacity	Libera-lization	Rest
TOTAL					
CSEA	551.5	152.0	98.7	304.4	−3.6
AFR	366.4	104.1	0.9	258.4	3.1
MES	348.5	85.7	111.5	127.2	24.1
PAC	279.3	78.1	117.7	103.7	−20.2
SEEA	275.3	115.2	117.1	87.7	−44.8
WORLD	**211.9**	**63.6**	**68.2**	**76.7**	**3.5**
CAC	217.2	54.1	59.8	66.0	37.2
EUR	138.0	32.2	34.4	64.8	6.6
NAM	247.8	70.4	88.0	48.5	40.9
SAM	231.8	58.2	117.8	32.9	22.9
INTRA-REGIONAL					
EUR	80.8	3.7	23.7	50.2	3.2
SEEA	184.0	102.7	71.8	47.1	−37.7
WORLD	**97.9**	**25.9**	**34.4**	**39.3**	**−1.8**
CSEA	54.5	34.2	7.8	27.9	−15.5
NAM	92.8	10.3	36.0	22.4	24.2
AFR	18.5	6.6	4.0	6.7	1.1
SAM	34.8	9.3	25.0	6.2	−5.7
CAC	30.2	8.0	7.9	6.1	8.2
PAC	9.3	−0.3	7.8	5.5	−3.7
MES	12.8	3.6	3.9	2.7	2.6
EXTRA-REGIONAL					
CSEA	496.9	117.7	90.9	276.5	11.8
AFR	348.0	97.5	−3.1	251.7	1.9
MES	335.7	82.1	107.6	124.5	21.5
PAC	270.0	78.4	109.9	98.2	−16.5
CAC	187.0	46.1	51.9	60.0	29.0
SEEA	91.3	12.4	45.3	40.6	−7.1
WORLD	**114.0**	**37.6**	**33.8**	**37.3**	**5.2**
SAM	196.9	48.8	92.8	26.8	28.5
NAM	155.0	60.1	52.0	26.1	16.7
EUR	57.2	28.5	10.6	14.6	3.4

Notes: Regions ordered by the contribution of trade liberalization.

Source: Own elaboration using results from column (5) in Table 5.