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Redefining Global Trade Patterns: BRICS, G7, and Technological Trade in Latin America

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Abstract
In 2024, new members joined the original BRICS countries, reinforcing their aspirations as a relevant global actor. This study examines Latin American countries' export structures orientation towards BRICS versus G7 markets. Using a unique dataset and a structural gravity model, we estimate the determinants of export intensity with a focus on the technological content of traded goods and assess whether integration with these two blocs offers distinct pathways for upgrading into higher-value segments of trade. Our findings reveal persistent structural constraints: while both blocs demand resource-intensive exports from Latin America, opportunities to expand mid- and high-tech exports remain limited. Results suggest that R&D activities and domestic technological capacities do not translate into greater high-tech export performance, highlighting structural difficulties of Latin American economies moving up the value chain and that global trade remains shaped more by the nature of demand in destination markets than by technology adoption at home.

Keywords: China, BRICS+; trade; investment; technical goods and innovation

JEL Codes: F14, F53, F61, O33, O38

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1. Introduction

The rise of emerging economies as central actors in global trade has reconfigured traditional patterns of international integration. The expansion of the BRICS group (Brazil, Russia, India, China, South Africa), which in 2024 incorporated Egypt, Ethiopia, Iran, Saudi Arabia, and the United Arab Emirates, represents a milestone in the consolidation of alternative coalitions to the economic order led by G7 economies. The G7 (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States) emerged in the early 1970s, as a platform for international coordination among leading industrialized economies seeking to address mounting global economic instability. The origins of the G7 and the BRICS groups reflect markedly different geopolitical moments and institutional logics. Over time, the G7 consolidated its influence by promoting core Western values and exercising substantial leverage through major international institutions, including the IMF and the World Bank, whereas the BRICS has positioned itself as a counterweight to Western hegemony and bases its agenda on principles of South-South cooperation. Unlike the G7's informal coordination, the BRICS has also established concrete institutions such as the New Development Bank and the Contingent Reserve Arrangement, seeking to challenge the Western-dominated architecture of global finance.

The expanding BRICS+ bloc currently accounts for approximately one-third of global GDP and nearly half of the world's population, positioning itself as a gravitational pole for developing economies, particularly those in Latin America whose export structures remain anchored in natural resources. For Latin American economies, this geopolitical reconfiguration raises fundamental questions about their development trajectories. Historically, the region has maintained close commercial ties with G7 markets, a relationship accompanied by trade agreements that, while facilitating market access, also reinforced specialization patterns based on static comparative advantages. Simultaneously, the emergence of China as the main trading partner for several countries in the region has intensified demand for raw materials, in some cases deepening export primarization. Cochrane and Zaidan (2024) noted that the growing weight of BRICS economies in terms of GDP, global trade, and control over strategic resources is undeniable, promoting shifts in world order unfolding through complex dynamics that cannot be fully explained from the perspective of trade relationships alone. In this context, questions emerge concerning whether integration with BRICS offers differentiated opportunities for technological diversification of Latin American exports or whether membership reproduces the primary specialization patterns observed in relationships with the G7.

The literature on economic development has extensively demonstrated that the composition of the export basket is not neutral for long-term growth (Hausmann et al., 2007; Lall, 2000; Dosi et al., 1990). Countries that manage to transition toward exports with higher technological content experience trajectories of productive learning, technological spillovers, and capability accumulation that sustain development. However, traditional trade theory, rooted in Ricardo (1817) and the Heckscher-Ohlin model (Heckscher, 1919; Ohlin, 1933), faces critical limitations when applied to structural change. While successfully predicting the resource-intensive export structure of many developing countries, trade patterns are treated as static equilibria, neglecting the dynamic effects of specialization on technological learning and capability accumulation (Chang, 2002). Moreover, technological convergence is assumed thereby negating persistent asymmetries in technological capabilities that constrain developing countries (Dosi et al., 1990).

An alternative framework emerging from evolutionary and Schumpeterian economics has challenged the explanatory capacity of mainstream trade theories. The technology gap perspective, formalized in the Dosi-Pavitt-Soete model (Dosi et al., 1990), identifies absolute technological advantages as the core determinant of trade patterns. In this framework, what ultimately determines a country's export profile is its global hierarchy of technology positioning, not its relative productivity ratios as emphasized by Ricardo. While empirical studies have confirmed that absolute advantages are fundamental determinants of trade patterns (Fagerberg, 1988; Dosi et al., 2015), within this perspective, comparative advantages appear only as ex-post outcomes of the underlying distribution of absolute technological advantages (Dosi & Tranchero, 2021).

Maintaining or closing technology gaps, rather than merely exploiting existing comparative advantages, becomes central to export competitiveness and results in a key policy implication for emerging markets. This perspective shifts attention toward dynamic processes of capability accumulation, underscoring the role of R&D investments, industrial learning, and national innovation systems in shaping trade patterns (Nelson & Winter, 1982; Bell & Pavitt, 1993). Different sectors generate markedly different trajectories of structural change, with manufacturing sectors traditionally considered the engine of growth due to their advantages associated with externalities, learning by doing, and greater innovation capacity (Hirschman, 1958; Stiglitz & Greenwald, 2014; Ahumada and Chang, 2025).

This study empirically examines the determinants of Latin America's trade insertion, differentiating by technological content of exports (Lall, 2000) and by destination bloc (BRICS vs G7). Employing structural gravity models estimated via Poisson Pseudo-Maximum Likelihood (PPML) following Santos Silva and Tenreyro (2006), we analyze whether domestic technological capabilities, measured through R&D and industrial readiness indicators from UNCTAD (2025), translate into greater export competitiveness in medium- and high-technology products, and whether this relationship differs systematically by destination market. We incorporate the concept of Multilateral Resistance Terms introduced by Anderson and van Wincoop (2003) through exporter and importer time fixed effects, as recommended by Feenstra (2004) and Yotov et al. (2016).

This paper makes three contributions to the existing literature. First, it provides systematic empirical evidence on the heterogeneous role of technological capabilities across export categories, showing that the relationship between domestic technological effort and export performance is not uniform but varies significantly depending on the technological intensity of the product. This distinction, largely absent from existing gravity models, is essential for understanding why aggregate measures of trade performance can mask divergent dynamics across sectors. Second, this paper examines whether the destination market itself conditions the possibilities for export upgrading, offering a direct empirical test of whether integration with BRICS versus G7 economies could generate different outcomes. The expansion of BRICS+ has been widely discussed as a driver of South-South trade expansion, yet its implications for export composition in developing regions remain empirically underexplored. Third, the situation of South and Central American economies, historically primary intensive economies, is highlighted in terms of whether a shift in trading partners manifests in potential technological upgrading. The evidence presented here suggests that neither bloc offers a clear pathway out of primary specialization, moreover, the role of the local technological capacity remains a key role for upgrading the export basket.

Our findings reveal persistent structural constraints. While both BRICS and G7 demand resource-intensive exports from Latin America, opportunities to expand medium- and high-technology exports remain limited for both groups. Results suggest that R&D activities and domestic industrial capabilities do not translate into greater high-tech export performance, especially toward G7 countries, while neither do significant upgrading patterns emerge in BRICS related markets. These findings illustrate the structural difficulties Latin American economies face in ascending global value chains, consistent with the technology gap perspective (Cimoli et al., 2009; Hidalgo & Hausmann, 2009; Tacchella et al., 2012), and further suggest that trade insertion continues to be determined more by the nature of demand in destination markets, than by domestic technological adoption.

The paper is organized as follows: Section 2 reviews the literature on BRICS+, G7, and technological trade; Section 3 presents the methodological strategy based on the gravity model framework of Tinbergen (1962) and its recent extensions; Section 4 describes the data and variables using the BLOCS database (Wu et al., 2025) and BACI (2025); Section 5 discusses the empirical results; and Section 6 concludes and discusses some policy implications.

2. Literature review

a. The G7 and BRICS groups

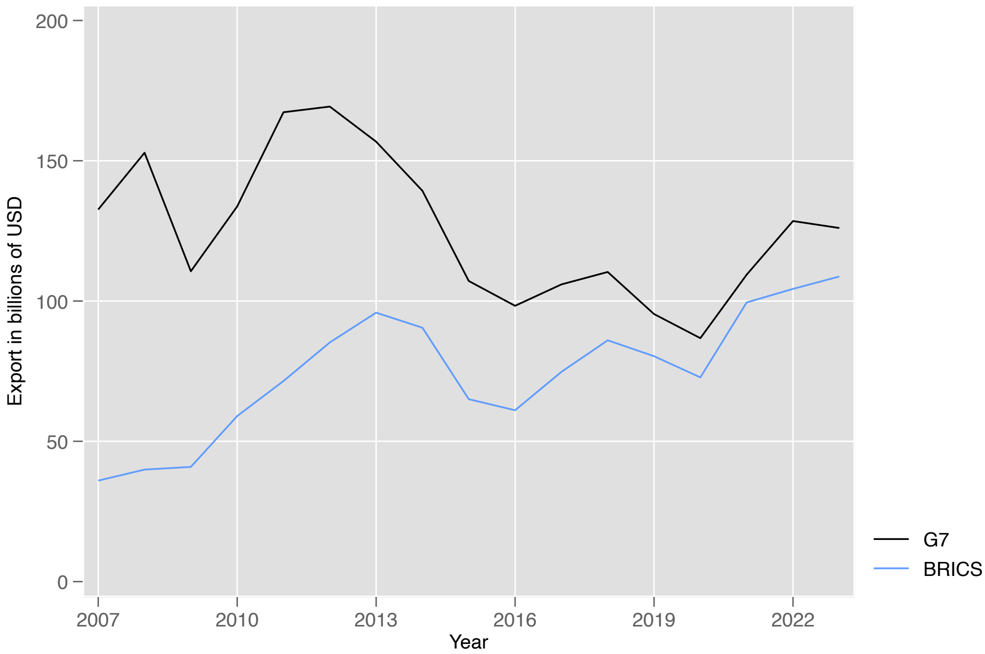
The origins of the G7 can be traced to the early 1970s, in the aftermath of the collapse of the Bretton Woods system, when the leading industrialized economies (France, Italy, Germany, Japan, the United States, the United Kingdom, and later Canada) sought stronger international coordination in a context of mounting global economic instability (Guzman and Stiglitz, 2024). The group emerged as a platform for international coordination, enabling these countries to jointly address issues related to trade, finance, and global security. Over time, the G7 consolidated its influence by promoting the core values associated with Western liberal democracies, such as the rule of law, political pluralism, and economic openness, and by exercising substantial leverage in major international institutions, including the IMF and the World Bank (Guzman and Stiglitz, 2024).

In contrast, the origins of the BRICS lie in a markedly different geopolitical moment; the group was constituted following the 2009 summit of Brazil, Russia, India, and China, with South Africa joining in 2010. Unlike the G7, the BRICS positioned itself as a counterweight to Western hegemony, grounding its agenda in principles of South–South cooperation and in priorities linked to the emergence of a new global economic landscape (Cochrane and Zaidan, 2024) including sustained economic growth, greater international cooperation, and the reform of international financial institutions. In pursuit of these goals, the BRICS has moved beyond the informal coordination mechanisms typical of the G7, establishing concrete institutions such as the New Development Bank and the Contingent Reserve Arrangement (Cochrane and Zaidan, 2024). These initiatives seek to challenge the Western-dominated architecture of global finance and to offer alternative development financing frameworks not tied to traditional G7 conditionalities.

As the BRICS increasingly presents itself as a challenger to the existing international order, it remains uncertain to what extent this coalition, now expanding into the so-called BRICS+ configuration with additional member states, will redefine international trade patterns or contribute to a restructuring of the global economic system. Although the increased weight of BRICS economies in terms of GDP, global trade, and control over strategic resources central to the energy transition is undeniable, scholars have emphasized that shifts in world order unfold through complex dynamics that cannot be fully explained from the perspective of trade relationships alone (Cochrane & Zaidan, 2024). In particular, despite their increasing economic prominence, the BRICS do not yet match the military and security capabilities embedded in the traditional power structures of the G7.

For many countries in the Global South, the implications of the advent of the BRICS remain insufficiently explored in the academic literature. Focusing specifically on Latin America—a region characterized by a resource-intensive export structure—the growing relevance of the BRICS becomes evident. In recent years, exports from Latin American economies to BRICS countries have expanded significantly, reaching levels that nearly match the value of their exports to G7 economies (Figure 1). This shift raises important questions about how emerging powers may reshape trade dynamics and the broader patterns of global economic integration for developing regions.

Figure 1: Total trade to BRICS and G7



Source: BLOCS

b. The importance of exports

A substantial body of research emphasizes that country export patterns matter for long-term economic development and technological catching-up (Hausmann et al., 2007; Lall, 2000; Dosi et al., 1990). The composition of the export basket, in particular its technological content, shapes both current competitiveness and future growth trajectories. Thus, understanding how Latin American economies integrate into global trade through BRICS versus G7 markets has important implications for development pathways in the Global South.

The theory of comparative advantage

Traditional trade theory, rooted in Ricardo (1817) and Heckscher-Ohlin (Heckscher, 1919; Ohlin, 1933), predicts that countries benefit from specializing according to their comparative advantages determined by relative factor endowments and productivity differences. Under neoclassical assumptions of technological convergence, perfect competition, and full resource utilization, specialization according to comparative advantage ensures efficient resource allocation and mutual gains from trade. Recent extensions (Krugman, 1979, 1980, 1991; Melitz, 2003; Melitz and Redding, 2021) introduced scale economies and firm heterogeneity (and even innovation) with a core maintenance of comparative advantages. Conclusions depend on the efficiency of international trade, insofar as abundant resource specialization allows all countries to be better off in terms of efficiency, thus understanding that trade is not a zero-sum game (Dosi & Tranchero, 2021).

While this framework successfully predicts the resource-intensive export structure of many developing countries, it faces two critical limitations when applied to structural change. First, it treats trade patterns as static equilibria, neglecting the dynamic effects of specialization on technological learning and capability accumulation (Chang, 2002). Second, it assumes technological convergence, thereby overlooking persistent asymmetries in technological capabilities that constrain developing countries behind the edge of the technological leaders (Dosi et al., 1990). Consequently, theories based solely on comparative advantage cannot explain why many resource-rich economies remain poor despite efficiently exploiting their endowments, nor why successful developers systematically violated their "natural" comparative advantages through industrial policy (Reinert, 2007).

Technological gap and the role of absolute comparative advantage

An alternative framework incorporating insights from evolutionary and Schumpeterian economics has challenged the explanatory capacity of mainstream trade theories for understanding long-run patterns of international insertion, particularly for technologically lagging economies. This influential alternative emerges from the technology differentials between countries -technology gap- and is formalized in the Dosi-Pavitt-Soete (DPS) model of international trade (Dosi et al., 1990), which identifies absolute technological advantages as the core determinant of trade patterns. This perspective argues that international specialisation is shaped not by relative intra-industry relative cost, as predicted by neoclassical comparative advantage, but by absolute cross-country differences in technological capabilities. In other words, what ultimately determines the export profile of a country is its position in the global hierarchy of technology.

The pattern of specialisation is thus expressed as a function of absolute productivity levels across sectors. A simplified representation is given by the following relationship:

$$X_{ij} = f\left(T_{ij}, C_{ij}, O_{ij}\right) \qquad (1)$$

where the export competitiveness of a country i in sector j (X_{ij}) depends on the technological level (T_{ij}), production costs (C_{ij}), and industrial organization (O_{ij}). While cost might be a factor for determining the international competitiveness in a sector, it is not the key explanation the mainstream trade theories predict. Instead, technological capacity is determinant in explaining the international competitiveness of countries (Dosi, et al. 1990). Dosi and Tranchero (2021) illustrate this using the aircraft industry; a country may attempt to reduce unit labour costs thus improving its *relative* cost structure, which does not grant the technological and organizational capabilities required to compete in aircraft manufacturing. Empirical studies have confirmed that absolute advantages are a more fundamental determinant of trade patterns (Fagerberg, 1988; Dosi et al., 2015).

Absolute levels of technology determine whether a country can participate in international trade at all. A country with large technology gaps may be excluded from trade in innovative goods regardless of its Ricardian type of comparative advantages in other sectors (Cimoli et al., 2009). It follows that comparative advantages appear only as ex-post outcomes of the underlying distribution of absolute technological advantages, and improving technological capability produces an increase in the market share of the world demand and reveals comparative advantages in that specific sector. Advanced countries currently export products even in those sectors where a comparative advantage is lacking, while developing countries, with limited technological capabilities, remain confined to a narrow range of primary products—precisely the opposite of Ricardian predictions (Hidalgo and Hausmann, 2009; Tacchella et al., 2012). The "Kaldor paradox" (Kaldor, 1978) also illustrates this issue based on evidence from the post-war period, where countries that experienced higher GDP growth were also those that exhibited higher growth in unit labor cost.

Empirical studies have further shown that technological capabilities are a significant determinant of export performance, though the relationship varies considerably across industries and levels of technological intensity. At the country and industry level, the evidence consistently shows that technological effort, measured through patents, R&D expenditure, or innovation indicators, positively affects export competitiveness (Fagerberg, 1988; Dosi et al., 1990; Wakelin, 1998; Carlin et al., 2001; Laursen and Meliciani, 2002). However, this relationship is heterogeneous. Wakelin, (1998) shows that, while technological effort is a robust determinant of high-technology export performance, unit labor costs remain a significant factor in low- and medium-technology sectors.

A key policy implication is therefore to maintain or close technology gaps, rather than merely exploiting existing comparative advantages, and this becomes central to export competitiveness. This perspective shifts attention away from static resource allocation toward dynamic processes of capability accumulation, underscoring the roles of R&D investments, industrial learning, and national innovation systems in shaping trade patterns (Nelson & Winter, 1982; Bell & Pavitt, 1993; Juhász, et al. 2024). Therefore, what a country exports matters fundamentally, as different sectors generate markedly different trajectories of structural change. Export specialization is consequently not neutral, rather heterogeneous across technological domains, with more technologically advanced sectors offering stronger learning opportunities, higher spillovers, and more favorable long-term growth dynamics than primary or low-technology activities (Dosi and Tranchero, 2021).

Another central element that emerges using this framework is the dynamics of structural change induced by trade insertion. Various theories (e.g., Dosi and Tranchero, 2021) show that economies devoted to the export of natural resources suffer from perpetual stagnation and have found the capacity to expand productive capabilities limited. Instead, manufacturing sectors have been considered the engine of growth resulting from advantages associated with externalities, learning by doing, and greater innovation capacity (Hirschman, 1958; Stiglitz & Greenwald, 2014).

When considering the export basket, various authors have focused on the type of products exported as fundamental for long-term productive dynamics. This is usually based on the capacities that industrial sectors have for externalities (Hirschman, 1958), spillovers (Cimoli, et al., 2009), learning by doing (Atkinson & Stiglitz, 1969), and learning by production (Andreoni and Chang, 2019). Similarly, efforts have been made to identify the technological composition of the export structure in order to identify the technological capacity that products have as a proxy for the country's technological level.

Lall (2000) and Lall et al. (2006) identify the technology embedded in exported goods based on technological classifications. In the former, a classification is developed based on the disaggregation of primary goods, manufactured goods based on natural resources, as well as low, medium, and high-technology manufactured goods. Furthermore, Lall et al. (2006) define the sophistication of exported products based on incorporated technology, developing a sophistication index. In both cases, a categorization of the export basket is developed as a proxy for the technological capacity of countries, using the disaggregation advantage that export data allow.

When considering disaggregation, comparative advantages appear only as ex-post outcomes of the underlying distribution of absolute technological advantages (Dosi and Tranchero, 2021). They are not the causal mechanism governing trade patterns, but rather the materialisation of deeper technological asymmetries. Thus, far from predicting specialisation across countries as the classical theory predicts (Ricardo, 1817; Heckscher, 1919; Ohlin, 1933), persistent gaps in technological capabilities lead to a structurally asymmetric global production (Cimoli, Dosi and Stiglitz, 2009; Hidalgo and Hausmann, 2009; Tacchella et al., 2012). Furthermore, a growing body of literature highlights the central role of industrial and technological policies in shaping countries' productive specialisation, particularly in sectors with higher value added. Absent such policies, economies with lower technological capabilities tend to specialise according to their existing absolute advantages, a process that often reinforces low-technology, resource-based production structures and limits long-term upgrading prospects (Chang, 2002; Reinert, 2007; Ahumada & Chang, 2025).

As acknowledged, infant industry protection was extensively employed by the United Kingdom before the repeal of the Corn Laws, 1721-1846 (Chang, 2003), a period during which policymakers and classical economists became strong advocates of free trade. As List (1885) argued, once the UK had acquired the industrial capabilities necessary to compete successfully in international markets, it effectively "*kicked away the ladder*" by promoting a liberal world economic order based on free trade principles. A similar pattern was observed in the United States, which maintained the highest tariff rates on manufacturing imports in the world between 1816 and 1945, using protectionist policies as a central instrument to advance toward the technological frontier (Chang, 2003).

Based on the key role of absolute technology levels, some authors have argued that international order has been established as a way to maintain the technological gap between countries (Ahumada and Chang, 2025). As a result, the contemporary international economic order has largely been shaped by the rules established in the post-war period under the General Agreement on Tariffs and Trade (GATT), and later consolidated with the creation of the World Trade Organization (WTO) in 1994. This order reflects, to a significant extent, the strategic interests and institutional influence of the United States, and other advanced economies (Guzmán and Stiglitz, 2024; Ahumada and Chang, 2025). Hence, developing countries face increasing constraints on their ability to implement policies aimed at enhancing domestic technological capabilities. These constraints are embedded in trade and investment agreements that restrict industrial policy space, limit knowledge diffusion, and strengthen intellectual property protections, thereby hindering technological catch-up with leading economies (Ahumada and Chang, 2025).

As a result, the current international economic order (i.e., intellectual property rules, technology licensing regimes, and standards regimes) tends to *preserve* technological monopolies and create significant barriers to technological catch-up for latecomer countries and helps explain the persistence of unequal patterns of international insertion (Cimoli, Dosi and Stiglitz, 2009; Dosi, Pavitt and Soete, 1990). Using this theoretical framework, our empirical strategy examines whether technological capabilities, measured by R&D capacity and industrial readiness, translate into export performance across products of varying technological sophistication. Specifically, we test whether the relationship between technological capabilities and export competitiveness differs systematically between BRICS and G7 destinations, and whether it differs across primary goods, low-, medium-, and high-technology manufactures.

3. Empirical Methodology

a. Gravity model

The gravity model has its foundations in establishing a functional relationship between economic entities based on the ability to explain bilateral trade as a result of distance and the size (or mass) of the two participants. In the original formulation by Tinbergen (1962), the gravity model posits that bilateral trade flows between two countries dependent on their economic size and the geographical distance separating them, expressed through the standard gravity equation. As a result, exports from country i to country j are predicted to be positively related to the GDP (representative of economic size) of both the exporting and importing economies, and negatively related to the distance between them. Thus, the standard equation for estimating the bilateral trade it can be expressed as follows:

$$ln\, x_{ij,t} = \beta_0 + \beta_1 dist_{ij,t} + \beta_2 gdp_{i,t} + \beta_3 gdp_{j,t} + \beta_4 D_{ij,t} + \varepsilon_{ij,t} \qquad (2)$$

In this framework, $x_{ij,t}$represents exports from country i to country j in period t. The variable $dist_{ij,t}$ captures the geographical distance between the two partners, while gdp enters the specification for both the exporting and the importing country. The term $D_{ij,t}$ includes a set of bilateral characteristics that typically influence trade flows—such as contiguity, common language, or colonial ties—together with other unobserved factors. These unobserved components may introduce bias into the estimated coefficients (Bacchetta et al., 2012), as they reflect country–specific or dyad–specific features that are not explicitly modeled which nevertheless shape trade patterns.

Moreover, the traditional gravity model treats bilateral relationships in isolation, implicitly assuming that trade between countries i and j depends solely on dyadic characteristics. This ignores that bilateral trade decisions are also shaped by relative trade costs with the rest of the world. To address this issue, Anderson and van Wincoop (2003) introduced the concept of Multilateral Resistance Terms (MRTs), arguing that what matters for bilateral trade is not only the directional trade barrier between i and j, but how that barrier compares to the set of barriers each country faces with respect to all other trading partners.

Operationalizing MRTs in empirical applications requires controlling for country-specific unobservables. Several authors have shown that this can be effectively achieved by including exporter and importer time fixed effects, which absorb all country-level characteristics that may influence trade flows (Feenstra, 2004; Yotov, et al., 2016). By incorporating these fixed effects, the specification accounts for unmeasured trade costs and restores the theoretical consistency of the gravity model.

A common limitation in empirical studies of international trade is the tendency to treat trade flows as homogeneous. In practice, these flows do exhibit substantial heterogeneity and as firms differ in their technological capabilities, industries vary in their structural characteristics, and sectors respond differently to trade costs. Ignoring this underlying heterogeneity can bias the estimated coefficients and obscure important patterns in the data (Chen and Novy, 2011).

To address this issue, we estimate trade flows disaggregated by the technological content of exports, following the classification proposed by Lall (2000). This disaggregation allows us to examine the factors that shape export performance in developing economies, particularly those that may support the transition toward more technologically advanced goods. The underlying idea being that the determinants of export flows are heterogeneous across products and therefore vary systematically with the level of technological sophistication they embody. Furthermore, the analysis differentiates results by destination market, distinguishing between exports directed to the G7 economies and those destined for the BRICS (here meaning the extended BRICS group), thereby allowing us to capture potential divergences in Latin America's patterns of international integration.

In this sense, we are developing the following specification:

$$X_{ijt} = exp(\beta_1 FDI\_IN_{ijt} + \beta_2 FDI\_OUT_{ijt} + \beta_3 R\&D_i + \beta_4 INDUSTRY_i + \beta_5 (R\&D_i \times INDUSTRY_i) + \beta_6 OTHER\_EXPORT_{ijt} + \beta_7 GDP_{it} XGDP_{jt} + \beta_8 IMPORT_{jt} + \beta_9 Z_{ij} + \mu_i + \mu_j + \mu_t) + \varepsilon_{ijt} \qquad (2)$$

Within this specification, X_{ijt} denotes exports from country i to country j in period t. The set of explanatory variables includes, first, inward and outward FDI stocks: FDI_IN_{it}, which captures the total stock of foreign direct investment received by country i from country j in period t, and FDI_OUT_{ijt} which represents the stock of outward FDI originating from country i to country j in the same period t.

In addition, the model incorporates two indicators derived from the Technology Frontier Readiness Index (UNCTAD, 2025). Based on this index, we use two sub-indexes for the exporting country i:

- $R\&D_i$, which captures technological research capacity; and
- $INDUSTRY_i$, which reflects industrial production capabilities.

We also include their interaction term, $R\&D_i \times INDUSTRY_i$, to capture complementarities between technological effort and industrial capacity. The specification further includes the variable $OTHER\_EXPORT_{ijt}$, which measures exports of the same product category from country i to the other geopolitical bloc. For example, when estimating exports from Latin American countries to the G7, this variable reflects the same product volume of exports to the BRICS.

We also control for standard gravity variables. $GDP_{it}XGDP_{jt}$ enter the model to capture the economic size of the pair of countries, and $IMPORT_{jt}$ measures the total imports of country j, which proxies for market absorption capacity. Finally, the vector Z_{ij} includes the usual bilateral controls widely used in gravity models, such as trade agreements and distance. Finally, μ_i and μ_j represent the fixed effect included for both origin and destination country, and μ_t is the time fixed effect.

This specification is estimated repeatedly across different trade flows. 2008-2023, disaggregated by both the technological content of exported goods and by destination market. Accordingly, we estimate the model separately for exports directed to BRICS countries and to G7 economies, and likewise for each technological category, primary products, and low-, medium-, and high-technology manufactures. The full construction of these variables and the classification criteria used are presented in detail in the following section on data and variables.

To estimate the specifications, we employ the Poisson Pseudo–Maximum Likelihood (PPML) estimator, which has become the standard approach for gravity model estimation. PPML offers several advantages over traditional OLS log-linearization: it naturally accommodates zero trade flows, produces robust estimates in the presence of heteroskedasticity, and preserves the multiplicative structure implied by the theoretical gravity model (Santos Silva & Tenreyro, 2006). These features make PPML a more reliable and theoretically consistent estimator for bilateral trade data. We now investigate the specific data.

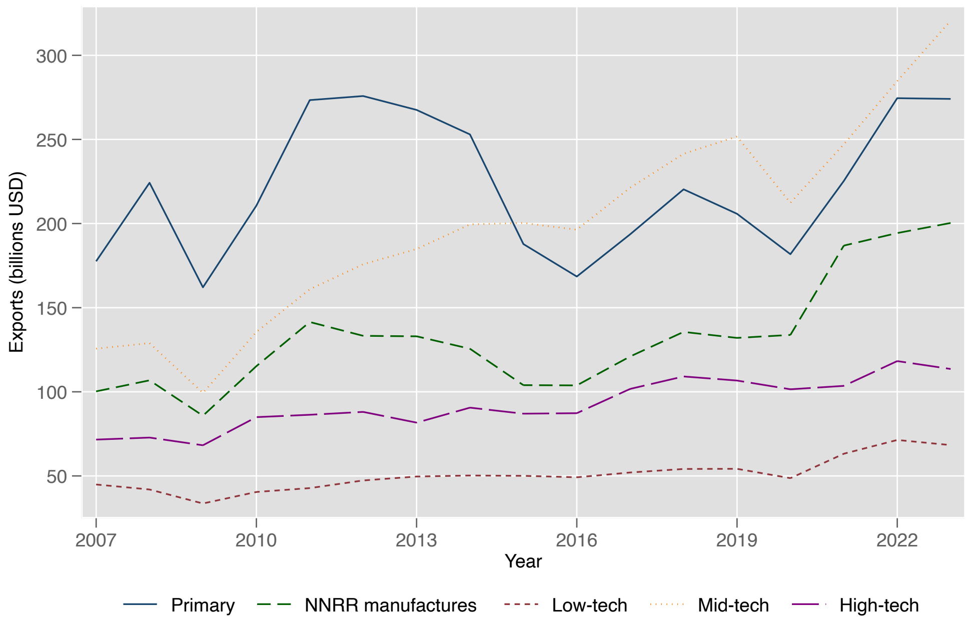
b. Data and variables

The data used in this study come from three main sources. First, we rely on the BLOCS database (Wu et al., 2025), which consolidates multiple datasets relevant for the analysis of international economics and trade relations in a bilateral panel. Among its components is the BACI database (BACI, 2025), which provides highly disaggregated bilateral trade flows at the product level. These flows are then transformed to classify exports according to their technological content, following the taxonomy proposed by Lall (2000). This classification distinguishes five categories of products: primary products, natural resource-based manufactures, low-technology manufactures, medium-technology manufactures, and high-technology manufactures.

Latin American economies exhibit significant heterogeneity in their export structures, and this heterogeneity has direct implications for the empirical strategy. As shown in Figures 2 and 3, the three largest economies in the region (Argentina, Brazil, and Mexico) contributed an important part of the total regional export basket in medium and high-tech manufactured products. Once these countries are excluded, the technological composition of regional exports shifts intensively toward primary goods, revealing the predominantly resource-based structure that characterizes the rest of the region. This structural difference reflects distinct productive trajectories, industrial histories, and insertion patterns into global value chains that would conflate fundamentally different dynamics within a single estimation.

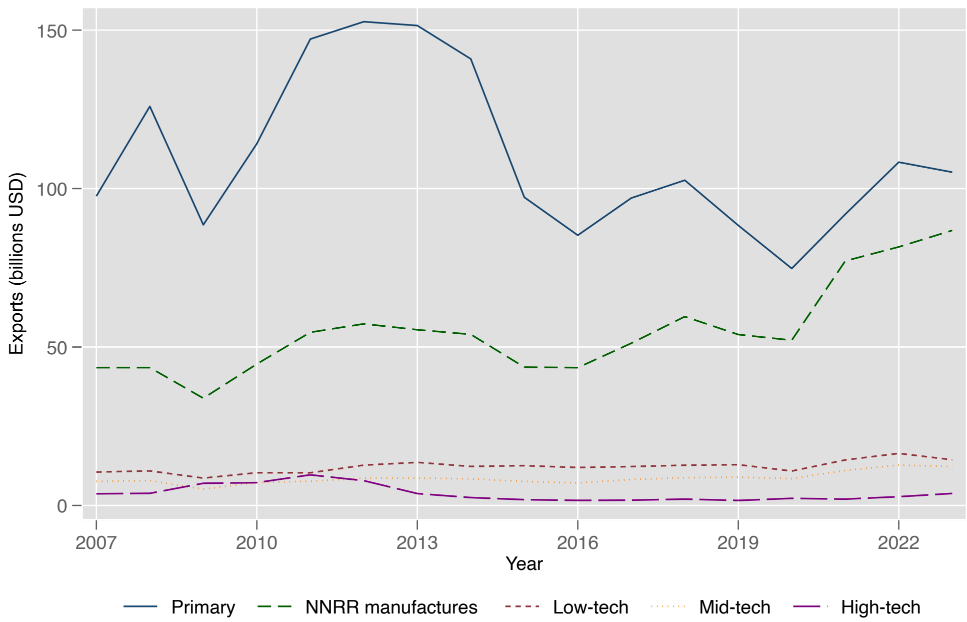
For this reason, the empirical analysis is conducted in two stages. The full sample, including Argentina, Brazil, and Mexico, provides an overview of south and central American economies' trade insertion in its entirety. A second estimation excludes these three economies, isolating the behavior of countries with predominantly primary export structures. This approach allows us to assess whether the determinants of export intensity, and the role of technological capabilities in particular, differ systematically between the two groups, and avoids the risk that the larger, more industrialized economies drive results that do not generalize to the rest of the region.

Figure 2: Total export from LATAM



Source: own elaboration using BLOCS and BACI.

Figure 3: Total export from LATAM (excluding Argentina, Brazil and Mexico)

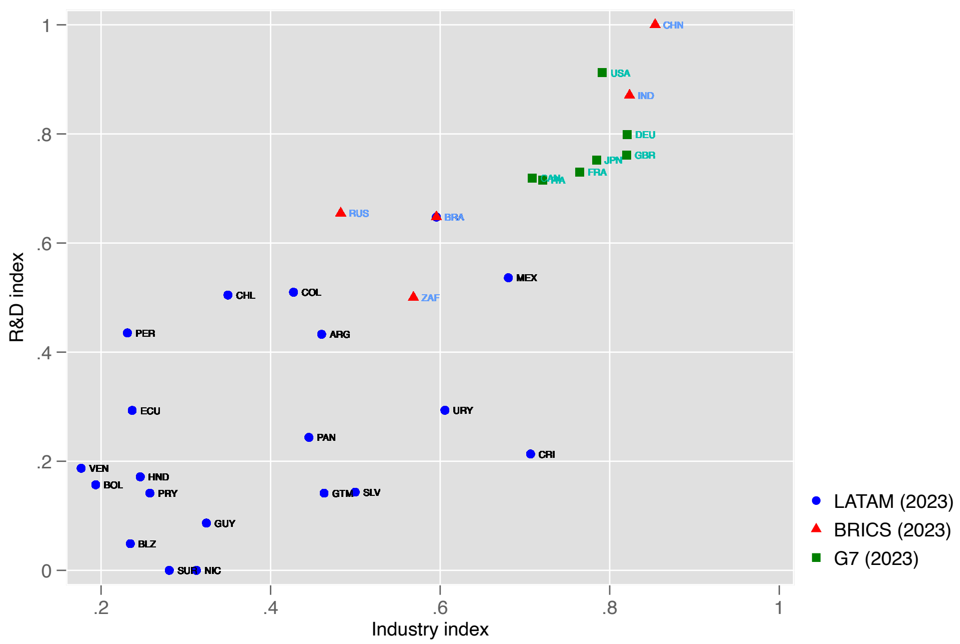


Source: own elaboration using BLOCS and BACI.

In addition, we incorporate the Frontier Technology Readiness Index (FTRI) from UNCTAD (UNCTAD, 2024) in order to measure the technological level in the estimation. This index aims to illustrate technological capacities at the national level, covering the use, adoption, and adaptation of technologies. While most of the empirical literature includes patents or R&D activity as proxies for technological level (Dosi et al., 2015), using the FTRI allows us to employ a broader measure of countries' technological capabilities, not restricted to the outcomes (patents) or inputs (R&D activity) of innovation, but rather considering a more holistic process and multiple factors (R&D activity, industry activity, ICT, skills, and access to finance) as necessary conditions for production. Recent studies have incorporated this indicator as a proxy for technological capacity (Han and Sun, 2024; Natanael, 2025).

Furthermore, as a robustness check, we implement additional estimations considering two key elements of this indicator: R&D activity and industry activity. In this manner, we aim to capture the role of R&D, which includes the number of publications and patents, and the industry activity indicator, which captures each country's capacity to use, adopt, and adapt frontier technologies within its productive structure. Finally, we also include the interaction term between these two subindicators in order to capture the complementarities arising from the nature of these components. Figure 4 illustrates the R&D capacity and industry activity indicators for Latin American countries relative to BRICS and G7 economies. This comparison highlights the technological and industrial gap between the region and both blocs, providing context for the explanatory variables used in the empirical analysis.

Figure 4: R&D activity and Industry activity, Frontier Technology Readiness Index (UNCTAD), 2023



Source: own elaboration using UNCTAD (2025)

Table 1: Variable descriptions

VARIABLES	Description	Source
Export	Total exports from country *i* to country *j*. As explained in the text, aggregate export flow is disaggregated in each estimation into four categories: primary goods, low-technology manufactures, medium-technology manufactures, and high-technology manufactures.	BACI
Frontier Technology Readiness Index (FTRI)	Index build to capture technological capacities related to physical investment, human capital and technological effort.	UNCTAD
R&D activity	Index build based on patent and publications for country *i*	UNCTAD
Industry activity	Index constructed from indicators of industrial activity capturing the use, adoption and adaptation of technology in the manufacturing, financial and ICT sectors for country *i*	UNCTAD
Export to the other bloc	Bilateral exports from country *i* to the alternative destination bloc (G7 or BRICS) for the same product category	BACI
FDI (instock)	Log of total FDI instock in country *i* from country *j*	BLOCS
FDI (outstock)	Log of total FDI outstock from the country *i* to country *j*	BLOCS
Trade agreement	Dummy variable that takes value of 1 if the country *i* has an RTA agreement with country *j*	BLOCS
Distance (Log)	Log of distance between most populated cities, measured in km	BLOCS
GDP (Log)	Log of GDP of country I multiplied by GDP of country j	BLOCS
Import (Log)	Log of import from country j to country i	BACI

The sample used in this study includes countries from Central and South America: Argentina, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Uruguay and Venezuela. Table 2 reports the descriptive statistics for the main variables for these countries as exporters, in relation to their destination markets and destination countries are considered for G7 (Canada, France, Germany, Italy, Japan, United Kingdom and United States) and BRICS (Brasil, China, India, South Africa and Russia). All data is from 2008-2023.

Table 2: descriptive statistics of the selected variables

Variable	Mean	SD	Min	Max
FTRI index_i	0.302524	0.194646	0	1
R&D index_i	0.2227019	0.1959827	0	1
$Industry\ index_j$	0.4638535	0.194213	0	1
FDI_{IN}	2.09454	3.162846	-3.827259	13.74245
FDI_{OUT}	1.368124	2.790786	-4.680045	13.89017
RTA	0.2612374	0.4393116	0	1
$Distance$	8.869323	0.7753348	0.6931472	9.899981
$Log\ (GDP_{it}XGDP_{jt})$	36.89746	3.212104	25.3413	47.45734
$Log\ (IMPORT_{jt})$	15.99356	4.673568	0.6931472	27.01208

4. Results and discussion

In this section, we present the main results derived from the identification strategy outlined above. Table 3 reports the estimated determinants of export performance, with the analysis disaggregated both by the technological content of exported products and by the destination country group. This structure allows us to examine whether the underlying drivers of trade differ systematically across technology categories and between exports directed to the BRICS and G7 economies.
The results of the estimations reveal substantial heterogeneity in the effects of the technological indicators on export performance across destinations and product groups. Table 3 reports the results for the full sample of Latin American countries, while Table 4 reports the estimations excluding the three major industrial economies (Argentina, Brazil, and Mexico).

When we use the FTRI as a proxy for the absolute level of technological capability (Dosi et al., 2015), we find heterogeneous results. In the full sample, significant and positive effects are only found for mid- and high-tech exports when the destination is BRICS, and mid-tech exports when the destination is G7. However, once Argentina, Brazil, and Mexico are excluded, the FTRI becomes statistically insignificant across all product categories and both destinations.

Table 3: Results for Latin American countries, 2008-2023.

	BRICS					G7				
VARIABLES	Primary	NNRR	lowtech	midtech	hightech	primary	NNRR	lowtech	midtech	hightech
FTRI Overall index	2.577	-0.124	1.968	3.783***	5.144**	0.176	-1.041	-0.0487	1.523**	2.311
	(1.784)	(1.518)	(1.819)	(1.009)	(2.266)	(0.683)	(1.003)	(0.355)	(0.714)	(2.541)
FDI (instock)	0.148***	-0.0268*	0.0101	-0.0310**	-0.0181	0.00189	0.00722	-0.0254***	0.0174*	0.0121
	(0.0266)	(0.0157)	(0.0232)	(0.0145)	(0.0287)	(0.00755)	(0.00941)	(0.00563)	(0.0101)	(0.0244)
FDI (outstock)	0.00722	-0.0339**	-0.0199	0.00713	0.00847	0.0259**	0.0572***	0.0131***	0.0386***	-0.0374*
	(0.0185)	(0.0164)	(0.0125)	(0.00980)	(0.0175)	(0.0113)	(0.0148)	(0.00461)	(0.00903)	(0.0194)
Trade agreement	1.132***	0.793***	0.209*	0.192*	0.174	-0.166**	0.149	0.125	-0.758***	-0.627
	(0.142)	(0.141)	(0.120)	(0.104)	(0.125)	(0.0710)	(0.128)	(0.0785)	(0.146)	(0.392)
Distance (Log)	-0.806***	-1.148***	-1.801***	-2.371***	-0.581***	-3.418***	-3.364***	-3.420***	-1.492***	-1.494***
	(0.216)	(0.163)	(0.423)	(0.139)	(0.189)	(0.191)	(0.309)	(0.145)	(0.241)	(0.453)
GDP (Log)	0.0881	0.815***	0.619***	0.642***	0.00269	0.363***	0.436**	0.208**	0.765***	-0.291
	(0.155)	(0.145)	(0.157)	(0.110)	(0.219)	(0.125)	(0.183)	(0.0882)	(0.117)	(0.270)
Population (Log)	-7.448***	-1.107	-3.719***	-5.782***	-3.499**	-0.860	-1.531	-0.808**	0.429	0.925
	(2.137)	(2.058)	(1.266)	(1.245)	(1.655)	(0.768)	(1.237)	(0.402)	(0.917)	(1.814)
Import (Log)	-0.142	-0.189**	-0.667**	-0.356***	0.543***	0.0136	0.394***	0.287***	0.513***	0.581***
	(0.122)	(0.0859)	(0.262)	(0.0823)	(0.100)	(0.0692)	(0.0914)	(0.0461)	(0.0970)	(0.207)
Export to the other bloc	-0.205	0.334**	0.704***	0.257***	0.514***	0.0629	-0.0267	0.166***	0.200***	0.374***
	(0.266)	(0.168)	(0.131)	(0.0700)	(0.100)	(0.0535)	(0.0927)	(0.0319)	(0.0565)	(0.0831)
Constant	207.2***	17.94	94.32***	147.0***	80.06**	47.91***	52.70**	45.03***	-30.88	-0.916
	(55.84)	(52.17)	(31.37)	(31.49)	(40.70)	(16.41)	(26.75)	(8.846)	(22.75)	(43.65)
Observations	1,277	1,277	1,277	1,277	1,277	1,449	1,449	1,449	1,449	1,449

SE in parentheses. * p<0.10 ** p<0.05 *** p<0.01

FE: year, importer, exporter

Note: estimates performed using STATA PPML 2008-2023. Multilateral resistance fixed effects are included.

Table 4: Results for Latin American countries, excluding Argentina, Brazil, Mexico, 2008-2023.

			BRICS					G7		
VARIABLES	Primary	NNRR	lowtech	midtech	hightech	primary	NNRR	lowtech	midtech	hightech
FTRI Overall index	2.084	-1.138	0.00936	0.836	2.718	1.277	-1.209	-0.665	0.429	2.501
	(1.806)	(1.444)	(3.277)	(1.473)	(3.192)	(0.838)	(1.138)	(0.531)	(0.935)	(2.594)
FDI (instock)	0.108***	-0.0248	-0.00562	-0.0768***	-0.261***	-0.0286***	-0.00970	-0.0106	0.0425***	0.0894***
	(0.0305)	(0.0159)	(0.0309)	(0.0251)	(0.0484)	(0.00977)	(0.0141)	(0.0105)	(0.0146)	(0.0293)
FDI (outstock)	-0.0924***	-0.100***	-0.0196	-0.0262	-0.0422	0.0444***	0.00603	-0.0212	-0.0370**	-0.192***
	(0.0330)	(0.0181)	(0.0265)	(0.0254)	(0.0563)	(0.0132)	(0.0114)	(0.0152)	(0.0157)	(0.0354)
Trade agreement	1.562***	0.455**	0.586***	0.0164	-0.0755	-0.190***	0.403***	0.0977	-0.138	-0.882***
	(0.198)	(0.193)	(0.157)	(0.118)	(0.203)	(0.0721)	(0.118)	(0.0821)	(0.0875)	(0.250)
Distance (Log)	-1.812***	-0.988***	-2.291***	-3.586***	-3.080***	-2.806***	-3.477***	-4.011***	-0.336	-0.842
	(0.398)	(0.237)	(0.682)	(0.247)	(0.496)	(0.242)	(0.235)	(0.268)	(0.330)	(0.978)
GDP (Log)	-0.583***	0.691***	0.468**	0.141	0.699**	0.558***	0.229	0.207	0.862***	-2.847***
	(0.206)	(0.179)	(0.190)	(0.166)	(0.284)	(0.156)	(0.212)	(0.182)	(0.197)	(0.654)
Population (Log)	-8.692***	-2.805*	-2.410	-2.811	-5.125	0.689	-1.458	-0.247	-1.189*	8.510***
	(2.512)	(1.688)	(2.785)	(2.750)	(3.383)	(0.829)	(0.894)	(0.411)	(0.692)	(3.014)
Import (Log)	0.302**	-0.170*	-0.597**	-0.332***	-0.234	-0.195***	0.174***	0.123*	0.532***	0.995***
	(0.146)	(0.0957)	(0.261)	(0.120)	(0.194)	(0.0734)	(0.0613)	(0.0654)	(0.0894)	(0.180)
Export to the other bloc	0.0406	0.106	0.231	0.628***	0.456***	0.0689	-0.0293	0.0721*	0.261***	0.256***
	(0.278)	(0.116)	(0.173)	(0.101)	(0.108)	(0.0528)	(0.0801)	(0.0400)	(0.0501)	(0.0856)
Constant	250.1***	65.26	73.28	99.76	122.6*	3.224	64.41***	40.69***	-9.393	-68.40
	(61.58)	(43.14)	(67.36)	(65.42)	(74.08)	(17.14)	(18.46)	(9.254)	(14.91)	(59.68)
Observations	1,087	1,087	1,087	1,087	1,087	1,179	1,179	1,179	1,179	1,179

SE in parentheses. * p<0.10 ** p<0.05 *** p<0.01

FE: year, importer, exporter

Note: estimates performed using STATA PPML 2008-2023. Multilateral resistance fixed effects are included.

This suggests that the significant effects found in the full sample are largely driven by these three economies, which concentrate the higher portion of the mid and high-tech export of the region (Figure 3). For the remaining Latin American countries, which are predominantly primary commodity exporters with limited manufacturing bases, the aggregate level of technological capability does not appear to be a robust determinant of export performance even in technologically intensive segments. In this sense, the FTRI captures a dimension of technological capability that is only operative for economies that have already achieved a degree of industrial diversification. For most Latin American countries, whose export structures remain concentrated in primary commodities, the index proves insufficient as an explanatory variable, given their limited participation in technologically intensive export categories. We perform further robustness checks to verify this finding.

Tables 5 and 6 present the results of a robustness check that replaces the FTRI with its two-constituent subindex (R&D activity and industry activity) along with their interaction term, allowing for an explicit assessment of the complementarity between technological and productive capabilities. The results show that, in both the full and restricted samples, the direct effect of R&D activity on low-tech exports toward BRICS destinations is negative and statistically significant, while the interaction term between R&D and the industry index is positive and significant. In the restricted sample, this same pattern extends to mid-tech exports, where the interaction term also becomes positive and significant once the three major economies are excluded. This complementarity pattern is consistent with a large body of work emphasizing that investment in innovation translates into export competitiveness only when countries have accumulated the productive capabilities needed to absorb, adapt, and deploy new knowledge (Cimoli, Dosi & Stiglitz, 2009; Hausmann & Rodrik, 2003). In this sense, technological effort is not a substitute for industrial capacity, rather, the two reinforce each other, and R&D activity only generates positive export effects beyond a certain threshold of industrial development (see Figures A5 and A6 for marginal effects).

For exports toward G7 countries, the picture is markedly different. In high-tech categories, both R&D activity and industry activity enter with positive and significant direct effects, but their interaction term is large and negative across both samples. As a result, the net marginal effect of R&D turns negative once the industry index exceeds a threshold, meaning that for exporters with moderate-to-high industrial capacity, additional R&D capability is associated with lower high-tech export flows to G7 markets. This counterintuitive result may reflect a structural insertion pattern: Latin American countries with relatively high industrial capacity but limited frontier R&D tend to be integrated into G7 supply chains as assemblers or providers of intermediate goods, a role that does not require (and may not benefit from) further R&D investment. Countries with stronger R&D profiles, by contrast, may compete in different niches or face distinct market barriers that the gravity framework does not fully capture.

Table 5: Results for Latin American countries using subindex of R&D activity and industry activity.

	BRICS					G7				
VARIABLES	Primary	NNRR	lowtech	midtech	hightech	primary	NNRR	lowtech	midtech	hightech
R&D index	3.307	-1.459	-3.351**	-0.332	-5.271	1.182	0.792	-1.706***	-0.423	6.828**
	(2.233)	(1.475)	(1.523)	(1.892)	(3.748)	(0.865)	(1.273)	(0.512)	(1.244)	(3.145)
Industry index	0.711	-1.927**	0.254	0.142	1.572	0.301	1.753***	0.918***	1.696***	10.89***
	(1.727)	(0.883)	(1.029)	(1.045)	(2.125)	(0.493)	(0.667)	(0.323)	(0.543)	(2.568)
Interaction term (R&D X Industry)	-3.926	0.0594	4.181*	3.222	1.661	-0.405	-3.204	0.289	0.432	-17.05***
	(3.459)	(2.709)	(2.136)	(2.698)	(3.505)	(1.576)	(2.070)	(0.847)	(1.856)	(3.556)
FDI (instock)	0.152***	-0.0362*	0.00901	-0.0227	-0.0275	0.00801	0.00684	-0.0277***	0.0241**	-0.0104
	(0.0265)	(0.0187)	(0.0236)	(0.0150)	(0.0283)	(0.00830)	(0.00970)	(0.00574)	(0.00997)	(0.0230)
FDI (outstock)	0.00522	-0.0421***	-0.0244*	0.0106	0.0106	0.0274***	0.0541***	0.00988**	0.0385***	-0.0117
	(0.0206)	(0.0152)	(0.0129)	(0.00984)	(0.0200)	(0.0101)	(0.0154)	(0.00441)	(0.00961)	(0.0145)
Trade agreement	1.131***	0.818***	0.205*	0.224**	0.142	-0.206***	0.198	0.225**	-0.687***	-0.749***
	(0.147)	(0.141)	(0.120)	(0.103)	(0.117)	(0.0748)	(0.129)	(0.0889)	(0.158)	(0.286)
Distance (Log)	-0.799***	-1.184***	-1.800***	-2.291***	-0.593***	-3.421***	-3.436***	-3.582***	-1.471***	-1.925***
	(0.222)	(0.167)	(0.438)	(0.145)	(0.182)	(0.194)	(0.308)	(0.153)	(0.254)	(0.361)
GDP (Log)	0.102	0.869***	0.603***	0.624***	0.0221	0.299**	0.570***	0.314***	0.728***	0.109
	(0.158)	(0.151)	(0.153)	(0.116)	(0.204)	(0.151)	(0.185)	(0.0978)	(0.132)	(0.200)
Population (Log)	-7.362***	-1.170	-4.050***	-7.076***	-3.465**	-0.676	-1.353	-0.0776	0.387	-0.359
	(2.191)	(2.050)	(1.284)	(1.337)	(1.556)	(0.791)	(1.243)	(0.361)	(0.927)	(1.635)
Import (Log)	-0.147	-0.215**	-0.669**	-0.308***	0.540***	0.0138	0.350***	0.214***	0.514***	0.380**
	(0.126)	(0.0859)	(0.269)	(0.0847)	(0.0944)	(0.0714)	(0.0893)	(0.0504)	(0.102)	(0.153)
Export to the other bloc	-0.230	0.468**	0.640***	0.281***	0.443***	0.0448	0.00456	0.105***	0.172***	0.0855
	(0.264)	(0.189)	(0.109)	(0.0900)	(0.116)	(0.0504)	(0.0882)	(0.0325)	(0.0617)	(0.0799)
Constant	205.6***	17.66	105.2***	177.7***	84.04**	46.21***	42.84	27.06***	-28.31	22.10
	(57.88)	(52.12)	(31.81)	(33.67)	(39.04)	(16.99)	(27.24)	(8.018)	(23.01)	(37.67)
Observations	1,277	1,277	1,277	1,277	1,277	1,449	1,449	1,449	1,449	1,449

SE in parentheses. * p<0.10 ** p<0.05 *** p<0.01

FE: year, importer, exporter

Note: estimates performed using STATA PPML 2008-2023. Multilateral resistance fixed effects are included.

Table 6: Results for Latin American countries, excluding Argentina, Brazil, Mexico, 2008-2023.

	BRICS					G7				
VARIABLES	Primary	NNRR	lowtech	midtech	hightech	primary	NNRR	lowtech	midtech	hightech
R&D index	3.049	-2.327	-3.901**	-3.916**	1.812	-0.545	-1.387	-1.519**	-1.409	7.855**
	(2.268)	(1.462)	(1.801)	(1.760)	(3.191)	(0.957)	(0.974)	(0.658)	(1.081)	(3.699)
Industry index	-2.576*	-0.571	-0.0818	-2.658**	3.711**	0.784	1.132	0.285	-0.237	11.12***
	(1.501)	(0.890)	(3.164)	(1.319)	(1.850)	(0.646)	(0.703)	(0.440)	(0.607)	(1.820)
Interaction term (R&D X Industry)	-3.359	1.806	6.945**	7.554**	5.413	1.243	1.580	0.310	3.780*	-20.47***
	(3.962)	(2.816)	(3.082)	(3.543)	(6.674)	(1.741)	(1.805)	(1.479)	(2.160)	(5.944)
FDI (instock)	0.0992***	-0.0401**	-0.0141	-0.0869***	-0.285***	-0.0289***	-0.0127	-0.0208*	0.0423***	0.0707**
	(0.0286)	(0.0187)	(0.0396)	(0.0246)	(0.0543)	(0.0112)	(0.0138)	(0.0117)	(0.0155)	(0.0301)
FDI (outstock)	-0.0902***	-0.104***	-0.0236	-0.0314	-0.00991	0.0410***	0.00204	-0.0231*	-0.0414***	-0.180***
	(0.0317)	(0.0194)	(0.0249)	(0.0259)	(0.0600)	(0.0132)	(0.0114)	(0.0127)	(0.0151)	(0.0401)
Trade agreement	1.583***	0.471**	0.560***	0.00117	-0.0986	-0.194***	0.414***	0.159**	-0.146	-0.741***
	(0.194)	(0.193)	(0.149)	(0.118)	(0.199)	(0.0709)	(0.116)	(0.0781)	(0.0893)	(0.229)
Distance (Log)	-1.814***	-1.071***	-2.350***	-3.647***	-3.030***	-2.791***	-3.436***	-4.049***	-0.324	-0.768
	(0.402)	(0.229)	(0.681)	(0.252)	(0.473)	(0.248)	(0.229)	(0.264)	(0.334)	(0.880)
GDP (Log)	-0.609***	0.730***	0.389*	0.0453	0.703**	0.548***	0.200	0.272	0.726***	-1.822**
	(0.202)	(0.179)	(0.221)	(0.177)	(0.283)	(0.173)	(0.239)	(0.181)	(0.220)	(0.811)
Population (Log)	-10.45***	-2.552	-2.285	-3.756	-5.376	0.547	-1.135	0.0949	-1.152*	3.515
	(2.562)	(1.672)	(2.312)	(2.786)	(3.311)	(0.778)	(0.851)	(0.424)	(0.679)	(3.218)
Import (Log)	0.291**	-0.173*	-0.593**	-0.318***	-0.254	-0.190**	0.189***	0.102	0.537***	0.952***
	(0.138)	(0.0952)	(0.262)	(0.121)	(0.189)	(0.0749)	(0.0603)	(0.0628)	(0.0910)	(0.173)
Export to the other bloc	0.235	0.0871	0.167	0.507***	0.453***	0.122**	-0.0234	0.0692*	0.231***	0.219**
	(0.237)	(0.116)	(0.172)	(0.119)	(0.0889)	(0.0495)	(0.0766)	(0.0421)	(0.0553)	(0.108)
Constant	291.2***	58.96	75.17	128.8*	125.8*	6.130	56.90***	31.17***	-4.241	-9.823
	(62.99)	(42.46)	(52.66)	(66.92)	(71.84)	(16.43)	(17.22)	(10.000)	(15.43)	(50.04)
Observations	1,087	1,087	1,087	1,087	1,087	1,179	1,179	1,179	1,179	1,179

SE in parentheses. * p<0.10 ** p<0.05 *** p<0.01

FE: year, importer, exporter

Note: estimates performed using STATA PPML 2008-2023. Multilateral resistance fixed effects are included.

The role of trade agreements (RTA) shows an interesting result; the negative and statistically significant effect of RTAs with G7 countries on exports of technologically intensive goods, particularly mid- and high-tech manufactures. For exports toward BRICS destinations, by contrast, RTAs display a positive and significant effect across primary and NNRR categories, but not in higher-technology segments. This asymmetry resonates with a strand of the literature arguing that the international trade regime shaped by hegemonic economies has contributed to reproducing a global division of production (Stiglitz & Guzman, 2024). In this framework, international rules tend to maintain an unequal trade structure in which advanced economies specialize in high-technology manufactures while technologically lagging countries remain concentrated in natural-resource-based activities. The negative association between RTAs with G7 countries and high-tech exports can be interpreted as consistent with this structural pattern and rather than fostering technological upgrading in developing economies, these agreements may reinforce existing specializations. Thus, the effect of RTA with the G7 appears aligned with lower exports of technologically sophisticated goods, reflecting the broader structural dynamics emphasized in the literature.

Another central finding concerns the role of exports toward the competing destination bloc. Across most specifications, the coefficients associated with this variable are positive and statistically significant, particularly in manufactured categories. This indicates that higher exports of a given product category to one bloc (BRICS) tend to be associated with higher exports of the same category to the alternative bloc (G7) rather than substituting for them. We therefore find no evidence of trade diversion away from one bloc toward the other. Instead, the results suggest a form of complementarity. Countries capable of expanding exports of a particular product type to one set of partners also tend to do so with the other. This pattern is consistent with the interpretation that export performance is driven by underlying productive and technological capacities (Dosi & Tranchero, 2021; Hidalgo & Hausmann, 2009).

The remaining control variables perform broadly in line with theoretical expectations. Distance enters negative and highly significant across all specifications. GDP is positive and significant in most manufactured categories, reflecting the role of market size as a trade determinant. Population enters negative and significant in several BRICS-bound specifications, particularly for primary goods, which may reflect the tendency of larger Latin American economies to diversify export destinations beyond BRICS markets. FDI variables and import penetration display more heterogeneous results across product categories, though their inclusion does not affect the qualitative interpretation of the main variables of interest.

5. Conclusion

This study examined the determinants of Latin American trade insertion in the global economy, with particular emphasis on the technological content of exports and differences between BRICS and G7 markets. Our results reveal patterns that pose significant challenges for the region's productive development strategies. We find that the relationship between domestic technological capabilities and export performance is highly conditional. R&D investments do not automatically translate into greater competitiveness in medium- and high-technology products, their effectiveness depends critically on the presence of complementary industrial capabilities. This finding reinforces the evolutionary perspective emphasizing that technological upgrading is a cumulative process (Cimoli et al., 2009; Hausmann & Rodrik, 2003). As the technology gap literature predicts (Dosi et al., 1990; Dosi & Tranchero, 2021), absolute levels of technology determine whether a country can participate in international trade in innovative goods. In both G7 and BRICS markets, the region remains specialized in resource-intensive exports, with limited possibilities to expand participation in higher value-added segments. Even though BRICS and G7 show slightly different patterns of insertion to Latin American economies, the main tendency found is consistent with the view that economies with limited technological capabilities remain confined to a narrow range of primary products (Hidalgo and Hausmann, 2009; Tacchella et al., 2012).

A particularly relevant finding is the negative effect of trade agreements with the G7 on high-technology exports. This result resonates with critical literature arguing that the international trade regime shaped by hegemonic economies has contributed to reproducing a global division of production (Stiglitz and Guzmán, 2024). In contrast, we find no evidence of trade diversion between blocs: higher exports to BRICS are positively associated with higher exports to G7, suggesting both destinations are complementary rather than substitutes.

These findings carry important implications for productive development policies in Latin America. They underscore the need for industrial and technological policies that simultaneously strengthen R&D investment and capacities for absorption, adaptation, and productive scaling (Nelson and Winter, 1982; Bell and Pavitt, 1993). Moreover, they suggest that mere diversification of trading partners will not automatically alter specialization patterns unless accompanied by domestic productive transformations. The lesson from historical development patterns remains relevant: successful catch-up requires policy space for industrial upgrading strategies (Chang, 2003; Reinert, 2007).

This study offers evidence that the reconfiguration of the global economic order around BRICS expansion has not substantially altered the structural constraints Latin American economies face in technologically diversifying their exports. Moving toward more dynamic patterns of international insertion will require not only leveraging opportunities offered by emerging markets, but fundamentally transforming the domestic productive and technological capabilities that determine what and how countries export. We acknowledge that our analysis does not capture firm-level heterogeneity or participation in global value chains, and that institutional and geopolitical factors may shape trade patterns beyond our specifications here. Future research should address these dimensions to provide a more comprehensive understanding of Latin America's evolving global trade insertion.

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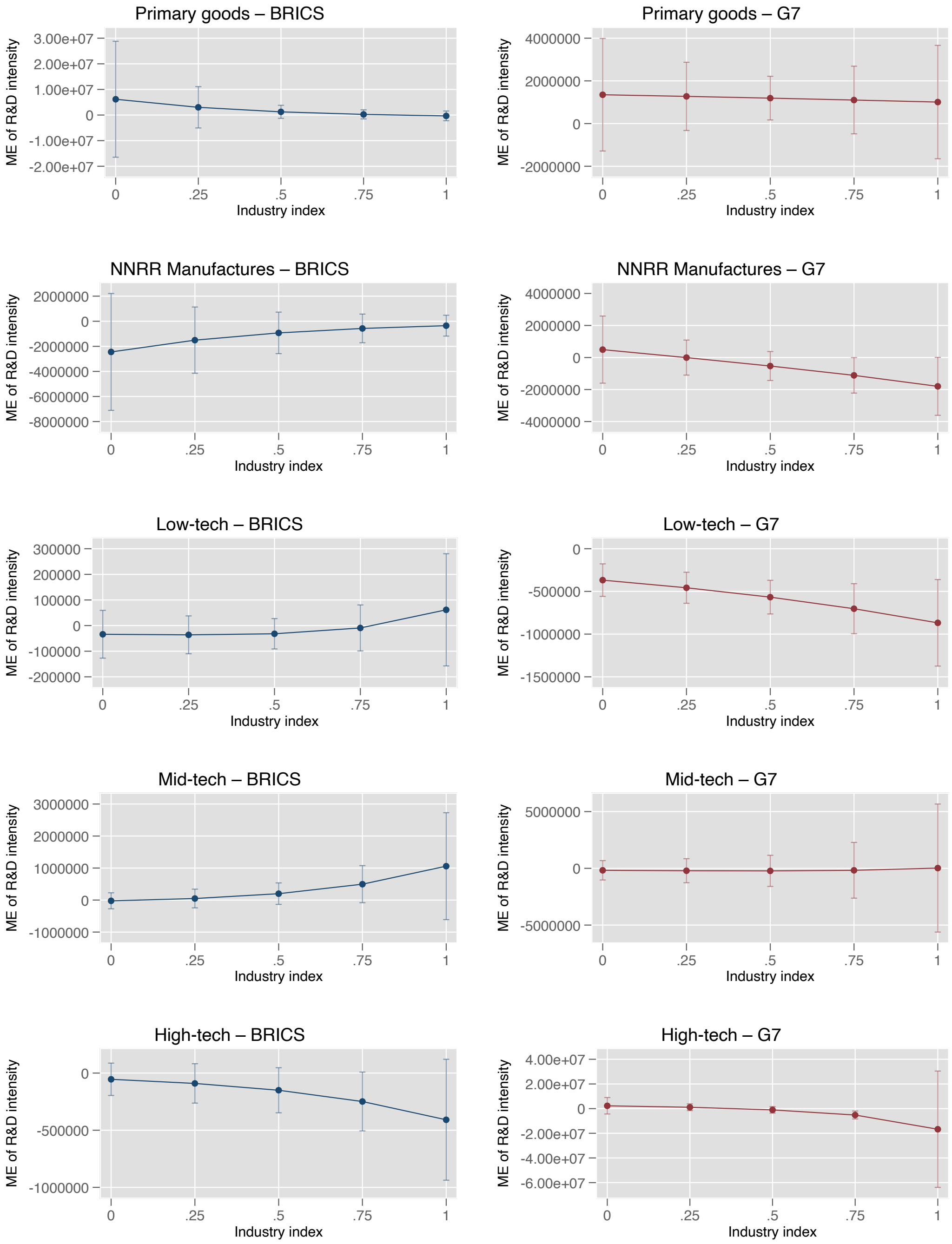
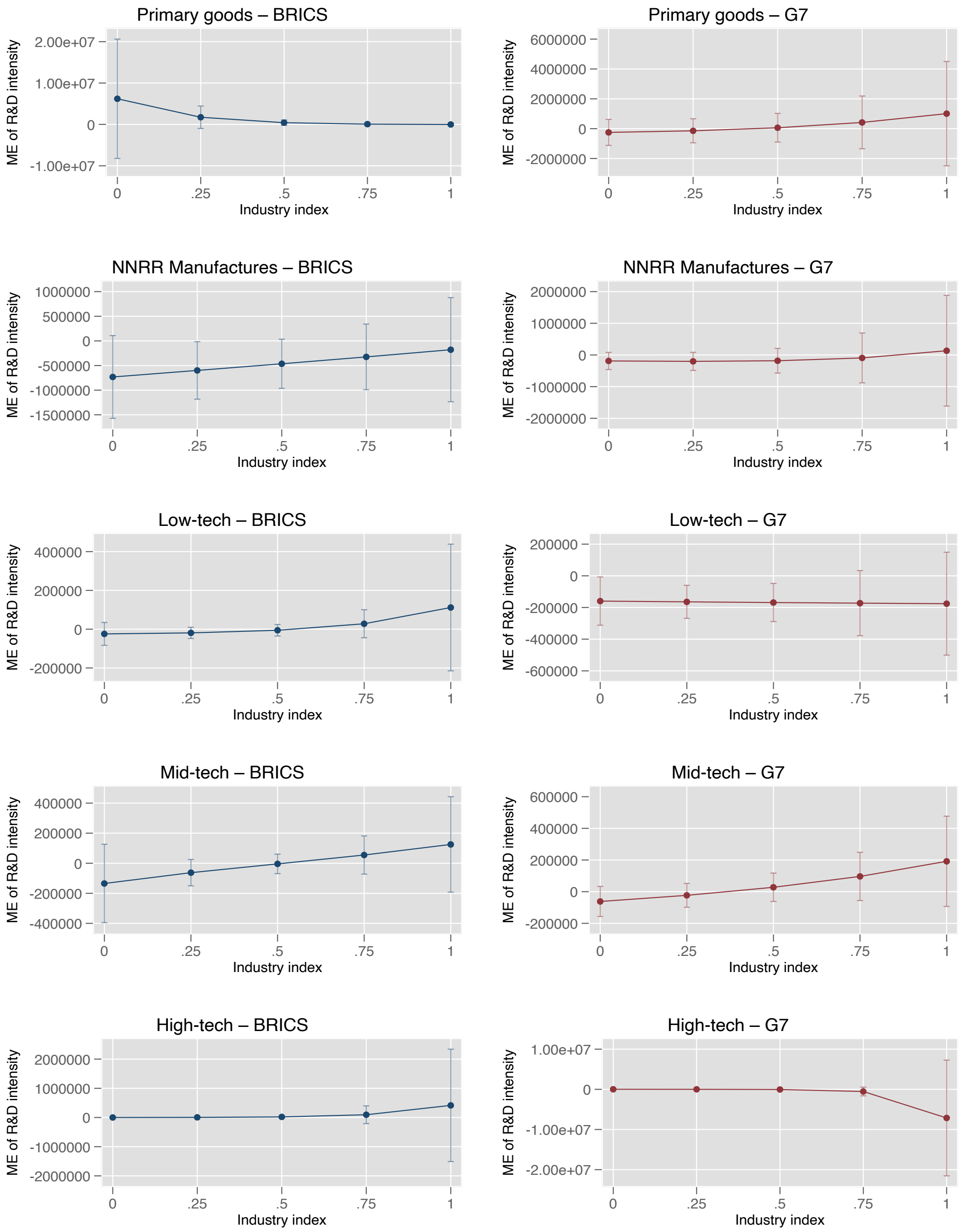
Annex

Figure A5: Marginal effect of R&D activity across industry activity



Source: own elaboration from estimations

Figure A6: Marginal effect of R&D activity across industry activity, excluding Argentina, Brazil, and Mexico



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