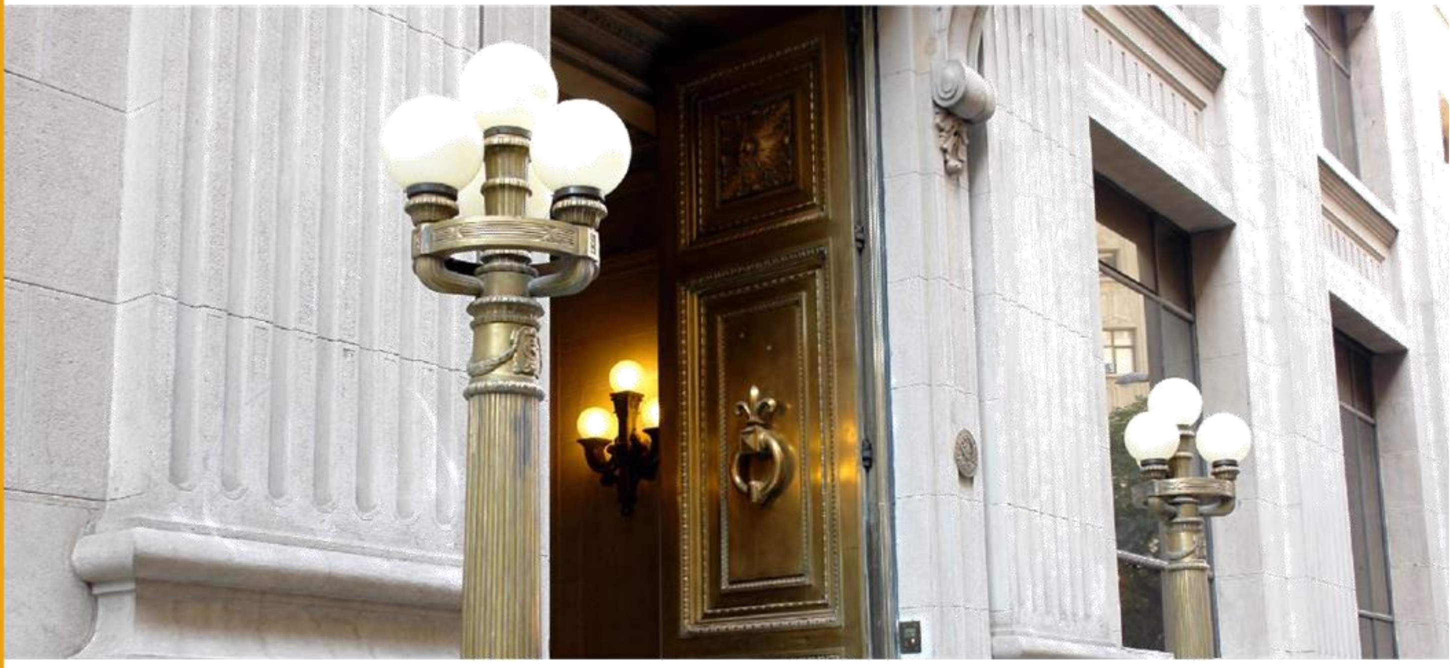
DOCUMENTOS DE TRABAJO

Effect of Tariffs on Chilean Exports

Lucas Bertinatto
Lissette Briones
Jorge Fornero

N° 1065 Diciembre 2025
BANCO CENTRAL DE CHILE



banco central Chile

Documentos de Trabajo del Banco Central de Chile
Working Papers of the Central Bank of Chile
Agustinas 1180, Santiago, Chile
Teléfono: (56-2) 3882475; Fax: (56-2) 38822311

Documento de Trabajo N° 1065 | **Working Paper N° 1065**

Effect of Tariffs on Chilean Exports

Lucas Bertinatto, Lissette Briones y Jorge Fornero[1,2]

Resumen

Este trabajo analiza los efectos de corto y largo plazo de los aranceles en las exportaciones chilenas utilizando una nueva base de microdatos. El panel considera registros de exportaciones de firmas por producto y destino, aranceles y otros controles macroeconómicos, entre 2003 a 2024. Proponemos una medida arancelaria relativa para considerar la desviación del comercio. Estimamos que un aumento de 10 puntos porcentuales en los aranceles en el país de destino implica una caída de 5.9% de las exportaciones bilaterales en el segundo año y consideran el margen intensivo. Este efecto se ve parcialmente compensado por el aumento de los envíos a otros destinos. Los resultados son heterogéneos entre los distintos sectores. Los aranceles reducen significativamente los niveles de exportación, y los resultados se mantienen robustos a cambios en las especificaciones, incluyendo controles de Acuerdos de Libre Comercio (ALC).

Abstract

This paper examines the short- and long-term effects of tariffs on Chilean exports using a novel micro-level panel from 2003 to 2024. The dataset includes firm-level exports by product and destination, tariffs, and macroeconomic controls. A relative tariff measure captures trade diversion. We find that a 10 percentage points increase in destination-country tariffs leads to a 5.9% drop in bilateral exports in the second year, focusing on the intensive margin. This effect is partially offset by the increase in shipments to other destinations. Findings are heterogeneous across sectors. Tariffs significantly reduce export levels, with results robust to alternative specifications, including Free Trade Agreements (FTA) controls.

[1] Emails: lbertinatto@bcentral.cl; lbriones@bcentral.cl; jfornero@bcentral.cl. We thank comments from seminar participants at the Central Bank of Chile, annual SECHI meeting 2025, XLIII Annual Economist Meeting 2025 BCRP, Patricia Tovar, Luis Felipe Céspedes and Marco Rojas. The authors thank Bernabé López-Martin and Emiliano Luttini for their initial contributions to this research during 2018–2019. Special thanks are extended to Pedro Moncarz for sharing tariff data of Argentina.

[2] The views expressed are those of the author and do not necessarily reflect the views of the Central Bank of Chile (CBC) or its board members. This study was developed within the scope of the research agenda conducted by the CBC in economic and financial affairs of its competence. The CBC has access to anonymized information from various public and private entities, by virtue of collaboration agreements signed with these institutions. To secure the privacy of workers and firms, the CBC mandates that the development, extraction and publication of the results should not allow the identification, directly or indirectly, of natural or legal persons. Officials of the Central Bank of Chile processed the disaggregated data. All the analysis was implemented by the authors and did not involve nor compromise the Chilean Customs Service.

1. Introduction

Trade policy typically develops and consolidates gradually over time, as it aims to achieve long-term objectives such as fostering domestic development with focus on specific industries, negotiating mutually beneficial trade agreements to strengthen relationships with trading partners, incentivizing foreign direct investment, promoting economic growth, etc. To reach these goals, trade policy relies on various instruments, including trade quotas, import tariffs, among others.

Beginning 2025, policymakers and practitioners have shown a renewed interest in analyzing the effects of tariffs on economies, following the announcement and subsequent imposition of higher tariffs by the United States (US) government on its imports.[3] Higher US tariffs are expected to affect Chile and other countries exports to the US through different channels. First, as tariffs are passing through to prices, exports could fall because of a decrease in US demand for imported goods. If exporters earn less profits from US sales, they're more likely to look for new markets to sell to, which reduces exports to the US and increases exports to other countries. From a general equilibrium perspective, higher US tariffs could also reduce Chilean exports by lowering global demand.[4] Finally, the decline in terms of trade due to the tariffs could depreciate the Chilean peso, which could mitigate the negative impact on exports.

Although tariffs have been widely studied, there's a lack of research in Chile, especially using detailed micro data. We believe that studying how tariffs have affected exports in the last decades is necessary to shed light on explaining recent events. This paper fills this gap in existing research.

The objective of this paper is to quantify the direct impact of tariff changes on Chilean exports. For this purpose, we have built a novel micro-level panel dataset of tariffs that covers more than 20 years (2003–2024). Among main variables, it underscores Chilean firms' exports and tariff disaggregated both at the product–destination level. The empirical strategy is to use panel econometric techniques to estimate exports' elasticities to changes in tariffs and other macroeconomic factors. This micro-level panel data offers advantages over aggregated data as tariffs historically apply to specific traded goods. As a result, the exogeneity of tariffs from the perspective of the exporter allows us to precisely identify their effect on exports. Furthermore, the use of microdata allows for robust estimates of exports elasticities to real exchange rates and external demand, given the exogenous nature of these variables with respect to firm-level exports.

Our empirical strategy follows the study by Fitzgerald and Haller (2018), which builds a micro-level panel for Irish firms to analyze the effects of tariffs and real exchange rates on exports and firm dynamics. However, a key distinction in our work lies in the definition of the tariff variable. Drawing on the richness of our dataset, we construct a *relative* tariff measure that

[3] On April 2, 2025, President Trump signed an executive order imposing a minimum tariff of 10 percent on all US imports, with higher tariffs on imports from 57 specific countries. Following the announcements, various countries have initiated negotiations, many of which had not concluded.

[4] Channels of propagation are at least two. First, the demand channel considers a fall in world trade flows and economic activity, adjustment in employment, and adverse spillovers due to integration to global production networks. Second, deterioration of expectations due to increase of uncertainty and more restrictive financial conditions, which may trigger investment projects to be put on hold.

compares a country's tariff with the average tariff imposed by the rest of Chile's trading partners. In the event of a tariff shock from a specific country, exporters may be incentivized to redirect part of their shipments toward alternative destinations where tariffs remain unchanged. Thus, estimates based on *relative* tariffs consider the effect of trade diversion, which is an advantage over the absolute tariffs.

The regressions also include: (i) the bilateral real exchange rate (RER), and (ii) the gross domestic product (GDP) of Chile's main trading partners. A higher RER is expected to stimulate exports by lowering the relative cost of domestic goods compared to the rest of the world. The foreign GDP approximates the size of external demand for local products. These variables are typically included in gravity models used to analyze international trade flows.

Beginning with short-term results, the findings suggest that changes in tariffs have a statistically significant impact on Chilean exports. A tariff increase of 10 percentage points (pp) by the destination country would result in an average 5.9% drop in exports of the affected product to that country, one year after the tariff is imposed, focusing exclusively on the intensive margin.[5] Part of this effect would be mitigated by a redirection of trade to other trading partners. Regarding export elasticities to RER and trading partners GDP, our estimates are aligned to those previously reported in studies that use aggregate data (Fornero *et al.*, 2020, Table 2). One percent increase in RER can explain an average surge in exports of 0.5% accumulated in the first two years. Moreover, one percent increase of trading partners' GDP is consistent with Chilean total exports that increase in the range 0.9 to 1% (unitary elasticity). Regarding *manufacturing* exports, the estimated effects of tariffs, RER and external demand are similar, although there is heterogeneity between industries. In general results are robust when excluding the pandemia from the data.

In the long-term specifications, the level of exports is also determined by tariffs. This relationship remains robust even after accounting for institutional changes through the inclusion of control variables aligned with the implementation of FTAs, which highlights the importance of considering the change in tariffs once an FTA is signed to estimate the change in exports. Finally, with more detailed information available than in previous studies, we found smaller long-run elasticities for trading partners' GDP, whereas export elasticities to RER are positive and statistically different from zero in all specifications.

The structure of this study is as follows. Section 2 summarizes the relevant literature. Section 3 describes the data. Section 4 outlines the methodology. Section 5 presents main results and robustness exercises. A final section concludes.

[5] Amiti *et al.* (2020) and other authors find that the temporal dynamics of tariff effects on exports exhibit time lags. Moreover, the timing is heterogeneous across sectors. Fitzgerald and Haller (2018) study the responses of Irish firms that start or stop exporting, as well as changes in export revenues of incumbent exporters in response to changes in tariffs and real exchange rates. We leave these questions for future research.

2. Literature review

The effects of tariff adjustments are a core topic in standard textbooks on international trade theory. Economic models suggest that the impact of changes in import tariffs depends on the elasticity of both exports and imports. These elasticities, in turn, are influenced by a range of factors, including the demand and supply elasticities in both the exporting and importing countries, the relative size of the countries in global trade, the ability to redirect shipments to alternative destinations, the efficiency of inventory management systems, among others.

A vast empirical literature based on gravity equations quantifies changes in international trade flows explained by the income of the trading partner, the degree of competitiveness of the country, trade transaction costs including transportation, trade policies such as tariffs, among other factors.

Fitzgerald and Haller (2018) use microdata for Ireland to estimate export responses to changes in tariffs and the real exchange rate. The results suggest an elasticity of aggregate exports with respect to tariffs of between -1.5 and -3.5 on impact, and between -2 and -5 in the long run.

A key precedent for the recent U.S. tariff hikes was the 2018 trade conflict, when the U.S. raised tariffs on Chinese goods, prompting retaliatory measures and a subsequent decline in bilateral trade. Fajgelbaum *et al.* (2024) argue that tariffs in one (large) country affect trade flows globally, not just bilaterally. Export reorientation, product complementarity or substitutability, and destination interdependence are key mechanisms. They find that on average, bystanders took the space of China and increased their exports to the US and to the rest of the world in products with higher US-Chinese tariffs. Additional documentation about production reallocation is provided by Haberkorn *et al.*, 2024 and Hoang and Lewis, 2024. Fajgelbaum and Khandelwal (2020) compile and synthesize findings from previous studies, while also outlining the main mechanisms, conditions, and transmission channels. According to the classical trade model, if a large country like the US increases its tariffs, the model predicts incomplete tariff pass-through to prices, as US decisions significantly affect global prices and trade flows. However, the empirical evidence is mixed: some studies on the US–China trade war find full tariff pass-through to prices—consistent with what would be expected for small open economies—e.g., Amiti *et al.* (2020), Cavallo *et al.* (2019); while others report evidence of incomplete pass-through (Ma and Ning, 2024; Yu *et al.*, 2024).

The evidence shows that China's retaliatory tariffs had a strong impact on US export volumes to China compared to other destinations. In particular, Fajgelbaum *et al.* (2020) find that a 10 pp increase in Chinese tariffs leads to an almost equivalent reduction (9.9%) in US exports to China at the product level, and unitary elasticity at the variety level. Amiti *et al.* (2020) find that for goods still exported, the response is roughly one-to-one, with elasticity gradually doubling over time, showing some heterogeneity across sectors. Minondo (2023) analyzes the tariffs imposed to Spanish firms by the US in October 2018 and shows that bilateral trade flows often drop with delay. The study also documents that exporters use strategies to avoid or neutralize the impact of tariffs.

Overall, the literature shows that higher tariffs lead to lower bilateral trade flows, though the effects are heterogeneous and may take time. This delay can happen for several reasons, for example, firms may struggle to quickly adjust to new conditions, and shifting exports to other countries can be costly. Over time, however, firms adapt by changing their production and export strategies or modifying products to avoid tariffs.

Some studies also examine the 2018 trade war using general equilibrium models, which help simulate how tariff increases might play out under different scenarios. For example, Itakura (2021) looks at realistic scenarios and estimates the likely impact on GDP in both the US and China, also highlighting key effects on global value chains.

Several studies analyze the effects of recent announced increases in tariffs. Cavallo *et al.* (2025) study short-run tariff pass-through and find partial adjustment within a matter of weeks, using high-frequency granular data. Other studies analyze financial markets or monetary policy responses to tariffs with structural dynamic models (Bianchi and Coulibaly, 2025, Kalemli-Özcan *et al.*, 2025, Monacelli, 2025). Ignatenko *et al.* (2025) highlight adverse impacts on both the U.S. and its trading partners. Auclert *et al.* (2025) estimate that higher 10 pp tariff could reduce U.S. GDP by 0.66%, rising to 2.3% with retaliation. Similarly, McKibbin *et al.* (2025) project GDP losses up to 2.1% under retaliatory scenarios. These findings indicate that tariffs may have notable economic effects, particularly in the presence of retaliation.

In the case of Chile, there is no existing literature estimating the impact of tariff changes on exports. Álvarez & Andreasen (2025) examine the influence of Free Trade Agreements (FTAs) on Chilean exports during last three decades using microdata and provide robust evidence of the positive impact of these FTAs on export levels and the variety of products exported. Presumably, the signature of FTA formalizes negotiations to reduce tariffs and enhance trade among interested parties; however, the direct effect of tariffs changes on exports is not examined. Previous studies use sectoral and aggregate exports data, e.g., Fornero *et al.* (2020), Carrasco *et al.* (2015) and Cabezas *et al.* (2004) analyze the response of Chile's manufacturing exports to bilateral real exchange rate fluctuations and changes in external demand. Earlier studies on Chile include Aravena (2005), Agosin (1999), and De Gregorio (1984). Finally, Fornero *et al.* (2020) also analyzes the value added in exports by removing the foreign content.

We created a detailed dataset that tracks exports by firm, product, and destination, along with tariffs by product and destination. This structure lets us measure how exports react to tariffs more precisely, since tariffs apply to specific products. The next section explains the context, describes the dataset, and outlines how we built the key variables used in our analysis.

3. Data

The dataset covers the period from 2003 to 2024, with observations recorded annually. The following subsections provide descriptive context to motivate the selection of countries and explain the construction of export variables derived from Chilean firms' invoice data, tariff schedules, and macroeconomic indicators commonly used in traditional gravity models.

3.1. Exports

3.1.1. Overview: GDP relevance, sectoral composition, and destination patterns

Chile is a small open economy that has actively participated in global trade, with exports about 35% of GDP (See Table 1.a) and imports around 32% (average 2003 and 2024). Goods exports represent 30.3%, led by mining —especially copper–, followed by manufacturing, and agricultural, forestry, and fishing products. Services contribute around 4.3%.

Table 1

a. Chile's Export Structure. Exports to GDP (%) (1)

Exports of goods and services 34.6				
Goods 30.3				Services
Agriculture, Forestry, & Fishing	Mining 16.8		Manufacturing	
	Copper Mining	Other Mining		
2.2	13.5	1.6	11.3	4.3

b. Destination of Exports (nominal share) (2)

Manufacturing Ranking	Trading partners	Manufacturing	Total
1	United States	17.1	13.7
2	Japan	9.5	9.6
3	China	8.9	25.1
4	Brazil	6.1	4.9
5	Peru	5.5	2.2
6	Bolivia	4.8	1.8
7	Mexico	4.3	2.4
8	Netherlands	3.7	3.5
9	South Korea	3.4	5.8
10	Argentina	2.8	1.2
11	Colombia	2.2	1.0
12	Spain	1.9	2.0
14	United Kingdom	1.7	1.1
16	Belgium	1.4	1.2
18	Italy	1.4	2.5
19	Germany	1.4	1.7
21	Russia	1.3	0.6
22	France	1.2	2.1
37	Finland	0.2	0.3
	Total considered	**78.8**	**82.7**

c. Description of extensive margins in micro level database (3)

	Total	Manufacturing	Chemicals	Food products, beverages & tobacco	Forestry & wooden furniture, pulp, paper & others	Metal products, machinery & equipment	Other manufacturing products
# Firms	2895	1638	529	542	235	434	236
# Products	2285	1638	388	272	158	523	297
Avg # markets/firm	2.4	2.2	1.9	3.5	1.5	1.4	1.5
Avg # markets/product	7.0	7.3	6.1	8.4	8.1	8.3	6.4

Notes: Sample period 2003–2024. (1) Nominal ratios from National Accounts. (2) Rank calculations use data from Central Bank of Chile, MM USD FOB. (3) Calculated on micro data base from Chilean National Customs Service.
Source: own calculations based on data from the Central Bank of Chile and Chilean National Customs Service.

Table 1, panel b shows average shares of Chilean nominal exports to different destination countries. It ranks Chile's manufacturing export destinations by their share of total manufacturing exports. The rightmost column reports share of total exports for comparison. Our analysis focuses on countries that are significant trading partners, defined as those countries whose trade flows with Chile exceeded one percent of the total annual trade.[6] Hence, the destination list of shipments accounts for 79% and 83% of manufacturing and total exports, respectively. Overall, the data reveals significant variation, with a marked increase in shipments to China, which has emerged as Chile's primary export destination. The United States, Chile's second most important trading partner, has maintained a relatively stable position throughout the period under review. In contrast, exports to other destinations—particularly certain European countries and Colombia—have experienced declines.

The use of a small set of countries enhances the tractability of the analysis; however, two important considerations should be kept in mind when interpreting the results. First, excluding smaller trading partners may obscure broader export dynamics, such as emerging demand in niche markets or strategic shifts in firms' regional diversification. Second, although the selection of 19 countries is broadly representative of Chile's overall export destinations, the analysis is conducted at the product level. Thus, it could be the case that for certain firms, products and/or sectors, the 19 countries considered represent all their exports, while for others, the percentage of exports considered is less than 80%.

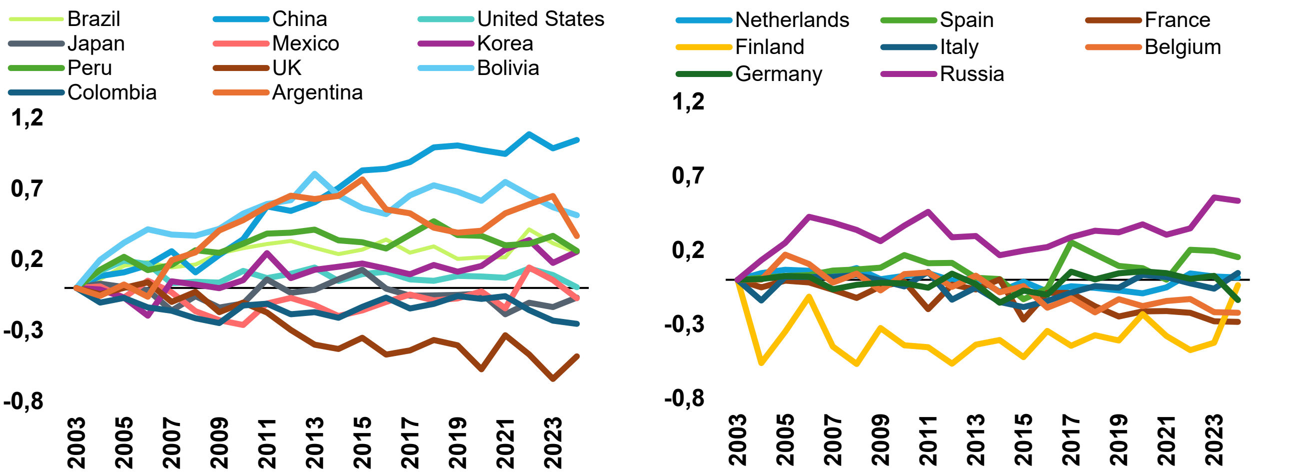
3.1.2. Exports invoice data

Exports microdata comes from the Chilean National Customs Service, 8-digit level. For the study we focus on export volumes measured in quantities of each product at the highest disaggregation by each firm and destination. From this point forward, we shall refer to the concept as 'exports' or 'export volumes'. Given the sparsity of the micro-level data set, we keep firms in the sample if they have export records for two consecutive years, a requirement to estimate exports annual growth. Note that this requirement implies that the calculated elasticities account for the effect of tariffs only considering the intensive margin, without incorporating the effect that the change in tariffs has on the entry or exit of exporters. Table 1 Panel c describes the extensive margin of the database. Comparing the number of firms and products (first and second rows), we notice that for total exports the number of firms is slightly larger than the number of exported products, whereas there is heterogeneity between subsectors.[7] In addition, the average markets per firm vary from 1.5 to 3.5 destinations, and the average markets per product range from 6.1 to 8.4. In the case of manufacturers, each firm exports to 2.2 destinations, and each product is exported to 7.3 countries on average.

[6] The list of relevant countries aligns with those included in the multilateral real exchange rate index calculated by the Central Bank of Chile. This selection ensures consistency with established macroeconomic indicators and enhances the comparability of trade-related analyses. The countries included are: Argentina, Bolivia, Brazil, China, Colombia, the United States, Japan, Mexico, Peru, South Korea, Russia, and the following European Union members: Germany, Belgium, Spain, Finland, France, Italy, the Netherlands, and the United Kingdom.

[7] Product codes come from the Harmonized System (HS), which has been updated over 21 years to include new and more specific goods.

Figure 1
Average volume of exports by country
(points, difference relative to 2003 levels)



Notes: Export volumes: Quantities exported. The figure reports log exports volume (exp) coefficients (B) for each country following Fitzgerald *et al.*, based on the following regression: $exp_{jt} = \alpha_0 + B \cdot D + v_j + \varepsilon_{jt}$, where D represents a set of year dummies (2004-2024), B is the matrix of estimated coefficients (relative to 2003), and v_j is a product fixed effect. Source: own calculations based on transactional data from Chilean National Customs Service.

3.2. Macroeconomic variables

The literature often includes two key macroeconomic variables: (i) the bilateral RER, which reflects a country's competitiveness relative to its export destination, and (ii) trading partners' GDP to measure income in the importer country.

The bilateral RER is computed using the nominal exchange rate, multiplied by either the producer price index (PPI) or consumer price index (CPI) of the destination country, and divided by Chile's CPI. These data are obtained from Bloomberg and the International Monetary Fund (IMF). The choice between the CPI/PPI follows the methodology used for the external price index (IPE) and Chile's official multilateral RER. The data is published monthly, and we use annual averages (index 2020=100). Real GDP data are obtained from the OECD, except for Bolivia and Peru that comes from national statistical offices. In line with standard gravity models of international trade, it is assumed that the real GDP of the destination country approximates its external demand for Chilean goods, which is assumed given (Demidova *et al.*, 2024). Furthermore, since the regression is done with microdata, there are no endogeneity issues when using the bilateral RER or external GDP as regressors. The statistical appendix provides further details.

3.3. Tariffs

We construct a novel micro-level dataset of *ad valorem* tariffs by product (at the 6-digit level) for Chile's nineteen main trading partners, covering the period from 2003 to 2024. We used several data sources and concordances to obtain a final database compatible with Harmonized System customs code year 2022 (HS22). Sources include World Trade Organization

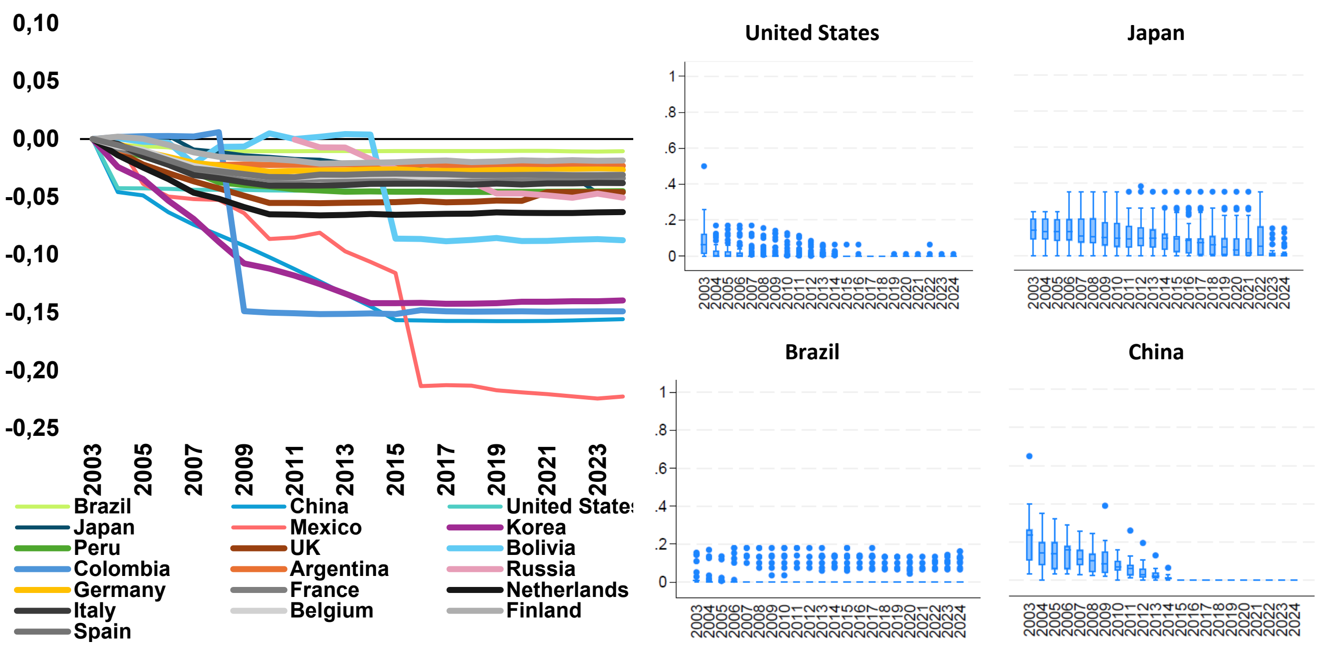
(WTO), bilateral and regional free trade agreements.[8] Accordingly, we compiled tariff schedules by examining agreements' documentation, information that is available at the webpage of the Chilean Undersecretariat of International Economic Relations (SUBREI, in Spanish). The statistical appendix provides further details on the construction of tariffs' variables.

Panel a of Figure 2 illustrates the temporal evolution of average tariffs applied by Chile's main trading partners, revealing a gradual reduction consistent with a broader trend toward trade liberalization in these countries. Additionally, panel b of Figure 2 highlights heterogeneity across tariff codes. It is important to note that tariffs provide an imperfect proxy for trade policy, as the latter encompasses a much wider array of instruments, including quotas, non-tariff barriers, rules of origin, and other trade-facilitating or trade-impeding measures.

Figure 2

a. Average Tariffs by country (1)
(points, difference relative to 2003 levels)

b. Tariff distribution: Food Products (2)
(points)



Notes: (1) The figure reports average tariff (τ) coefficients (B) for each country following Fitzgerald *et al.*, based on the following regression: $\tau_{jt} = \alpha_0 + B \cdot D + v_j + \varepsilon_{jt}$, where D represents a set of year dummies (2004-2024), B is the matrix of estimated coefficients (relative to 2003), and v_j is a product fixed effect. (2) Chapters 16 to 24 of the 2022 customs tariff codes are considered. Boxplot: lower and upper bounds correspond to the 25th and 75th percentiles, respectively. The median is represented as a line within the box. Whiskers indicate minimum and maximum values within 1.5 times the interquartile range, which represents 50% of the dataset. Dots outside the whiskers indicate extreme values or outliers. Source: own calculations based on WTO, ALADI, and Chilean FTA data.

[8] Included: effective tariffs and the Argentina–Chile preference schedule under ALADI, international trade agreements between the US and Chile, and between the European Union and Chile. Additionally, due to incomplete information on bilateral agreements with Bolivia and Brazil and missing tariff data in some cases, the average Most Favored Nation (MFN) tariff is assumed.

As noted in the introduction, we introduce a modification to the tariff variable used by Fitzgerald and Haller (2018) in order to account for the relative change in tariffs across destinations, which allows us to capture the trade diversion effect resulting from these changes. Accordingly, the variable $\Delta\tilde{\tau}_{jpt}$ is defined as:

$$\Delta\tilde{\tau}_{jpt} \equiv \Delta\tau_{jpt} - \Delta\bar{\tau}_{j(-p)t} \quad \textbf{(1)}$$

where $\Delta\tau_{jpt}$ denotes the percentage change in the tariff applied to product *j* in year *t* by destination country *p*, and $\Delta\bar{\tau}_{j(-p)t}$ captures the percentage change in the weighted average tariff on product *j* across all other destination countries (excluding *p*) in the same year.[9] This implies that our regressor measures the change in tariffs imposed by one country relative to the average change in tariffs imposed by the rest of Chile's trading partners. Therefore, as constructed, this variable does not capture the effect that a uniform tariff change would have on all destinations. Notably, the original estimation by Fitzgerald and Haller (2018) also did not account for such uniform changes in the elasticity estimated, as they are absorbed by fixed effects.

The proposed tariff variable captures two key dimensions of trade resistance: **bilateral trade resistance**, referring to barriers between specific country pairs, and **multilateral trade resistance**, which reflects the overall trade barriers a country faces with all its trading partners (Anderson and van Wincoop, 2003, 2004). When the tariffs of a particular country increase, exports to that country may decline due to reduced import demand or lower incentives for exporters. Conversely, exports to other countries might benefit, as exporters are incentivized to redirect shipments to destinations offering higher net export prices. In our regression, if the US raises tariffs on Chilean exports, then exports to the US experience an increase in the $\Delta\tau_{jpt}$ component, which raises $\Delta\tilde{\tau}_{jpt}$, potentially discouraging exports to the US. Meanwhile, exports to other destinations experience an increase in the average world tariff ($\Delta\bar{\tau}_{j(-p)t}$), reducing $\Delta\tilde{\tau}_{jpt}$ and potentially encouraging shipments to those markets. Our regression will estimate both effects at the same time. In any case, as a robustness check, we also present the results when using the absolute tariff as regressors.

Figure 3 shows the evolution of the relative tariff variable with respect to the rest of the world. The figure reveals that countries such as China and Mexico experienced the greatest relative tariff reductions, while in other cases—such as Brazil—the relative tariff variable increased over time, due to more substantial reductions by other destinations.

Following the transformations described above, and after merging the tariff microdata with customs records at the firm, exported product, and destination-country levels, we get a panel dataset with approximately 200,000 observations.

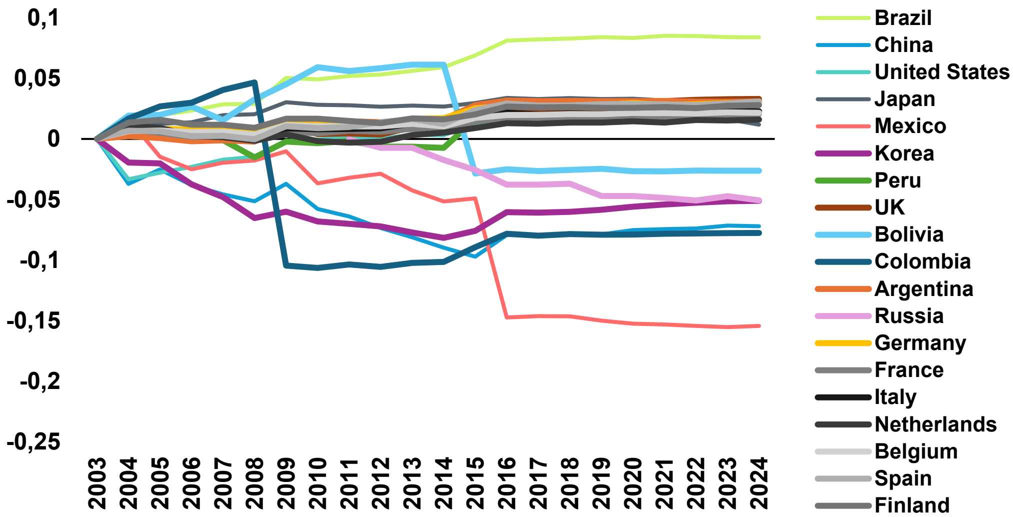
Table 2 summarizes key descriptive statistics for transformed variables, as they enter in the short-run regressions. Statistics are calculated along the time dimension across all observations. For instance, in the case of exports, the average annual change per firm-product-destination combination shows an average decline of 5.9%. However, this figure should not be interpreted at the aggregate level, as the total number of exporters changes over the period.

[9] The weighted average tariff is obtained by adjusting product-market-specific applied tariffs according to their proportional incidence of trade relationships.

Figure 3

Average evolution of *relative* tariffs ($\tilde{\tau}_{jpt}$) by country

(difference relative to 2003 levels, points)



Notes: The figure reports average tariff ($\tilde{\tau}$) coefficients (B) for each country. See details in Note (1) of Figure 2.
Source: own calculations based on WTO, ALADI, and Chilean Free Trade Agreements data.

Table 2: Descriptive statistics

Variables	Mean	SD	p50	p25	p75
$\Delta\, \text{exp}_{ijp}$	-5.9	121.3	-0.9	-58.2	48.6
Δrer_p	0.7	7.9	0.4	-4.2	6.1
Δgdp_p	2.8	3.8	2.8	1.4	4.7
$\Delta tariffs_{ijp}$	-0.3	1.9	0.0	0.0	0.0
$\Delta relative\ tariffs\_ijp$	0.0	2.0	0.0	0.0	0.2

Notes: Macroeconomic variables expressed as log changes multiplied by 100, while tariffs are expressed as simple differences multiplied by 100. Sample period: 2003-2024. Statistics reported are based on 195,665 observations used in the main regression on the short-term.
Source: own calculations based on data from Chilean National Customs Service.

4. Methodology

This section is divided into two subsections. The first presents the panel regression specification that links the short-term relationship between exports and their main determinants. The second subsection analyzes the long-term relationship.

4.1. Short-term

The panel regression specification to be estimated can be written as follows:

$$\Delta\, exp_{ijpt} = \alpha\ \Delta\, rer_{pt} + \beta\ \Delta gdp_{pt} + \gamma \Delta\tilde{\tau}_{jpt} + v_{ijt} + \delta_{jp} + \varepsilon_{ijpt} \quad \textbf{(2)}$$

where the dependent variable is the log change in the annual export volume ($\Delta\, exp$) of firm *i* exporting product *j* to country *p* in year *t.* [10] The specification closely resembles equation (2) in Li *et al.* (2015), capturing analogous structural features. The term $\Delta\, rer_{pt}$ corresponds to the log change in the bilateral RER between Chile and country *p* in year t. The term Δgdp_{pt} denotes the log change in the GDP of country *p* in year *t*. Finally, $\Delta\tilde{\tau}_{jpt}$ is our measure of relative tariff defined in the previous section.

Fixed effects are incorporated in equation (2) to control for characteristics that may confound the relationship of interest. First, to control for firm-specific supply shocks that may explain changes in export volumes, we include v_{ijt} a firm–product–year fixed effect. This controls all firm-level factors that affect exports of a specific product each year, and that is transversal to all destinations. Second, δ_{jp} denotes a product–destination fixed effect that captures time-invariant demand— or trade-related factors that does not vary over time and that is homogeneous to all firms. Lastly, equation (2) includes one-year lags for the key explanatory variables to account for the possibility that tariff changes affect export flows with a delay, in line with the evidence presented by Amiti *et al.* (2020).

Regarding the expected signs, the elasticities α and β are expected to be positive, while γ is interpreted as a semi-elasticity and is expected to have a negative sign.

4.2 Long-term

A log-linear long-term relationship is specified as follows:

$$exp_{ijpt} = \alpha_{LT}\, rer_{pt} + \beta_{LT} gdp_{pt} + \gamma_{LT}\tilde{\tau}_{jpt} + v_{ijt} + \delta_{jp} + \varepsilon_{ijpt} \quad \textbf{(3)}$$

where the variables and coefficients were defined in subsection 4.1, and the elasticities and semi-elasticities to be estimated include "LT" subscripts to denote long-term values and distinguish them from those previously introduced in equation (2).[11] Except tariffs, all variables in equation (3) are expressed in log levels: export volumes, bilateral RER and trading partners' GDPs. We incorporate fixed effects as in equation (2), following the approach of Fitzgerald and Haller (2018). More broadly, this levels-based specification aligns with those employed by Chen and Kurokawa (2022) and Fitzgerald and Haller (2018).

5. Results

This section presents an analysis of the main results. In the first subsection, we examine the findings related to Chilean exports in the short-term. In the second subsection, we present the long-term relationship, and in the third and fourth, we introduce alternative specifications, as a robustness check for the long-term and short equation.

[10] This specification is standard in the literature; we follow studies by Fornero *et al.* (2020) and Carrasco *et al.* (2015) for Chile. For other economies, see Ahmed *et al.* (2015), Raissi and Tulin (2015), Basarac Sertić *et al.* (2015), among others. The specification is extended to use micro-level data of exports and tariffs applied to Chilean exported products.

[11] Fornero *et al.* (2020) use dummies for the main free trade agreements (FTAs) signed by Chile. We mainly use tariffs to study their direct impact on exports, but we also look at the effect of signing FTAs as part of our robustness checks.

5.1. Short-term

Table 3 reports the estimated elasticities and semi-elasticities defined in equation (2). We show four specifications for Total and Manufacturing exports respectively. The first column corresponds to the main regression using the full sample and relative tariffs. The second column shows results up to 2019, the third uses only contemporaneous variables and the fourth column reports estimates using absolute tariffs, which are mostly used in previous literature.

Main results for total and manufacturing exports indicate that a relative change in tariffs on Chilean export products has a significant effect, albeit with a one-year lag. Specifically, for total exports the estimates suggest that an increase of 10 pp in tariffs in the destination country would, on average, lead to a 5.9% decrease in exports to that destination in the second year. Notice that this effect measures the intensive margin, as it uses observations of firms that continue to export. This effect is statistically significant and implies a semi-elasticity of approximately 59% two years after the tariff change. Nonetheless, the results also point to a possible redirection of shipments to other countries, implying a smaller overall effect on total exports. The results remain similar when excluding the pandemic period, i.e., considering observations only up to 2019 (Column 2). Then, when using only the contemporaneous variables (Column 3) we find no effect of tariffs on exports consistent with lagged effects found in the literature. The evidence indicates that the decrease in tariffs experienced during the period 2003-2024 has had a statistically significant and positive effect on both total and manufacturing exports. The elasticities estimated for total exports are similar to those found for manufacturing.[12]

The estimated semi-elasticities of relative tariffs are lower than those for absolute tariffs (see Columns 1 and 4), and we reject the null that states equality between both semi-elasticities at usual statistical levels.[13] We believe that differences in the sizes of tariffs semi-elasticities suggest trade diversion effects on export volumes, since the inclusion of the term $\Delta\bar{\tau}_{j(-p)t}$ changes the estimated elasticity, suggesting that it provides relevant information for export dynamics.

Focusing on regressions that include lags, Table 3 reports elasticities of approximately 0.6 and 0.9-1.1 for a bilateral RER depreciation and the growth of foreign GDP for total exports, respectively, accumulated in the first two years. Focusing on manufacturing exports, we find similar export elasticities with respect to foreign GDP and a bilateral RER depreciation. Overall, our estimates accord with elasticities of foreign GDP and bilateral RER reported in the existing literature, especially when the sample is limited to 2019.[14]

Next, we analyze exports of key subsectors within manufacturing for our main specification. Table 4 illustrates that tariffs have heterogeneous effects across subsectors. Both chemicals and food, beverages & tobacco and others are quite sensitive to tariffs. Cumulative to the second year, the effect is around 1pp of increase per each 1pp of decrease in tariffs. Notice that

---

[12] We perform a t-test under the null hypothesis that the semi-elasticities of tariffs for total and manufacturing exports (Column 1) are equal. This hypothesis cannot be rejected (p-value = 0.224)

[13] We test whether the semi-elasticity coefficients of tariffs reported in columns (1) and (4) are statistically equal under the null hypothesis. To do so, we perform a t-test for the difference in coefficients. The test rejects the null hypothesis at the 1% significance level, indicating that the coefficients are significantly different from each other. We use the t-statistic because it assumes independence, which fits our case since the models are estimated separately, and the variables are not included together.

[14] However, an important difference is that Fornero *et al.* (2020) use aggregate data.

these two subsectors explain about 67% of total manufacturing exports. For forestry and metal industries the semi-elasticity to tariffs is statistically not different than zero. With respect to the elasticities to foreign demand and RER we also find heterogeneous results.[15] We confirm these findings in Tables A.2 and A.3 in the appendix, which show additional robustness checks.

Table 3: Estimated short-term supply coefficients- export volume

	Total				Manufacturing			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Δrer	0.229***	0.322***	0.344***	0.231***	0.216***	0.320***	0.329***	0.221***
	(0.055)	(0.073)	(0.050)	(0.055)	(0.074)	(0.103)	(0.069)	(0.074)
L1.	0.241***	0.281***		0.242***	0.303***	0.361***		0.304***
	(0.055)	(0.071)		(0.055)	(0.074)	(0.099)		(0.074)
Δgdp	0.914***	1.219***	1.113***	0.910***	1.103***	1.256***	1.187***	1.094***
	(0.151)	(0.238)	(0.134)	(0.151)	(0.198)	(0.329)	(0.178)	(0.198)
L1.	-0.135	-0.342		-0.134	-0.378*	-0.486		-0.373*
	(0.151)	(0.229)		(0.151)	(0.198)	(0.316)		(0.198)
$\Delta tariffs_{jpt}$	-0.044	-0.044	-0.031	-0.128	-0.074	-0.126	-0.048	-0.193
	(0.152)	(0.157)	(0.122)	(0.185)	(0.184)	(0.189)	(0.167)	(0.225)
L1.	-0.587***	-0.574***		-0.681***	-0.598***	-0.604***		-0.660***
	(0.133)	(0.137)		(0.163)	(0.180)	(0.186)		(0.220)
Observations	195,665	143,918	287,604	195,665	111,563	82,393	161,241	111,563
R-squared	0.432	0.443	0.434	0.432	0.450	0.458	0.452	0.450

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. L1 denotes a one-period lagged variable (year). Estimations correspond to equation (2). Includes FEs: v_{ijt} firm–product–year; δ_{jp} product–destination. (1) Main regression using *relative* tariffs $\Delta\tilde{\tau}_{jpt}$ and full sample. (2) Subsample up to 2019. (3) Only contemporaneous variables. (4) Use absolute tariffs $\Delta\tau_{jpt}$.

Finally, Table 5 reports the elasticities for export prices in US dollars at the border of the country of origin —that is, excluding tariffs.[16] The estimated results show semi-elasticities to tariffs with expected signs but lower order of magnitude than effects reported on volumes, and more importantly, not statistically different from zero. This could mean that the effect of the fall in exports resulting from a tariff increase is due to a fall in external demand (because of the increase in the price of imported goods) and not to a reduced incentive for exporters to export (given that the price they receive does not change). In any case, further research is required for proper interpretation.

Although the direct effect of higher tariffs on nominal export growth is not explicitly modeled, a decline is expected. In other words, since nominal export values reflect both price and volume changes, stable prices (Table 5) combined with lower volumes (Table 3) lead to reduced export values.

[15] More elaborated specifications for specific sectors are beyond the scope the present paper, thus we leave further analysis for future agenda. One avenue to examine is that product differentiation might reduce responses to tariffs, e.g., Minondo (2023). In addition, bilateral RER as measure of competitiveness might be too general for manufacturing sectors (Goda *et al.* 2024).

[16] Price corresponds to the unit value of exports, calculated as the ratio of nominal exports to export volume.

Table 4: Estimated supply coefficients- export volume separating manufacturing sectors

	Chemicals	Food products, beverages & tobacco	Forestry & wooden furniture, pulp, paper and others	Metal products, machinery & equipment	Other manufacturing products
Δrer	0.272	0.204**	0.268	0.068	0.724**
	(0.174)	(0.086)	(0.232)	(0.259)	(0.290)
L1.	0.183	0.269***	0.307	0.633**	-0.329
	(0.174)	(0.085)	(0.232)	(0.256)	(0.293)
Δgdp	1.662***	1.205***	0.861	0.467	0.987
	(0.407)	(0.268)	(0.546)	(0.602)	(0.720)
L1.	-1.332***	-0.311	-1.106**	0.291	1.335*
	(0.407)	(0.270)	(0.545)	(0.590)	(0.746)
$\Delta\tilde{\tau}_{jpt}$	0.146	-0.596***	0.515	1.441	0.571
	(0.488)	(0.204)	(0.598)	(0.883)	(0.478)
L1.	-1.007**	-0.350*	-0.594	-0.734	-1.380**
	(0.488)	(0.197)	(0.568)	(0.810)	(0.538)
Observations	21,798	48,252	10,036	22,523	7,985
R-squared	0.448	0.411	0.442	0.472	0.508
Share 2024	23.3	43.6	19.1	9.7	7.2

Notes: sector's share in manufacturing exports in MM USD of 2024, according to Balance of Payments, Central Bank of Chile. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Other manufacturing includes Textile, clothing, leather & footwear, Non-metallic minerals & base metals and other industrial products. Estimation of equation (2), separating sectors. Include FEs: v_{ijt} firm–product–year; δ_{jp} product–destination.

Table 5: Estimated short-run supply coefficients- export unit values (XUV)

	Full sample		Up to 2019	
	Total	Manufacturing	Total	Manufacturing
Δrer	0.087***	0.027	0.127***	0.027
	(0.023)	(0.035)	(0.031)	(0.050)
L1.	0.001	-0.014	0.013	0.004
	(0.023)	(0.035)	(0.030)	(0.048)
Δgdp	0.161**	0.138	0.163	0.268*
	(0.063)	(0.094)	(0.100)	(0.159)
L1.	0.032	0.037	-0.095	-0.147
	(0.063)	(0.094)	(0.096)	(0.152)
$\Delta\tilde{\tau}_{jpt}$	-0.020	-0.017	-0.027	-0.019
	(0.064)	(0.088)	(0.066)	(0.092)
L1.	-0.004	0.000	-0.019	-0.027
	(0.056)	(0.086)	(0.058)	(0.090)
Observations	195,705	112,667	143,942	83,210
R-squared	0.478	0.470	0.488	0.476

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. L1 denotes one-year lag of the variable. Estimation of equation (2). Dependent variable XUV. Include FEs: v_{ijt} firm–product–year; δ_{jp} product–destination.

5.2. Long-term

In this section, we present empirical findings that examine the relationship between export levels and trading partners' GDPs, bilateral RERs, and relative tariffs. Table 6 reports the estimated elasticities derived from Equation (3), considering two specifications: (1) a baseline model that excludes relative tariffs (which results can be compared with previous studies), and (2) a full specification that incorporates relative tariff measures. The examination of results suggests that the level of both total and manufacturing exports is determined by relative tariffs, whereas remaining elasticities of macroeconomic variables remain statistically significant, even if we omit tariffs from the specifications. It is worth noting that the estimated export elasticities are lower than those reported in previous studies based on aggregate export data. In particular, the elasticity to trading partner's GDPs is estimated between 0.3 and 0.6, while the elasticity to a bilateral RER depreciation is around 0.4, both estimates below the short run elasticities.

Table 6: Estimated long-term supply coefficients- export volume

	Total		Manufacturing	
	(1)	(2)	(3)	(4)
rer	0.359***	0.371***	0.370***	0.401***
	(0.039)	(0.041)	(0.048)	(0.053)
gdp	0.549***	0.426***	0.423***	0.254***
	(0.051)	(0.053)	(0.064)	(0.070)
$\tilde{\tau}_{jpt}$		-0.439***		-0.286*
		(0.106)		(0.149)
Observations	254,592	195,665	161,947	111,563
R-squared	0.885	0.912	0.869	0.911

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Table report estimated elasticities equation (3), making two cases, (1) omit relative tariffs, whereas (2) consider them. Dependent variable "exp": log export volume. Include FEs: v_{ijt} firm–product–year; δ_{jp} product–destination.

5.3. Robustness: Does the signature of FTAs exert a positive influence on exports beyond tariffs?

As discussed in Section 2, a substantial body of literature finds that the signing of a Free Trade Agreement (FTA) has a positive impact on export volumes. Using Chilean data, a recent study by Álvarez & Andreasen (2025) estimates these effects. In this section we examine a different specification that adds to equation (3) an indicator of FTA entry, as a change in regime. The hypothesis is that the FTA likely benefits the signing parties and boosts bilateral trade beyond mere tariff reductions by fostering business cooperation, facilitating network development, and lowering fixed export costs, among others reasons. To test the relevance of signing a FTA, we estimate an alternative specification that incorporates both an FTA indicator and an interaction term between the FTA indicator and relative tariffs. For the sake of clarity, it can be written as follows:

$$exp_{ijpt} = \alpha_{LT}\, rer_{pt} + \beta_{LT} gdp_{pt} + \gamma_{LT}\tilde{\tau}_{jpt} + \gamma_1 FTA_{pt} + \gamma_2 FTA_{pt}\tilde{\tau}_{jpt} + v_{ijt} + \delta_{jp} + \varepsilon_{ijpt} \quad \textbf{(3')}$$

where FTA_{pt} corresponds to a step dummy that takes the value of 1 starting from the year in which the FTA between Chile and country p is signed and remains at 1 thereafter.[17] Accordingly, in case $FTA_{pt} = 0$, then (3') equals the baseline regression (3), whereas if $FTA_{pt} = 1$, the fixed effect product-destination turns out to be $\gamma_1 + \delta_{jp}$ and the specific semi-elasticity to tariffs will be $\gamma_{LT} + \gamma_2$. If γ_2 is negative and significatively different from zero, then we conclude that the FTA exerts a marginal increase of exports' growth for each percentage point change in the tariff.[18]

Table 7 reports supporting evidence of the main results presented in section 5.2. Estimates of exports semi-elasticities with respect to tariffs remain statistically significant and negative in the two cases analyzed. The estimated semi-elasticity decreases slightly from -0.44 to -0.42. Meanwhile, the FTA indicator is statistically significant, suggesting that the agreement contributes to an additional increase in exports of approximately 0.04. Moreover, when adding the interaction term, we find a smaller average semi-elasticity of -0.2 for total exports, and when the tariff changes within an FTA this effect increases up to -1.3. These changes are slightly different for manufacturing exports since adding the FTA dummy turns the semi-elasticity of tariffs (without the interaction) not significatively different from zero. Lastly, when adding the interaction term, the evidence suggests a negative and significant effect for the tariff movements within the FTA. The evidence highlights the impact that tariff changes have on exports, an effect that is even more significant when an FTA is signed.

Table 7: Robustness- Estimated long-term supply coefficients- export volume[19]

	Total			Manufacturing		
	(1)	(2)	(3)	(1)	(2)	(3)
rer	0.371***	0.396***	0.395***	0.401***	0.455***	0.447***
	(0.041)	(0.043)	(0.043)	(0.053)	(0.057)	(0.057)
gdp	0.426***	0.408***	0.412***	0.254***	0.217***	0.232***
	(0.053)	(0.054)	(0.054)	(0.070)	(0.071)	(0.071)
$\tilde{\tau}_{jpt}$	-0.439***	-0.417***	-0.224**	-0.286*	-0.235	-0.006
	(0.106)	(0.107)	(0.113)	(0.149)	(0.150)	(0.160)
FTA		0.041*	0.028		0.071**	0.054*
		(0.021)	(0.022)		(0.028)	(0.028)
$FTA{*}\tilde{\tau}_{jpt}$			-1.341***			-1.406***
			(0.268)			(0.342)
Observations	195,665	195,665	195,665	111,563	111,563	111,563
R-squared	0.912	0.912	0.912	0.911	0.911	0.911

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimation corresponds to equation (3) and (3)' restricting sample to results in Table 3. Columns (1) Main regression (2) Adding the step variable FTA (3) Adding step variable FTA and interaction between FTA and relative tariffs. Dependent variable "exp": log export volume. Includes FEs: v_{ijt} firm–product–year; δ_{jp} product–destination.

[17] Details of incorporated agreements are described in the statistical appendix.

[18] FTAs are generally associated with reducing tariffs, but there are specific circumstances where certain tariff increases may occur as part of or alongside an agreement. For example, Chile exempts products like alcohol, tobacco, and luxury goods to protect sensitive sectors, and agricultural goods may be subject to safeguard measures that temporarily raise tariffs. Although these increases are marginal, taken as a whole, FTAs have led to an overall reduction in tariffs.

[19] In fixed effects panel models, R-squared reflects changes within units over time. Since the step dummy only changes across time and not within units, it does not affect the within R-squared.

5.4. Robustness: additional exercises

This section develops additional robustness exercises that challenge the baseline specification equation (2).

First, we add destination-year fixed effects (ψ_{pt}) to control for factors to each destination country and year that might affect export growth. This alternative specification is written as:

$$\Delta\, exp_{ijpt} = \gamma \Delta \tilde{\tau}_{jpt} + v_{ijt} + \delta_{jp} + \psi_{pt} + \varepsilon_{ijpt}, \qquad \textbf{(2')}$$

where, in this setup, ψ_{pt} leads to omit the rer_{pt} and gdp_{pt}, since their variation is already captured. More importantly, ψ_{pt} also accounts for other factors influencing exports, such as exchange rate movements of competing exporters (Castellares and Huarancca, 2025), non-tariff measures imposed by destination countries, and other relevant factors.[20]

Estimated results from specification (2') are reported in Table A.4 in the appendix, while Table A.5 presents the analogous case for long-term regression. The results indicate that the semi-elasticity of total exports with respect to relative tariffs remains negative and statistically significant in both the growth and levels regressions. Regarding the subset of manufacturing exports, the semi-elasticities estimated display the expected signs, but statistical significance is less supportive.[21]

Second, given the annual frequency of the data and the inclusion of multiple fixed effects in the specification, we do not cluster standard errors at the product level, as much of the product-level variation is already absorbed. In the appendix, Table A.6 and A.7 demonstrate that the main results remain robust when clustering is applied.

Third, we remove product-market fixed effects from the main baseline specification. This robustness check is motivated by the fact that differentiating levels as shown in equation (3) yields equation (2), albeit without product-market fixed effects, which vanish because they are constant over time. Overall, the results, as reported in Table A.8 of the appendix, remain robust, showing a slight decrease in the semi-elasticity to tariffs, alongside an increase in the elasticity to trading partners' GDP. The base specification is preferred because it allows us to control effects that are fixed at the product level, reducing the risk o-f having omitted variables in the specification.

Fourth, constructing the micro-level panel data required several methodological choices, which we discussed earlier. A key decision was to apply a filter that retains observations only for firms exporting in two consecutive years. This approach enables us to identify changes in exports exclusively along the intensive margin. For consistency, we preserved the same number of observations when estimating the level regressions.

---

[20] Non-tariffs measures —such as sanitary and phytosanitary standards, residue limits, and substance restrictions— can raise costs, limit access for exporters, ultimately reducing export growth. The maintained assumption is that ψ_{pt} does not vary with *j*.

[21] While individual semi-elasticities are not statistically significant, their signs are consistent with theoretical predictions. A joint test rejecting the null of a positive sum at the 10% level suggests evidence of a negative accumulated effect between the two years.

Omitting the filter in the long-run specification increases the number of observations nearly threefold, reaching approximately 550,000. However, this additional data is notably sparse, consisting largely of unique, non-repeated entries. As a robustness check, we proceed to estimate the levels regressions using the full panel dataset, employing two distinct econometric methodologies. First, we use Ordinary Least Squares (OLS). Second, given the sparsity and distributional characteristics of the unfiltered data, we employ Poisson Pseudo Maximum Likelihood (PPML), which is well-suited for handling data that is not normally distributed and with heteroskedasticity. The results of this exercise are presented in Table A.9 in the appendix. The estimated semi-elasticities remain robust across specifications; however, their magnitudes decline under the standard OLS regression, while they increase when using PPML methods. Balancing the panel to include zero trade flows offers analytical value at the firm level, but falls outside the scope of this study, which focuses solely on the intensive margin. This extension is more relevant to research on firm dynamics and is left for future work.

6. Conclusions

In this paper, we address the question: How do exports respond to tariff changes? We built a new dataset using detailed customs records from Chile (2003–2024), tracking products exported by Chilean firms and combining this with the specific tariffs set by each trading partner. We include also bilateral RER and measures of foreign demand, following the tradition of gravity models in international trade, and previous empirical studies for Chile. This approach allows us to obtain estimates of the elasticity of exports to its determinants.

We find a short-run negative and statistically significant semi-elasticity of exports to the imposition of tariffs on Chilean products. Specifically, the estimates suggest that a 10pp increase in tariffs on product A in destination B leads on average to a 5.9% decline in bilateral exports in the second year. This lagged effect is consistent with the findings of Amiti *et al.* (2020). We find evidence of trade diversion effects that mitigate the negative effects on total exports. Estimates align with previous literature on the responsiveness of exports to foreign GDP and bilateral real exchange rates. In addition, estimates are robust to restricting the sample to manufacturing firms and to excluding the pandemic period, i.e., considering observations only up to 2019.

Looking at groups of manufacturing exports, we find relevant heterogenous effects among subsectors. We learn that chemicals and food, beverages and tobacco manufacturing sectors are the most sensitive to tariff changes accumulating at the second year almost a 1 pp effect, implying unitary semi-elasticity. When looking at border prices—what Chilean exporters record in the invoice—the results suggest that prices do not change much in response to tariff changes.

Next, in the long-term specifications, exports are affected by tariffs, and this impact remains robust even when considering the signing of FTAs. We also find smaller long-run elasticities for trading partners' GDP (0.43 for total and 0.26 for manufacturing), while export elasticities to RER are also positive and statistically different from zero in all specifications.

Our findings underscore the significant role of tariff reductions in driving export growth over more than two decades of trade liberalization. Leveraging a product-level database, we provide a more granular analysis than earlier studies, showing that lower tariffs have had a substantial positive impact on both total and manufacturing exports. While these elasticity estimates offer valuable insights, their application to contexts beyond the sample—such as the U.S. tariff increases examined in Briones *et al.* (2025) —should be approached with caution. The sample is largely composed of tariff reductions, raising concerns about asymmetric and nonlinear export responses. Furthermore, concurrent retaliatory measures by multiple countries may alter trade dynamics in ways not captured by our baseline estimates. Future research should broaden the scope of trade policy episodes to strengthen the robustness and policy relevance of these findings.

It is worth noting that the short-run effects found on national exports could impact local industries and firm dynamics in different ways. These effects could either amplify a contraction in domestic supply due to lower external shipments or, alternatively, be partially offset by increased sales within domestic sectors. This question can be explored in future research.

References

Auclert, A., Rognlie, M., and Straub, L. (2025), "The Macroeconomics of Tariff Shocks", NBER Working Paper No. 33726: link.

Ahmed, S., Appendino, M., and Ruta, M. (2015). Global value chains and the exchange rate elasticity of exports (IMF Working Paper No. WP/15/252). Retrieved from IMF website: Link.

Álvarez, R., and Andreasen, E. (2025), "Exploring the Effects of FTAs on Chilean Exports: Heterogeneous responses and Financial Constraints", Estudios de Economía, 51 (2), pp 299-324. Link.

Amiti, M., Redding, S., and Weinstein, D. (2020), "Who's Paying for the US Tariffs? A Longer-Term Perspective" AEA Papers and Proceedings, 110: 541–46. Link.

Anderson, J., and van Wincoop, E. (2003), "Gravity with Gravitas: A Solution to the Border Puzzle." American Economic Review 93 (1): 170–192. Link.

Anderson, J., and van Wincoop, E. (2004), "Trade Costs." Journal of Economic Literature 42 (3): 691–751. Link.

Basarac Sertić, M., Vučković, V., and Škrabić Perić, B. (2015). Determinants of manufacturing industry exports in European Union member states: A panel data analysis. Economic Research-Ekonomska Istraživanja, 28(1), 384–397. Link.

Bianchi, J., and L. Coulibaly (2025), "The Optimal Monetary Policy Response to Tariffs", National Bureau of Economic Research Working Paper Series, #33560, March. Link.

Briones, L., Logan, V., Andalaft, S., Bertinatto, L., Fornero, J., Heresi, R., and Kohn, D. (2025), "Efecto de aranceles en las exportaciones chilenas". Minuta anexa IPoM junio 2025. Link.

Carrasco, S., Godoy, C., and Gianelli, D. (2015). Sensibilidad de las exportaciones al TCR: un análisis sectorial y por destino (Central Bank of Chile, Working Paper No. 745). Retrieved from Central Bank of Chile website, Link.

Castellares, R., and Huarancca, M. (2025), "Entre barreras y oportunidades: Impacto de los nuevos aranceles en los flujos comerciales bilaterales", mimeo. Presented at XLIII Encuentro Economistas Perú BCRP.

Cavallo, A., Gopinath, G., Neiman, B., and Tang, J. (2019) "Tariff Pass-through at the Border and at the Store: Evidence from US Trade Policy," AER: Insights 2021, 3(1): 19–34. Link.

Cavallo, A., Llamas, P. and Vazquez, F. (2025) "Tracking the Short-Run Price Impact of US Tariffs," Mimeo (August 7, 2025). Link.

Chen, Z. and Kurokawa, Y. (2021), "Do exporters respond to both tariffs and nominal exchange rates? Evidence from Chinese firm-product data. Review of International Economics, 30, 514–548. Link.

Demidova, S., Kucheryavyy, K., Naito, T., and Rodríguez-Clare, A. (2024), "The small open economy in a generalized gravity model", Journal of International Economics, 152, Link.

Fajgelbaum, P. and Khandelwal, A. (2020), "The Economic Impacts of the US-China Trade War", NBER Working Paper #29315, Link.

Fajgelbaum, P., Goldberg, P., Kennedy, P., and Khandelwal, A. (2020), "The Return to Protectionism", The Quarterly Journal of Economics, 135(1): 1–55. Link.

Fitzgerald, D. and Haller, S. (2018). "Exporters and shocks." Journal of International Economics, 113, 154–171, Link.

Fornero, J., Fuentes, M., and Gatty, A. (2020). "How do manufacturing exports react to the real exchange rate and foreign demand? The Chilean case." The World Economy 43 (1): 274–300. Link.

Haberkorn, F., Hoang, T., Lewis, G., Mix, C., and Moore, D, (2024) "Global Trade Patterns in the Wake of the 2018-2019 US-China Tariff Hikes", April. FEDS Notes No. 2024-04-12-2. Link.

Hoang, T., and Lewis, G. (2024), As the US Is Derisking from China, Other Foreign US Suppliers are Relying More on Chinese Imports, August. FEDS Notes No. 2024-08-02-4. Link.

Goda, T., Torres García, A., and Larrahondo, C. (2024), "Real exchange rates and manufacturing exports in emerging economies: the role of sectoral heterogeneity and product complexity". Review of World Economics 160, 1057–1082. Link.

Ignatenko, A., Lashkaripour, A., Macedoni, L., and Simonovska, I. (2025), "Making America great again? The economic impacts of Liberation Day tariffs", Journal of International Economics, 157, 104138. Link.

Itakura, K. (2020), "Evaluating the Impact of the US–China Trade War", Asian Economic Policy Review, 15: 77-93. Link.

Kalemli-Özcan, Ṣ., Can, S., and Yildirim, M., (2025), "Global Networks, Monetary Policy and Trade", National Bureau of Economic Research Working Paper Series, #33686, April. Link.

Li, M., Ma, H., and Xu, Y. (2015), "How do exchange rate movements affect Chinese exports? — A firm-level investigation", Journal of International Economics, 97(1), 148-161. Link.

Ma, H., and Ning, J. (2024), "The return of protectionism: Prospects for Sino-US trade relations in the wake of the trade war" China Economic Quarterly International, 4(3): 182-211. Link.

McKibbin, W., Noland, M. and Shuetrim, G. (2025), "The global economic effects of Trump's 2025 tariffs", PIIE Working Paper 25-13 link

Minondo, A. (2024), "How exporters neutralised an increase in tariffs", *The World Economy*, 47, 1274–1296. Link.

Monacelli, T. (2025), "Tariffs and Monetary Policy", CEPR Discussion Paper No. 20142. CEPR Press. Link.

Raissi, M., and Tulin, V. (2015), Price and income elasticity of indian exports — The role of supply-side bottlenecks (IMF working paper WP/15/161). Retrieved from IMF website, Link.

Yu M., Tian, W., and Zheng, C. (2024), "China's Retaliatory Tariffs Against the Us: Firm Import-Export Linkage Along Global Production Line", mimeo. Link.

Appendix

1. **Data details**

- **Exports**

The data for exports corresponds to the destination-product-firm level quantities by the 8-digit level. This information is obtained from Customs Service microdata. Since the variable is measured in differences, the final panel only includes firms that export in consecutive years.

The destination countries for exports considered in the sample are described in Table 2b. Table A.1 illustrates the temporal evolution of their relative shares. Over more than 20 years of data, exports to China rose from 8% to 30%, while shipments to several European countries —such as the Netherlands, Italy, France, and the United Kingdom— declined.

Table A.1: Relative shares of total (nominal) exports

	2003-05	**2006-10**	**2011-15**	**2016-20**	**2021-24**
Germany	2.3	2.5	2.0	1.6	1.0
Argentina	4.1	5.0	5.2	3.6	2.5
Belgium	2.8	3.1	3.9	2.8	2.9
Bolivia	1.9	2.3	2.8	2.1	2.0
Brazil	5.9	6.6	7.3	6.4	6.8
China	7.8	11.1	13.2	19.0	29.4
Colombia	3.1	3.4	3.9	3.0	2.1
South Korea	4.8	5.1	4.9	7.2	7.8
United States	20.5	17.3	19.3	20.4	19.9
Spain	2.1	2.1	2.4	1.9	1.5
Finland	0.3	0.3	0.3	0.2	0.1
France	2.1	1.4	1.3	1.0	0.7
Italy	3.1	3.1	2.6	1.7	1.1
Japan	11.5	10.2	8.4	8.7	6.8
Mexico	6.2	6.3	5.3	5.0	4.3
Netherlands	10.0	9.7	6.2	5.4	4.4
Peru	5.3	6.9	7.8	7.1	4.9
Russia	0.4	0.6	0.7	0.6	0.5
UK	6.0	2.9	2.7	2.2	1.5

Source: Balance of Payments, Central Bank of Chile.

- **Gross Domestic Product (GDP). Index 2020=100.**

Real GDP data are obtained from the OECD at a quarterly frequency. The original unit of measurement is local currency, and the indices are chain-linked using the same base year to facilitate cross-country comparisons. The data are seasonally adjusted and account for holiday effects. Annual data are calculated from quarterly figures.

In the absence of data, the series is extended backward using the earliest available OECD data and spliced using real GDP growth rates published by the International Monetary Fund (IMF, WEO April 2025). For Peru and Bolivia, seasonally adjusted official data are sourced from the Central Reserve Bank of Peru (BCRP) and the National Institute of Statistics of Bolivia, respectively.

- **Bilateral Real Exchange Rate (Bilateral RER). Index 2020=100.**

The bilateral real exchange rate is calculated at a monthly frequency and is based on the following:

- Exchange rate parities published by the Central Bank of Chile. The exchange rate is measured as the number of Chilean pesos required to purchase one unit of foreign currency.
- External price indices use Producer Price Indices (PPI) or Consumer Price Indices (CPI) when PPI data are unavailable. The indices are consistent with those used in the calculation of the External Price Index (IPE). We supplement the price indices with additional countries based on the relevance of manufacturing and total exports. The IPE uses different criteria to compute the weights.
- Local CPI, published by the National Statistics Institute (INE).

Monthly RER data are averaged to obtain annual frequency figures.

- **Ad valorem tariffs. Percent.**

The database is built using multiple sources, primarily WTO data, supplemented with manually extracted information from trade agreement documents in PDF format. Figure A.1 summarizes the sources and trade agreements included in the analysis. It displays each agreement's abbreviation, indicates the use of liberalization schedules (highlighted in dark orange), and notes whether the liberalization calendar has concluded. Once the calendar is over, the maintained assumption is that the agreement continues in effect without changes (light orange). Before the agreement takes effect, green indicates where Most Favored Nation (MFN) average tariff data is used, and gray shows periods with no available information.

The details of construction are as follows:

- The information comes from Regional Trade Agreements (RTAs) and their respective tariff liberalization schedules as reported to the WTO by each member. It is important to note that a structured database calendar is not available for all partners or agreements. Data are missing for the 1991 Free Trade Agreement (FTA) with Mexico.
- Regarding RTAs, additional information is obtained from the WTO's "Tariff Download Facility," in cases such as Bolivia and Russia.
- Some tariff liberalization schedules are also extracted directly from the PDFs of the agreements and their respective annexes. These include: the 2004 FTA with the United States, the 2003 Association Agreement (AA) with the European Union, the Economic Complementation Agreement (ACE, in Spanish) with Mercosur (the annex for Brazil), and the 2019 modernization of the FTA with China.
- For Argentina, tariff and preference data with Chile from 2003 to 2019 were provided by Pedro Moncarz.
- For Russia, which joined the WTO in 2012, data are available starting in 2010.

- Finally, we complement the data with average MFN tariffs from the WTO, which reflect rates applied by members outside of preferential agreements. This information is used for years before agreements were implemented or when product-level data from agreements is unavailable
- Each agreement and its schedule are based on different versions of the Harmonized System (HS). We use the UN's correlation tables to align the data structure with the latest version (HS22)
- As an additional assumption, for Mexico and Peru under the entry into force of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (TPP), if a tariff was already at zero, it is assumed to remain unchanged, even if the agreement specifies a positive rate.

The choices made throughout the process are documented to ensure that third parties can replicate the database accurately. As a result, the reported tariff levels may not reflect those faced by firms at a given time and should be viewed as theoretical estimates.

Note: Information on quotas assigned in some agreements is not considered.

Figure A.1. Summary of Sources and agreements of Tariff Database

Countries	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Germany	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA											
Argentina	ACE	ACE	ACE	ACE	ACE	ACE	ACE	ACE	ACE	ACE	ACE	ACE	ACE	ACE	ACE	ACE	FTA					
Bolivia																						
Brazil	ACE	ACE	ACE	ACE	ACE																	
Belgium	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA											
China				FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA				FTA	FTA	FTA			
Colombia							TLC	TLC	TLC	TLC				AP	AP	AP	AP	AP	AP	AP	AP	AP
South Korea		FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA				
United States		FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA									
Spain	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA											
Finland	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA											
France	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA											
Italy	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA											
Japan					FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	TPP	TPP
Mexico														AP	AP	AP	AP	AP	AP	AP	TPP	TPP
Netherlands	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA											
Peru	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	FTA	AP	AP	AP	AP	AP	AP	AP	TPP	TPP
UK	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA								FTA			
Russia																						

Tariffs Schedules for regional or bilateral agreements (Source: Agreements PDF's or WTO)
The latest agreement remains in effect
Average Most Favoured Nation tariff (Source: WTO)
No information

Notes: FTA: Free trade agreement, AA: Association Agreement, ACE: Economic Complementation Agreement, AP: Pacific Alliance. TPP: Comprehensive and Progressive Agreement for Trans-Pacific Partnership. Source: Own elaboration.

- **FTA indicator**

The FTA indicator used in Section 5.3 and Equation (3’) is a step dummy variable that takes the value of 1 from the year the agreement enters into force onward. It includes the following agreements in one variable:

  - Chile signed FTAs with the US and South Korea in 2004, China in 2006, Japan in 2007, Peru and Colombia in 2009, Argentina in 2019, and the United Kingdom in 2021. Moreover, it signed the AP in 2016 with Mexico, Colombia and Peru.
  - The TPP is excluded from this indicator, as the participating countries—Mexico, Japan, and Peru—had pre-existing FTAs with Chile.

We performed the same exercise as in equation (3’), but considering one separate variable per agreement. The results remain consistent with the original specification and available upon request.

2. Other results

Table A.2: Robustness absolute versus relative tariffs - Estimated short-term supply coefficients- export volume

	Chemicals		Food products, beverages & tobacco		Forestry & wooden furniture, pulp, paper and others		Metal products, machinery & equipment		Other manufacturing products	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Δrer	0.272	0.271	0.204**	0.204**	0.268	0.269	0.068	0.079	0.724**	0.726**
	(0.174)	(0.174)	(0.086)	(0.086)	(0.232)	(0.232)	(0.259)	(0.259)	(0.290)	(0.291)
L1.	0.183	0.183	0.269***	0.270***	0.307	0.304	0.633**	0.633**	-0.329	-0.327
	(0.174)	(0.175)	(0.085)	(0.085)	(0.232)	(0.232)	(0.256)	(0.257)	(0.293)	(0.293)
Δgdp	1.662***	1.665***	1.205***	1.209***	0.861	0.861	0.467	0.440	0.987	0.981
	(0.407)	(0.408)	(0.268)	(0.268)	(0.546)	(0.546)	(0.602)	(0.603)	(0.720)	(0.720)
L1.	-1.332***	-1.338***	-0.311	-0.312	-1.106**	-1.098**	0.291	0.305	1.335*	1.343*
	(0.407)	(0.407)	(0.270)	(0.270)	(0.545)	(0.545)	(0.590)	(0.590)	(0.746)	(0.747)
$\Delta tariffs$	0.146	0.242	-0.596***	-0.688***	0.515	0.680	1.441	1.166	0.571	0.461
	(0.488)	(0.621)	(0.204)	(0.240)	(0.598)	(0.731)	(0.883)	(1.095)	(0.478)	(0.648)
L1.	-1.007**	-1.282**	-0.350*	-0.427*	-0.594	-0.622	-0.734	-0.579	-1.380**	-1.723**
	(0.488)	(0.616)	(0.197)	(0.233)	(0.568)	(0.688)	(0.810)	(1.024)	(0.538)	(0.742)
Observations	21,798	21,798	48,252	48,252	10,036	10,036	22,523	22,523	7,985	7,985
R-squared	0.448	0.448	0.411	0.411	0.442	0.442	0.472	0.472	0.508	0.508

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. L1 denotes a one-period lagged variable (year). Estimations correspond to equation (2). Include FEs: v_{ijt} firm–product–year; δ_{jp} product–destination. (1) Main regression using relative tariffs. (2) Comparison using absolute tariffs.

Table A.3: Robustness contemporaneous versus lags - Estimated short-term supply coefficients- export volume

	Chemicals		Food products, beverages & tobacco		Forestry & wooden furniture, pulp, paper and others		Metal products, machinery & equipment		Other manufacturing products	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Δrer	0.272	0.271*	0.204**	0.308***	0.268	0.214	0.068	0.454**	0.724**	0.662**
	(0.174)	(0.163)	(0.086)	(0.078)	(0.232)	(0.230)	(0.259)	(0.222)	(0.290)	(0.278)
L1.	0.183		0.269***		0.307		0.633**		-0.329	
	(0.174)		(0.085)		(0.232)		(0.256)		(0.293)	
Δgdp	1.662***	1.727***	1.205***	1.055***	0.861	0.684	0.467	1.098**	0.987	0.689
	(0.407)	(0.374)	(0.268)	(0.239)	(0.546)	(0.530)	(0.602)	(0.502)	(0.720)	(0.671)
L1.	-1.332***		-0.311		-1.106**		0.291		1.335*	
	(0.407)		(0.270)		(0.545)		(0.590)		(0.746)	
$\Delta\tilde{\tau}_{jpt}$	0.146	0.141	-0.596***	-0.328*	0.515	-0.295	1.441	0.751	0.571	0.554
	(0.488)	(0.455)	(0.204)	(0.185)	(0.598)	(0.577)	(0.883)	(0.734)	(0.478)	(0.423)
L1.	-1.007**		-0.350*		-0.594		-0.734		-1.380**	
	(0.488)		(0.197)		(0.568)		(0.810)		(0.538)	
Observations	21,798	30,598	48,252	68,289	10,036	13,711	22,523	35,532	7,985	11,528
R-squared	0.448	0.455	0.411	0.405	0.442	0.446	0.472	0.475	0.508	0.507

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. L1 denotes a one-period lagged variable (year). Estimations correspond to equation (2). Include FEs: v_{ijt} firm–product–year; δ_{jp} product–destination. (1) Main regression. (2) Comparison using only contemporaneous variables.

Table A.4: Robustness additional fixed effect - Estimated short-term supply coefficients- export volume

	Total		Manufacturing	
	(1)	**(2)**	**(1)**	**(2)**
Δrer	0.229***		0.216***	
	(0.055)		(0.074)	
L1.	0.241***		0.303***	
	(0.055)		(0.074)	
Δgdp	0.914***		1.103***	
	(0.151)		(0.198)	
L1.	-0.135		-0.378*	
	(0.151)		(0.198)	
$\Delta\tilde{\tau}_{jpt}$	-0.044	-0.547**	-0.074	-0.346
	(0.152)	(0.238)	(0.184)	(0.318)
L1.	-0.587***	-0.338*	-0.598***	-0.397
	(0.133)	(0.189)	(0.180)	(0.309)
Observations	195,665	195,665	111,563	111,563
R-squared	0.432	0.437	0.450	0.455
Fixed effects:				
v_{ijt} firm–product–year	√	√	√	√
δ_{jp} product–destination	√	√	√	√
ψ_{pt} destination–year		√		√

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimation corresponds to equation (3) restricting sample to results in Table 3. Columns (1) Main regression, column (2) adds a third fixed effect across destination p and year.

Table A.5: Robustness additional fixed effect - Estimated long-term supply coefficients- export volume

	Total		Manufacturing	
	(1)	**(2)**	**(3)**	**(4)**
rer	0.371***		0.401***	
	(0.041)		(0.053)	
gdp	0.426***		0.254***	
	(0.053)		(0.070)	
$\tilde{\tau}_{jpt}$	-0.439***	-0.487***	-0.286*	-0.562**
	(0.106)	(0.149)	(0.149)	(0.250)
Observations	195,665	195,665	111,563	111,563
R-squared	0.912	0.913	0.911	0.912
Fixed effects:				
v_{ijt} firm–product–year	√	√	√	√
δ_{jp} product–destination	√	√	√	√
ψ_{pt} destination–year		√		√

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimation corresponds to equation (3) restricting sample to results in Table 3. Columns (1) Main regression (3), column (2) adds a third fixed effect across destination p and year t. Dependent variable "exp": log export volume.

Table A.6: Robustness clustering errors by product - Estimated short-term supply coefficients- export volume

	Total		Manufacturing	
	(1)	**(2)**	**(1)**	**(2)**
Δrer	0.229***	0.229***	0.216***	0.216***
	(0.055)	(0.070)	(0.074)	(0.079)
L1.	0.241***	0.241***	0.303***	0.303***
	(0.055)	(0.070)	(0.074)	(0.083)
Δgdp	0.914***	0.914***	1.103***	1.103***
	(0.151)	(0.195)	(0.198)	(0.218)
L1.	-0.135	-0.135	-0.378*	-0.378
	(0.151)	(0.188)	(0.198)	(0.231)
$\Delta\tilde{\tau}_{jpt}$	-0.044	-0.044	-0.074	-0.074
	(0.152)	(0.155)	(0.184)	(0.175)
L1.	-0.587***	-0.587***	-0.598***	-0.598***
	(0.133)	(0.133)	(0.180)	(0.179)
Observations	195,665	195,665	111,563	111,563
R-squared	0.432	0.432	0.450	0.450

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimation corresponds to equation (3) restricting sample to results in Table 3. Columns (1) Main regression (2) Clustering errors by product level. Includes FEs: v_{ijt} firm–product–year; δ_{jp} product–destination.

Table A.7: Robustness clustering errors by product - Estimated long-term supply coefficients- export volume

	Total		Manufacturing	
	(1)	**(2)**	**(3)**	**(4)**
rer	0.371***	0.371***	0.401***	0.401***
	(0.041)	(0.080)	(0.053)	(0.093)
gdp	0.426***	0.426***	0.254***	0.254*
	(0.053)	(0.124)	(0.070)	(0.135)
$\tilde{\tau}_{jpt}$	-0.439***	-0.439***	-0.286*	-0.286
	(0.106)	(0.146)	(0.149)	(0.198)
Observations	195,665	195,665	111,563	111,563
R-squared	0.912	0.912	0.911	0.911

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimation corresponds to equation (3) restricting sample to results in Table 3. Columns (1) Main regression (2) Clustering errors by product level. Dependent variable "exp": log export volume. Includes FEs: v_{ijt} firm–product–year; δ_{jp} product–destination.

Table A.8: Robustness removing product-destination fixed effects – Estimated short-term supply coefficients-export volume

	Total		Manufacturing	
	(1)	**(2)**	**(1)**	**(2)**
Δrer	0.229***	0.276***	0.216***	0.260***
	(0.055)	(0.051)	(0.074)	(0.068)
L1.	0.241***	0.233***	0.303***	0.261***
	(0.055)	(0.050)	(0.074)	(0.068)
Δgdp	0.914***	1.069***	1.103***	1.206***
	(0.151)	(0.130)	(0.198)	(0.171)
L1.	-0.135	-0.014	-0.378*	-0.265
	(0.151)	(0.129)	(0.198)	(0.169)
$\Delta\tilde{\tau}_{jpt}$	-0.044	0.026	-0.074	0.084
	(0.152)	(0.139)	(0.184)	(0.169)
L1.	-0.587***	-0.501***	-0.598***	-0.492***
	(0.133)	(0.119)	(0.180)	(0.165)
Observations	195,665	199,282	111,563	114,111
R-squared	0.432	0.404	0.450	0.418
Fixed effects:				
v_{ijt} firm–product–year	√	√	√	√
δ_{jp} product–destination	√	-	√	-

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. L1 denotes a one-period lagged variable (year). Estimations correspond to equation (2). Columns (1) Main (2) Removing product-destination fixed effect.

Table A.9: Robustness full sample & PPML – Estimated long-term supply coefficients- export volume

	Total			Manufacturing		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
rer	0.371***	0.245***	0.986***	0.401***	0.282***	0.631***
	(0.041)	(0.027)	(0.144)	(0.053)	(0.035)	(0.219)
gdp	0.426***	0.472***	1.054***	0.254***	0.264***	0.920***
	(0.053)	(0.033)	(0.096)	(0.070)	(0.045)	(0.153)
$\tilde{\tau}_{jpt}$	-0.439***	-0.254***	-0.636***	-0.286*	0.101	-0.858*
	(0.106)	(0.066)	(0.126)	(0.149)	(0.098)	(0.453)
Observations	195,665	526,422	537,713	111,563	298,807	309,449
R-squared	0.912	0.898	0.9773	0.911	0.889	0.9780

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimations correspond to equation (3). Dependent variable "exp": log export volume and FEs v_{ijt} firm–product–year; δ_{jp} product–destination. (1) Main restricting sample to results in Table 3 (2) Without restricting sample (3) Estimating with PPML. R-squared corresponds to pseudo R2.

Documentos de Trabajo Banco Central de Chile	Working Papers Central Bank of Chile
NÚMEROS ANTERIORES	PAST ISSUES
La serie de Documentos de Trabajo en versión PDF puede obtenerse gratis en la dirección electrónica: www.bcentral.cl/esp/estpub/estudios/dtbc. Existe la posibilidad de solicitar una copia impresa con un costo de Ch$500 si es dentro de Chile y US$12 si es fuera de Chile. Las solicitudes se pueden hacer por fax: +56 2 26702231 o a través del correo electrónico: bcch@bcentral.cl.	Working Papers in PDF format can be downloaded free of charge from: www.bcentral.cl/eng/stdpub/studies/workingpaper. Printed versions can be ordered individually for US$12 per copy (for order inside Chile the charge is Ch$500.) Orders can be placed by fax: +56 2 26702231 or by email: bcch@bcentral.cl.

DTBC – 1058
Artificial Intelligence Models for Nowcasting Economic Activity
Jennifer Peña, Katherine Jara, Fernando Sierra

DTBC – 1057
Clasificación de Riesgo de Crédito Bancario, Ventas y Estados Financieros en Base a Información Tributaria de Firmas en Chile
Ivette Fernández D., Jorge Fernández B., Francisco Vásquez L.

DTBC – 1056
Exogenous Influences on Long-term Inflation Expectation Deviations: Evidence from Chile
Carlos A. Medel

DTBC – 907*
Earnings Inequality in Production Networks
Federico Huneeus, Kory Kroft, Kevin Lim

DTBC – 1055
Markup Distribution and Aggregate Dynamics
Mario Giarda, Will Jianyu Lu, Antonio Martner

DTBC – 1054
Decoding Central Banks' Practices: A Closer Look at Inflation Expectations Surveys
Valentina Cortés Ayala, Karlla Muñoz Cáceres, Daniel Pérez Klein

DTBC – 1053
An Assessment of the Effects of Monetary Policy Communication in Chile
Mario González-Frugone, Ignacio Rojas

DTBC – 1052
This Time is Global: Synchronisation in Economic Policy Uncertainty Indices
Carlos Medel

DTBC – 1051
Beyond Costs: The Dominant Role of Strategic Complementarities in Pricing Elias Albagli, Francesco Grigoli, Emiliano Luttini, Dagoberto Quevedo, Marco Rojas

DTBC – 1050
The Anatomy of Aggregate Productivity
Federico Huneeus, Yasutaka Koike-Mori, Antonio Martner

banco central Chile

DOCUMENTOS DE TRABAJO Diciembre 2025