CHILE - SOUTH KOREA FTA: EXTENSIVE AND INTENSIVE MARGINS ANALYSIS

TLC CHILE - COREA DEL SUR: ANALISIS DE LOS MARGENES EXTENSIVOS E INTENSIVOS

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Abstract

This paper analyzes the impact of the Chile-South Korea Free Trade Agreement (CKFTA) over the bilateral extensive and intensive margins of trade. Using disaggregated product-level data for the period 1996-2017, the paper tests the impact of CKFTA on bilateral flows, as well as differentiate these effects between intensive and extensive margins at the product level. To estimate, a Poisson-Pseudo Maximum Likelihood model is proposed. It is found that the CKFTA had a positive effect over bilateral trade flows, and although new products were added to the bilateral export basket (extensive margin), the impact is stronger on goods already traded (intensive margin). Moreover, the paper concludes that this effect is stronger for Chilean exports.

Keywords: *FTA, Chile, South Korea, CKFTA, export performance, PPML, intensive & extensive margins.*

JEL Classifications: *F13, F14, F53.*

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Resumen

Este artículo analiza el impacto del Tratado de Libre Comercio entre Chile y Corea del Sur (CKFTA) respecto de los márgenes de comercio extensivos e intensivos. Usando datos desagregados a nivel de producto para el período 1996-2017, el artículo prueba el impacto del acuerdo en los flujos bilaterales, así como también diferencia estos efectos entre márgenes intensivos y extensivos a nivel de producto. Para estimar se propone un modelo de Pseudomáxima Verosimilitud de Poisson. Se encuentra que el CKFTA tuvo un efecto positivo en los flujos comerciales bilaterales, y aunque se agregaron nuevos productos a la canasta exportadora bilateral (margen extensivo), el impacto es más fuerte en los bienes ya comercializados (margen intensivo). Además, el artículo concluye que este efecto es más fuerte para las exportaciones chilenas.

Palabras clave: *TLC, Chile, Corea del Sur, rendimiento exportador, PPML, márgenes extensivos e intensivos.*

Clasificación JEL: *F13, F14, F53.*

1. INTRODUCTION

In 2003, Chile and South Korea (hereafter, Korea) subscribed a bilateral free trade agreement (CKFTA). This agreement, which entered into force in April 2004, became a milestone in international trade relations, as it became the first FTA subscribed by Korea with a western economy, the first Chilean agreement with an Asian economy; and the first transpacific free trade agreement. Although this agreement was negotiated within a pro-multilateral negotiations environment, the upcoming deterioration of the multilateral trading system (and the failure of the Doha Round), marked the beginning of an era of preferential trade liberalization through the Pacific Rim, with the negotiation of various bilateral and regional agreements. 17 years later, the international political economy scenario has changed. Together with the impasse of the multilateral negotiations and the economic crisis as a result of the COVID-19 pandemic, an uprising contestation of globalization effects and protectionism have risen in various economies. This new scenario reveals the need to evaluate the effects of this kind of agreements, particularly for countries that have relied on these instruments for both their international trade integration and economic development processes.

Chile and Korea are amongst those economies that have turned their trade policy into preferential trade agreements, negotiating within their respective regions, as with overseas partners. Even though there is a growing literature on the effects of free trade agreements for Chile (Jean, Mulder, & Ramos, 2014; López & Muñoz, 2008; Reyes,

2005; Schiff, 2002; Schuschny, Durán, & De Miguel, 2008) and Korea (Andreosso-O'Callaghan, 2009; Lakatos & Nilsson, 2017; Nakajima, 2002; Porto, 2018), little evidence exists regarding the bilateral economic relations. Papers referring to the bilateral relation focus on the political process leading to the establishment of the FTA (Chung, 2003; Park & Koo, 2007; Sohn, 2001), or sectorial assessments, where agriculture, as a sensitive sector for the Korean economy, becomes of particular interest (Ahn & Im, 2016; Y.-S. Kim & Choi, 2007; Moon, Seok, & Kim, 2018). Recent studies have looked into the impact of the CKFTA on aggregate bilateral trade flows using synthetic control methods (Muñoz, López, & Cáceres, 2022) and qualitative analysis of the agreement on expanding and adding value to the countries' export baskets (Muñoz, Cáceres, & López, 2021). Nevertheless, there is a gap in the literature when assessing this particular agreement, which represents a breach in policymaking, as most official reports rely only on descriptive statistics regarding the exports volumes, main products or number of products being exchanged (DIRECON, 2005, 2006, 2007, 2011).

The purpose of this paper is to assess the CKFTA, and test whether this agreement has led to an intensification of bilateral trade flows. In particular, it examines to what extent the growth of bilateral exports may be explained by already existing products, which benefited from the barriers reductions resulting after the CKFTA, and its impact on the establishment of new trade relations (i.e., the incorporation of new goods into export baskets). Using a sample covering over 5,000 products (HS 6-digit classification) for the period 1996-2017, it constructed a Poisson-Pseudo Maximum Likelihood (PPML) model to assess the impact of the CKFTA in the overall export relation, and in the intensive and extensive margins of trade. It reveals that, while the CKFTA had a positive impact on overall exports, this impact is stronger for existing products (intensive margin). Furthermore, as robustness check the results of a synthetic control method and a logistic regression are presented.

After this introduction, the paper is structured as follows. The second section presents some stylized facts regarding Chile - Korea's bilateral relation, with particular emphasis on the FTA negotiation, from which the paper's hypotheses are derived. Later, in the third section, the methodological approach is derived. The fourth section presents and discusses the main findings of the empirical model. The fifth section, as robustness check, analyses two alternative specifications, synthetic control method and logistic regression. Finally, some concluding remarks and policy recommendations are shown.

2.   STYLIZED FACTS AND HYPOTHESES

In 1999, during APEC's leaders meeting held in Auckland, New Zealand, Chile and Korea announced their intention to negotiate a bilateral free trade agreement. After six negotiation rounds, the agreement was signed on 15 February 2003. Following both parliaments' approval, the Chile-Korea Free Trade Agreement (CKFTA) entered into

force on 1 April 2004 (OAS, 2019), becoming the first FTA between a Latinamerican and an Asian economy.

The pursuit of the agreement had different motivation coming from Chile and Korea (Muñoz *et al.*, 2021). While Chile was already embraced in the search of preferential trade agreements to open its economy, it was also pursuing a more active involvement in the Asia Pacific region (Herreros, 2010; Schuschny *et al.*, 2008; Wilhelmy, 2010); South Korea's policy departure from its long-standing support for the multilateral trading system began with its FTAs negotiations with Chile (W.-h. Kim, 2003; Park & Koo, 2007; Sohn, 2001).

On the one hand, for Chile, the aproximation to the Asia Pacific region has become a State policy, but with varied intensities (López & Muñoz, 2015). From its participation in regional forums –such as APEC, PECC, PBEC– Chile has strenghthen its position over regional and bilateral ties with economies within the region (Wilhelmy, 2010). Nevertheless, it did not progress the objective of becoming a platform or bridge between both regions (Artaza, 2007), for which there was a need for new instruments and alliance to take full advantage of the existing and potential relations. In this context, the FTA with Korea not only supposed a preferential access to an interesting market, but also the construction of a model to reach other economies within the region (Jara, 2005). For Chilean governmental authorities, the agreement would suppose an international recognition to its trade policy orientation, the streghtening of a "country team" involving an active consultation with the private sector, an opportunity to increase and diversify exports, better trade reglamentation, investment promotion, bilateralism empowerment post-Seattle WTO ministerial conference failure, and an improvement of the country's image (DIRECON, 2002).

On the other hand, for Korea the motivations behind pursuing this agreement were sustained in economic, political and diplomatic leverage. Due to the rise of preferential trade agreements and the erosion of multilateral preferences worldwide, Korea considered initiating its own preferential openning process (Cheong, 2003; MOFA, 2002), which was prompted by the aftermath of the Asian Financial Crisis. In this context, Chile as a partner had a potential minimal costs for South Korea's uncompetitive sectors such as agricuture, and its accumulated experience in FTA negotiations made the country an ideal candidate for South Korea's first FTA partner (Park & Koo, 2007; Sohn, 2001).

The CKFTA normative structure was based on the World Trade Organization (WTO) agreements (goods, services and intellectual property), took into consideration the ongoing Doha Development Agenda (DDA), and followed previous Chilean negotiation texts (Mexico and Canada). Amongst its most important chapters included: trade in goods, rules of origin, customs procedures, trade remedies, sanitary and phitosanitary measurements, standard-related measures, investment, services and related matters (including investment, cross-border trade in services, telecommunications, temporary entry for business persons, and competition), government procurement, intellectual property rights, & dispute settlement (DIRECON, 2002). The main difference between

both economies was their approach towards agricultural liberalization. While for Chile, the sector becomes one of its most important export cluster; for Korea, it was a sensitive and protected sector (Muñoz *et al.*, 2021). In the final text of the agreement, some agricultural products were treated as "exceptions to liberalisation", others were included in a "Doha Development Agenda" DDA category, subject to the results of the WTO's multilateral negotiations, and a "seasonal tariff system" was imposed on Chilean wines for the first 10 years (Bridges, 2004). Hence, goods trade liberalization was scheduled into different tariff reduction periods, with special timeframes for sensitive products (agriculture), quotas, and the inclusion of a DDA category, subject to review after the conclusion of the multilateral negotiations (Table 1).

TABLE 1

CKFTA TARIFF REDUCTION SCHEME

Category	Korea		Chile	
	N° of items	%	N° of items	%
Immediate	9,470	87.2%	2,422	41.4%
NMF 0%	750	6.7%	–	–
5 years	701	6.3%	2,018	34.5%
7 years	35	0.3%	14	0.2%
9 years	1	0.01%	–	–
10 years	262	2.3%	1,194	20.4%
10 years est	1	0.01%	–	–
13 years (5 years exempt)	–	–	152	2.6%
16 years	12	0.11%	–	–
Quotas	24	0.2%	–	–
DDA	373	3.3%	–	–
Exceptions	21	0.2%	54	0.9%

Source: DIRECON (2002).

When reviewing the evolution of the trade relation between both economies since the entry into force of the FTA, it can be seen that after the entry-into-force of the CKFTA in 2004, exports grew at an exponenciall rate till the turmoils of the financial crisis in 2009 (Figure 1). In the aftermath of the crisis, trade flows have shown an erratic behaviour, which is consistent with the slow recovery of the global economy. Nevertheless, when comparing the pre-FTA scenario with 2017, exports more than doubled for Korea, and grew by four times for Chile, which is highlighted by most governmental reports (DIRECON, 2011).

FIGURE 1

TOTAL EXPORTS KOREA TO CHILE & CHILE TO KOREA (1996-2017)
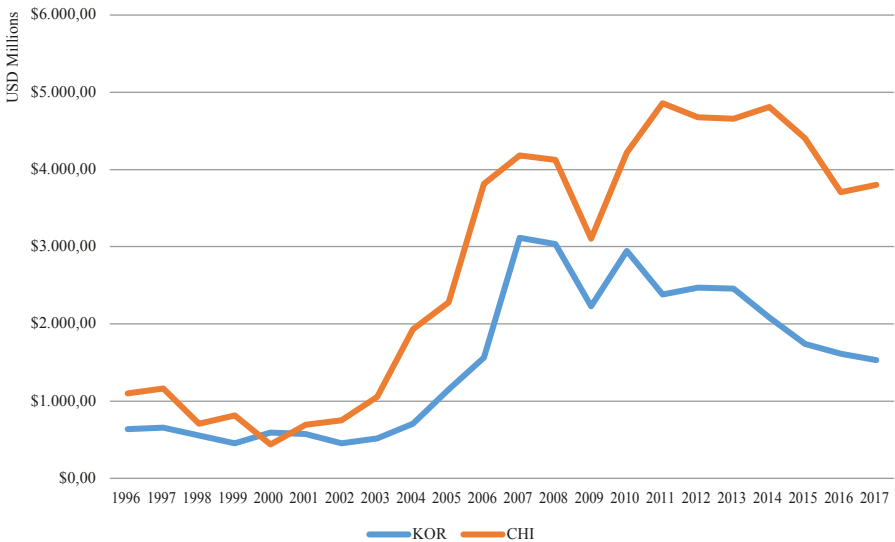
Source: Authors' calculation using UN Comtrade data.

At a product level, the number of merchandizes conforming bilateral exports also grew after the CKFTA. As shown in Figure 2, the number of products (at a 6-digit level) have shown an important growth for both economies. For Chile, it grew from 117 tariff lines in 1996 to 428 in 2017, while for Korea it rose from 723 to 1349 in the same period. Moreover, Yoon (2015) shows that for Korea the growth in the number of firms mutiplied around threefold, with over 200 companies entering the Chilean market every year.

Nevertheless, while the abovementioned figures show a positive trend on both overall exports and diversification measured as the incorporation of new products, when analysing trade flows values at a product level, it can be infered that the impact of the CKFTA has not been homogeneous. Even though the CKFTA may have a positive impact over aggregate trade flows, from an overall analysis of exports it can be stated that this growth has been concentrated on products already being traded between both economies. This is to say that the agreement benefited the trade exchange of already traded products, as a result of both tariff and non-tariff reductions.

To test this hypothesis, the paper splits exports into two groups. First, it identifies those products being exported before the agreement was subscribed. Second, it identifies those products that begun to be exchange between both economies after

FIGURE 2

NUMBER OF PRODUCTS EXPORTED BETWEEN KOREA AND CHILE (1996-2017)
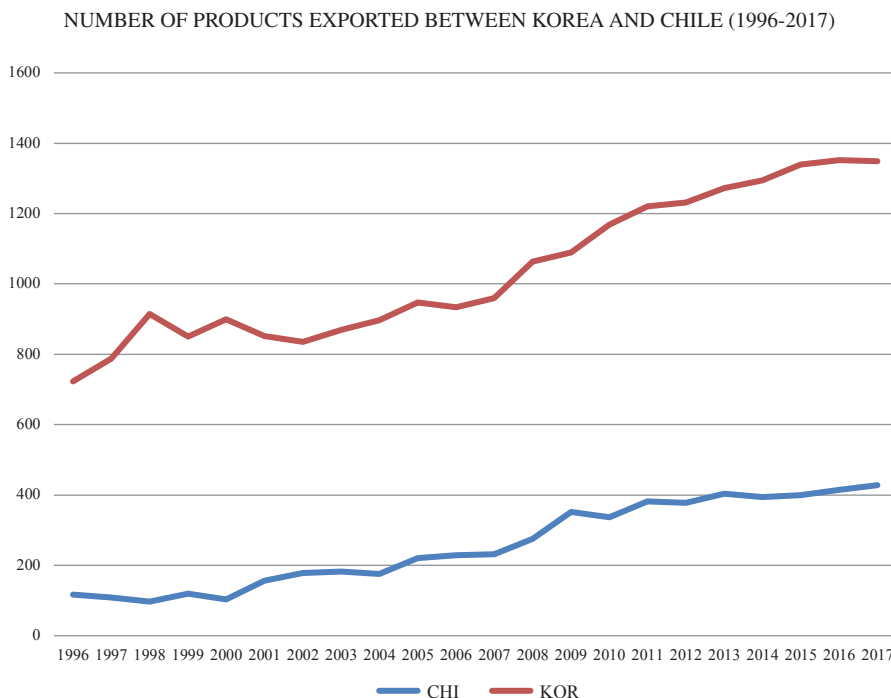
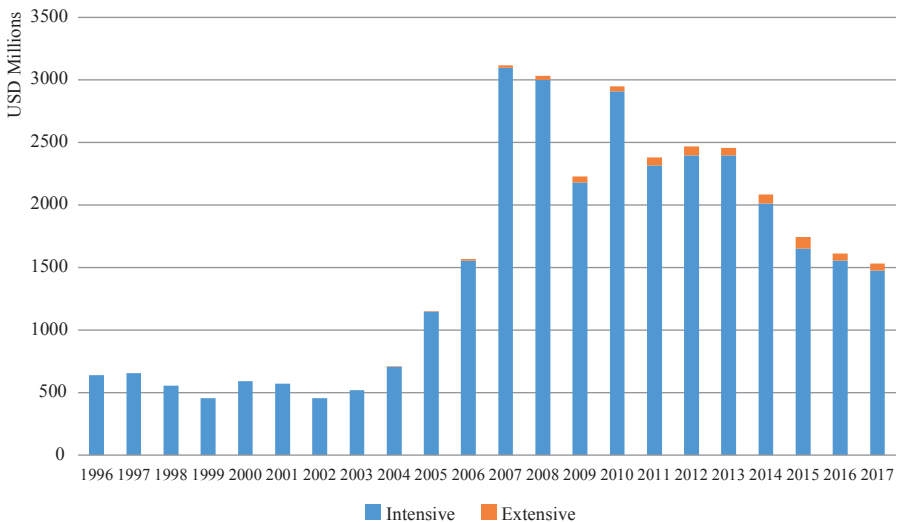Source: Authors' calculation using UN Comtrade data.

the agreement entered into force, and reviews its performance. The hypothesis behind this differentiation is that the subscription of the CKFTA generated the conditions for new trade relations to establish between both economies. These relations result from preferential market access (in the form of tariff reductions and non-tariff barriers removal) and the establishment of a framework for bilateral economic relations and trade. It has to be acknowledged that the economic relation between two countries is not limited to the subscription of an FTA, but this milestone allows economies to enhance their interactions. For instance, Chile opened trade and agricultural attachés offices in Seoul, and bilateral business missions have surged as a result of the FTA. Hence, this differentiation not only takes into account that the reduction of trade barriers resulted from the CKFTA allows new products to enter the bilateral export baskets, but that the institutional framework derived from the agreement increases the odds of new businesses.

To illustrate this differenciated effect, Figures 3 and 4 show the exports value evolution in the sample period, for both Chile and Korea, differentiating between

these two categories: existing and new products. It may be recalled that most of the aggregated exports growth is explained by products that were already being exported to the trading partner, so, although new products have been incorporated into the export baskets, their weight in the bilateral relation is minimum.

FIGURE 3

KOREAN EXPORTS TO CHILE. INTENSIVE AND EXTENSIVE DISAGGREGATION (1996-2017)

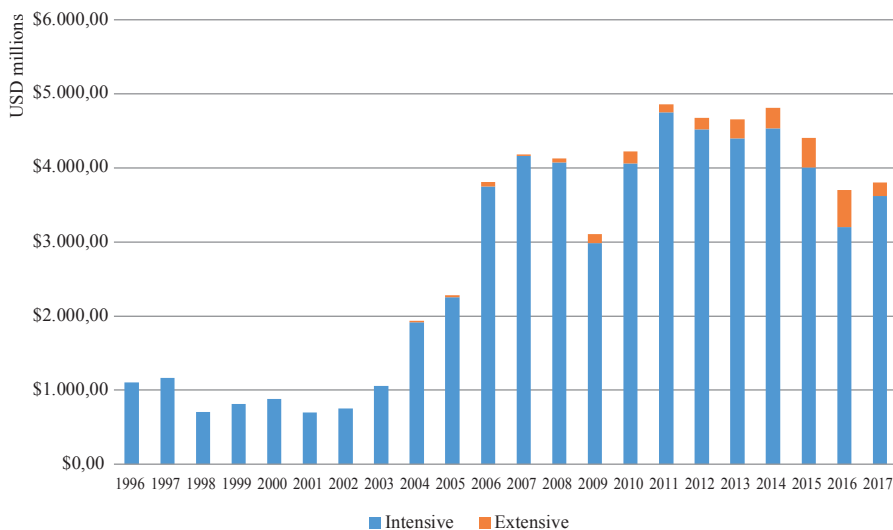Source: Authors' calculation using UN Comtrade data.

In 2015, in the framework of the IX CKFTA administration comission, both countries expressed their intention to modernize the CKFTA (DIRECON, 2015), launching the negotiations to update the agreement in 2018. The first negotiation round was held in Seoul, on November 2018, while the second, covering trade facilitation, gender, environment, anticorruption, intellectual property and labour issues amongst others was held in Santiago, on July 2019 (SUBREI, 2019). Due to the uprise of the COVID-19 pandemic, subsequent negotiatons rounds have been held virtually, with meetings in 2020 and 2021. The latest, in June 2021 covered anticorruption, trade in goods, digital economy, trade facilitation, environment, labour, gender and intellectual property issues (SUBREI, 2021).

In this context, it becomes of the outmost importance to assess the impact of the agreement. Following the previous discussion, the paper analyzes the effects the

FIGURE 4

CHILEAN EXPORTS TO KOREA. INTENSIVE AND EXTENSIVE DISAGGREGATION
(1996-2017)

Source: Authors' calculation using UN Comtrade data.

FTA between Chile and Korea had on bilateral trade flows. After 17 years in place, it would be expected to see a positive effect of the CKFTA over bilateral trade flows, hence the first working hypothesis can be derived:

H1: Due to the removal of trade barriers (tariff reductions, non-tariff barriers), CKFTA had a positive effect on bilateral trade flows.

Nevertheless, as shown in the stylized facts, this effect may not be evenly distributed among the different products exported between both countries. Although trade agreements are instruments that remove trade barriers and facilitate trade exchange between economies, they are only one condition that may lead to the improvement of exports. Exporters need to build networks for the distribution of their goods; specific regulations and labelling are sometimes required; and, ultimately, there is a need for consumers to know the products. Hence, differentiated impacts can be expected on those products already being traded between both economies, and those new products that have been incorporated since the establishment of the FTA. On the one hand, those products already being traded between signatory economies are competitive

enough to overcome tariff protection and the absence of institutional frameworks that govern bilateral trade relations. Hence, it is likely that they are more capable of benefiting from the preferences derived from an FTA. On the other hand, products not being traded may not be competitive to enter the partners market either due to trade protectionism or their own productive capabilities. The FTA would only make an impact on the first case, but still the consolidation of business networks is needed to take advantage of the FTA's institutional framework and trade preferences. Therefore, the second working hypothesis can be stated as follows:

H2: CKFTA had a stronger effect on already exporting goods (intensive margin of trade) than over new products (extensive margin of trade).

Finally, as it can be stated that the most-favored nation (MFN) tariff barriers imposed by both countries differ, the impact of trade liberalization should not be equivalent. To illustrate this point, it must be taken into consideration that Chile had a stronger previous unilateral liberalization, with average of MFN tariffs lower than Korea's. At the time of the FTA subscription, Chile imposed a flat MFN tariff of 6%, while Korea had an average MFN tariff of 12.8%, with variance amongst products and sectors, with peaks in agriculture products of 52.2%. Therefore, the expected average preferential margin for Korean exports was 6%, while for Chile's exports was 12.8%. Hence, it would be expected that the CKFTA had a stronger effect on Chilean exports, relative to Korea's, since the preferential margin (difference between MFN and preferential rate) is higher for Chilean exports. This could be stated as the following hypothesis:

H3: As Korea presented a more protectionist scheme (higher average MFN tariffs) than Chile, CKFTA had a stronger effect on the expansion of Chilean exports.

In order to test these working hypotheses, the following section presents the methodological discussion leading to the proposed model, and later, the data sources used for estimation purposes.

3. EMPIRICAL METHOD AND DATA

Understanding the factors that explain the expansion of trade flows has become one of the leading issues in international economy. In order to derive the empirical estimation, the paper assumes an Armington model (Alston, Carter, Green, & Pick, 1990; Mc Daniel & Balistreri, 2003; Yotov, Piermartini, Monteiro, & Larch, 2016), in which N countries produce a variety of products defined as Q_i with price p_i such that the domestic production may be defined as $Y_i = p_i Q_i$. Let country i's aggregate expenditure be denoted as E_i which may be represent as $E_i = \phi_i Y_i$, where $\phi_i > 1$ denotes trade deficit and $0 < \phi_i < 1$ trade surplus.

Following the literature (Heufer & Hjertstrand, 2019; Yotov *et al.*, 2016), it can be assumed consumer preferences to be homothetic, identical across countries, and given the CES-utility function:

$$\left\{ \sum_i \alpha_i^{\frac{1-\sigma}{\sigma}} C_{ij}^{\frac{\sigma-1}{\sigma}} \right\}^{\frac{\sigma}{\sigma-1}} \tag{1}$$

where $\sigma > 1$ is the elasticity of substitution, $\alpha > 0$ is the CES preferences parameter, and C_{ij} the consumption varieties from country i to j. Hence, consumers will maximize equation 1 according to the following budget constrains:

$$\sum_i p_{ij} c_{ij} = E_j \tag{2}$$

Considering frictions from moving goods from country i to country j, we set the delivery price $p_{ij} = p_i t_{ij}$, where trade cost is defined as $t_{ij} \geq 1$, therefore the optimization problem may be expressed as:

$$X_{ij} = \left(\frac{\alpha_i p_i t_{ij}}{P_j} \right)^{(1-\sigma)} E_j \tag{3}$$

Where X_{ij} denotes trade flows, and P_j a CES consumer price index:

$$P_j = \left[\sum_i \left(\alpha_i p_i t_{ij} \right)^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \tag{4}$$

The market clearance for goods from each origin may be described as:

$$Y_i = \sum_j \left(\frac{\alpha_i p_i t_{ij}}{P_j} \right)^{1-\sigma} E_j \tag{5}$$

Defining $Y_i \equiv \sum_j X_{ij} \; \forall \; i$ and dividing equation (5) by Y, it can be obtained:

$$\left(\alpha_i p_i \right)^{1-\sigma} = \frac{\dfrac{Y_i}{y}}{\sum_j \left(\dfrac{t_{ij}}{P_j} \right)^{1-\sigma} \dfrac{E_j}{Y}} \tag{6}$$

Following Anderson and Van Wincoop (2003) it is defined $\Pi_i^{1-\sigma} \equiv \sum_j \left(\dfrac{t_{ij}}{P_j}\right)^{1-\sigma} \dfrac{E_j}{Y}$, and substitute into equation 6:

$$\left(\alpha_i p_i\right)^{1-\sigma} = \frac{\dfrac{Y_i}{y}}{\Pi_i^{1-\sigma}} \tag{7}$$

Using equation 7 in equations (3) and (4), a functional form of bilateral trade exchanges ca be obtained:

$$X_{ij} = \frac{Y_i E_j}{Y}\left(\frac{t_{ij}}{\Pi_i P_j}\right)^{1-\sigma} \tag{8}$$

Finally, the trade cost term can be identified as:

$$\Phi_{ij} = \left(\frac{t_{ij}}{\Pi_i P_j}\right)^{1-\sigma} \tag{9}$$

so that,

$$X_{ij} = \frac{Y_i E_j}{Y}\Phi_{ij} \tag{10}$$

In order to expand the framework of analysis and capture the intensive and extensive margins of trade, the paper follows the model proposed by Chaney (2008). Here, trade barriers have impacts on two different margins, the intensive margin defined by how much each existing exporter changes the size of its exports, and the extensive margin defined by how much new entrants' export. Therefore, although removal of trade barriers may boost bilateral exchanges, this effect may be differentiated between merchandizes.

In order to differentiate both margins, following Besedeš and Prusa (2011), bilateral trade in equation (10) is defined:

$$X_t = \sum N_{k,t} v_{k,t} \tag{11}$$

where X_t is the value of exports in year t, $N_{k,t}$ is the number of export relationships, and $v_{k,t}$ the average value per relationship. The number of relationships will vary

within time according to those products that are capable of sustain their participation in bilateral trade (survival-stayers) and the deepening of this relation, minus those products exiting the relation (failure) and newcomers (entry). The authors propose this as stated in Equation (2), where $h_{z,t+1}^{i}$ denotes the hazard rate of a relationship in industry z (the probability of sector z of exiting or entering the relationship).

$$X_{t+1} - X_t = \sum_{z \in Z} \left\{ \Sigma \left[\left(1 - h_{z,t+1}^{i}\right) n_{z,t}^{i} \right] \left[v_{z,t+1}^{i} - v_{z,t}^{i} \right] - \sum_{i=1}^{I} \left[\left(h_{z,t+1}^{i} n_{z,t}^{i}\right) v_{z,t}^{i} \right] + \right.$$
$$\left. \epsilon_{z,t+1} v_{z,t+1}^{0} h_{z,t+1} \right\} \tag{12}$$

Summing up, and as stated in equation (3), trade flows may be explained by an intensive and an extensive margin, covering existing $\left(n_{z,t}^{i} v_{z,t}^{i}\right)$ and new trade $\left(\hat{n}_{z,t}^{i} \hat{v}_{z,t}^{i}\right)$ flows between two economies.

$$X_t = \Sigma \left\{ \left[n_{z,t}^{i} v_{z,t}^{i} \right] + \left[\hat{n}_{z,t}^{i} \hat{v}_{z,t}^{i} \right] \right\} \tag{13}$$

Once established that bilateral trade flows may be understood as the sum of both existing and new trade relations -the concepts of extensive and intensive margins of trade at the products level-it becomes relevant to understand the determinants of bilateral trade at the product level, in order to study which factors determine the entry/exit of these products. For this purpose, following the notation expressed in equation (8), the bilateral trade flows at the product level can be expressed as:

$$X_{ijt}^{k} = \frac{Y_{it} Y_{ikt} E_{jt} E_{jkt}}{Y_t} \left(\frac{t_{ijt}}{\Pi_{it} P_{jt}} \right)^{1-\sigma} \tag{14}$$

Where X_{ijt}^{k} is the product level trade flow (sector k) between countries i and j in period t; Y_{it} is the gross product of country i in year t, Y_{ikt} is the share of sector k in the gross output, E_{jt} and E_{jkt} are both expenditures of country j (gross and in sector k), and $\left(\frac{t_{ijt}}{\Pi_{it} P_{jt}} \right)^{1-\sigma}$ the trade cost term Φ_{ij}.

In order to test the paper's working hypotheses, equation (14) can be expressed as the following log-linear functional form:

$$\ln(X_{ijt}^{k}) = \alpha_1 \ln\left(GDP_{i,t}\right) + \alpha_2 \ln\left(GDP_{j,t}\right) + \alpha_3 \ln\left(GDP_{i,k,t}\right) + \alpha_4 \ln\left(GDP_{j,k,t}\right) + \alpha_5 \ln\left(\Phi_{ij}\right) \tag{15}$$

Where the trade flow of a specific product being a function of overall GDP of the exporter and importer countries, which represent the overall economic capability of

the countries; and, the shares of that product in the exporter and importer countries GDP, as a way to estimate the comparative advantage in the production of said product. Therefore, it becomes critical to define Φ_{ij} such that the trade cost may be incorporated in the estimation.

The literature has added new parameters to control for other factors affecting international trade, including trade costs (Ryzhkova & Koval, 2018), colonial ties (Head, Mayer, & Ries, 2010; Sandberg, Seale Jr, & Taylor, 2006), common language (Egger & Lassmann, 2012; Lohmann, 2011), common border (Feenstra, 2002; McCallum, 1995), institutional quality (De Groot, Linders, Rietveld, & Subramanian, 2004), free trade agreements (Carrere, 2006; Fairlie, 2019; Martínez-Zarzoso & Nowak-Lehmann, 2003), amongst others. For purpose of this research, a vector of control variables, Φ_{ij} is defined, including tariffs, measured as the mean of country j applied tariffs, a dummy variable to denote the existence of preferential trade agreements, and governance indicators[1], as defined by Kaufmann, Kraay, and Mastruzzi (2011). Hence the baseline equation is stated as:

$$\ln(X_{ijt}^k) = \alpha_1 \ln\left(GDP_{i,t}\right) + \alpha_2 \ln\left(GDP_{j,t}\right) + \alpha_3 \ln\left(Sh_{GDPi,k,t}\right) + \alpha_4 \ln\left(Sh\_GDP_{j,k,t}\right) + \alpha_n \ln\left(\Phi_{ij}\right)$$

$$(16)$$

Following the abovementioned, and in order to capture the effect of the CKFTA over trade flows (H1), the model specified in equation (16) adds a dummy variable capturing the entering into force of the Chile-Korea Free Trade Agreement:

$$\ln(X_{ijt}^k) = \alpha_1 \ln\left(GDP_{i,t}\right) + \alpha_2 \ln\left(GDP_{j,t}\right) + \alpha_3 \ln\left(Sh\_GDP_{i,k,t}\right) + \alpha_4 \ln\left(Sh\_GDP_{j,k,t}\right) + \alpha_n \ln\left(\Phi_{ij}\right) + \gamma_1 CKFTA_{ijt}$$

$$(17)$$

For estimation purposes, the paper compiles bilateral trade flows between Chile and Korea at a 6-digit level disaggregation, for the period 1996 and 2017. This allows to have eight years before the entry into force of the FTA and 14 years after the agreement was subscribed, an adequate sample to test the paper's hypotheses. Export values were taken from UN's COMRADE Dataset and mirrored with Chile's Customs office information for verification purposes. For control purposes, the model includes bilateral trade flows between Chile and selected Asian economies[2], and Korea with selected Latin American economies[3]. To analyze the difference between intensive and

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[1]   Voice and accountability, government effectiveness, control of corruption, political stability, rule of law and regulatory quality.
[2]   China, Indonesia, Japan, and Singapore.
[3]   Colombia, Costa Rica, Ecuador, Mexico, and Peru.

extensive margins of trade, it creates two categories: old and new products. For this purpose, the paper identified those products that had been traded before the agreement entered into force (before 2004), which were denoted as old products. The rest were identified as new products, independently from the year in which they enter into the bilateral relation. GDP was taken from the World Bank's World Development Indicators. Tariffs were compiled from UNCTAD TRAINS dataset and double checked with official information from the customs offices from Chile and Korea. Governance indicators were obtained from the World Bank's Worldwide Governance Indicators. Table 2 summarize the main descriptive statistics for the data for Chile and Korea.

TABLE 2

DESCRIPTIVE DATA

Variable	Number of observations	Mean	Std. Dev.	Min	Max
Exports	2,258,080	366.2573	23857.39	0	1.04e+07
Intensive Exports	10,027	1686.519	20028.19	.002	881571.6
Extensive Exports	215,781	359.2842	15448.47	0	1810833
Ln (GDP Exporter / Importer)	2,258,080	26.57209	1.431669	23.18101	30.14147
TR_AP	2,191,364	7.420913	3.712995	0	20.57
GDP_Share_exp	2,258,080	1.14e-09	1.07e-07	0	.0000458
GDP_Share_imp	2,258,080	8.73e-10	2.40e-08	0	.0000104
VA	2,258,080	.4502849	.6679419	-1.74897	1.292521
RL	2,258,080	.5965294	.8237406	-1.251499	1.827708
GE	2,258,080	.7108081	.7150268	-.996869	2.436975
CC	2,258,080	.5547389	.8465496	-1.176364	2.32558
PS	2,258,080	.1343185	.7590158	-2.374467	1.61567
RQ	2,258,080	.7477129	.7126626	-1.296207	2.260543

Source: Authors' calculations using UN (2019) COMTRADE and World Bank (2019).

As an extension of equation (17), and to capture the differentiated effect that the CKFTA could have over intensive and extensive margins of trade (H2), equation (18) includes an interaction dummy $INT_{i,j,t}$ to denote those products that were traded before the agreement $\left(\hat{v}_{z,t}^{i} \right)$. This dummy variable captures the impact of the CKFTA on these products, as they were traded both before and after the subscription and entry into force of the agreement. With this variable, the paper intends to capture the differentiated effect of the CKFTA between those pre-existing products ($n_{z,t}^{i}$, intensive

margin of trade), and new goods ($\hat{v}_{z,t}^i$, extensive margin of trade). Likely, a variable $EXT_{i,j,t}$ has been included to capture the effect on the extensive margin.

$$\ln(X_{ijt}^k) = \alpha_1 \ln\left(GDP_{i,t}\right) + \alpha_2 \ln\left(GDP_{j,t}\right) + \alpha_3 \ln\left(GDP_{i,k,t}\right) + \alpha_4 \ln\left(GDP_{j,k,t}\right) + \alpha_n \ln\left(\Phi_{ij}\right) +$$
$$\gamma_1 \text{INT}_{ijt} + \gamma_2 \text{EXT}_{ijt}$$

(18)

Furthermore, as shown in equation (19), in order to extent the analysis, the model includes interaction variables to differentiate the effects of the CFKTA between Chilean and Korean exports. $\text{INT}\_\text{k}_{i,j,t}$, being a dummy variable identifying intensive Korean exports to Chile, and $\text{EXT}\_\text{K}_{i,j,t}$ an interaction variable identifying Korean extensive exports to Chile. In the same manner, variables identifying Chilean exports to Korea are included. These variables have been interacted with the FTA in order to capture the agreements effects on both goods categories. Hence, we may differentiate the impact of CKFTA between both economies' exports.

$$\ln(X_{ijt}^k) = \alpha_1 \ln\left(GDP_{i,t}\right) + \alpha_2 \ln\left(GDP_{j,t}\right) + \alpha_3 \ln\left(GDP_{i,k,t}\right) + \alpha_4 \ln\left(GDP_{j,k,t}\right) + \alpha_n \ln\left(\Phi_{ij}\right) +$$
$$\gamma_1 \text{INT}\_\text{k}_{ijt} + \gamma_2 \text{INT}\_\text{c}_{ijt} + \gamma_3 \text{EXT}\_\text{k}_{ijt} + \gamma_4 EXT\_\text{c}_{ijt}$$

(19)

4. ESTIMATIONS RESULTS AND MAIN FINDINGS

While the objective of the paper is to look into the effect of the CKFTA over intensive and extensive margins, it becomes relevant to establish, as a starting point, that the agreement had a positive effect over aggregate bilateral trade. For this purpose, first a gravity model for Chile - Korea bilateral trade exchanges were estimated. This model included 8266 observations, which represent aggregate exports between both countries and their respective trading partner, covering over 100 countries for the period 1997-2020. Besides standard gravity model determinants (GDP and distance), language, common border and FTAs have been identified as control variables. A special dummy variable for CKFTA has been included to assess the impact of this agreement over bilateral trade flows.

The results of the gravity model are consistent with the literature, with positive and significant coefficients associated with both exporter and importer GDP, and a negative coefficient associated with the distance between trading partners. As seen in Table 3, it can be concluded that the CKFTA has a positive and significant effect over bilateral trade flows. Interesting is to note that the impact of the CKFTA is larger than that of other FTA included in the regression model. This allows to conclude that the CKFTA has a positive and significant impact on overall bilateral trade flows, hence the paper turns into the analysis of the agreement at a products level.

TABLE 3

GRAVITY MODEL RESULTS

Variables	
Ln(GDP_exp)	3.436325
	(0.1328398)***
Ln(GDP_imp)	0.962525
	(0.0086606)***
Ln(GDP_pc_exp)	-3.795435
	(0.3080429)***
Ln(GDP_pc_imp)	0.1627615
	(0.013758)***
Ln(dist)	-0.9745523
	(0.0173252)***
Ln(FTA)	0.852796
	(0.0429474)***
Ln(Lang)	1.417479
	(0.0407752)***
Ln(border)	0.6151223
	(0.0409604)***
Ln(CKFTA)	2.695641
	(0.0576811)***
R^2	0.7650
Observations	8,266
Num. years	24
Years-fixed effects	Yes

Notes: 1. Dependent Variable: Exports.
         2. Robust error in parenthesis. *$p<0.1$, **$p<0.05$, ***$p<0.001$.
Source: Authors' calculations.

While in the previous section a theoretical underpinning of the model has been presented, there is a need to define an appropriate estimation technic. As largely recognized by the literature, the log-linear OLS estimation may lead to biased results, particularly for the large number of zeros present in trade statistics. In fact, one of the main characteristics of the data set used is the large number of zero observations. In this case, these zeros account for information, as they represent actual products that are not being traded at a certain period of time, and which may be traded after the subscription of the CKFTA, or still not being traded after the agreement subscription. Therefore, in order to correctly analyze the effects of the CKFTA, it is needed to account for a methodological approach consistent with this data.

As stated by Santos Silva and Tenreyro (2006), standard empirical methods used to analyze trade flows led to inappropriate results, as through variables log-

linearization in presence of heteroscedasticity results in inconsistent estimations. Moreover, these procedures are incompatible with zeros in trade data. To overcome these problems, they propose the utilization of a Poisson pseudo-maximum likelihood (PPML) estimator. Further literature has proved the properties of PPML estimators as a best fit for trade data analysis (Arvis & Shepherd, 2013; Gómez-Herrera, 2013; Martin & Pham, 2008; Santos Silva & Tenreyro, 2011). In consequence, following the literature, the paper estimates the regressions following a PPML. Results for the estimates are shown in Table 4.

The first three columns present the results for overall trade flows as presented in equation (16), which are used as a baseline for this study. These estimations vary in their inclusion of the vector of control variables and year fixed effects. Overall, the positive and significant value of the coefficient associated to exporter's GDP reflects that as countries productive structures grow, their exports increase, which is consistent with the literature. In the same direction, the positive coefficient associated to importer's GDP reflects that as income disposal increases, the import of goods does so. For parsimony in the results presentation, coefficients associated to control variables (MFN tariffs, openness and governance indicators) are not presented in Table 4. Nevertheless, it can be stated that their values and significance are consistent with the literature. In particular, regarding the trade cost variables, the mean of the applied tariff presents an expected and significant negative coefficient. As it can be assumed, the higher the tariff level, it would increase the cost of imports thus reducing trade flows. These estimations allow to conclude that the proper model should be estimated including both the vector of control variables and year fixed effects.

Hence, column 4 in Table 4 presents the results for the estimation of equation (17). In this equation, it was introduced the first variable of interest, this is the dummy controlling for the CKFTA. As seen in Table 4, the coefficient associated with this variable is significant and positive, as expected, meaning that the agreement had a positive effect over trade flows between both economies. When differentiating the data into new and old products, in order to test the intensive and extensive margins of trade generated by the agreement –column 5, equation (18)– it can be seen that the interaction dummy, which captures the intensive margin of trade, is positive and significant. Hence, it may imply that although the agreement has a positive effect on overall exports, the effect is higher for incumbent products, therefore, a major share of exports growth is explained by an expansion of the intensive margin of trade. On the contrary, the coefficient associated to the extensive margin of trade is negative, but nonsignificant.

Finally, columns 6 present the results of estimations for equation (19). These equations looked into the differences that may arise between both economies. Here, as it was established in the hypothesis, it is found that the CKFTA had a greater impact for overall Chilean exports than for Korea's, as the coefficient associated with Chilean exports are larger for both the extensive and intensive margins. Nevertheless, when analyzing the results associated with the interaction term for extensive margin

TABLE 4

ESTIMATION RESULTS

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE
Ln(GDP_exp)	0.9211219	0.7463705	0.4968542	0.6274982	0.6933183	0.8441749
	(0.0000366)***	(0.0000766)***	(0.0686666)***	(0.0778584)***	(0.0742885)***	(0.0900966)***
Ln(GDP_imp)	0.9479321	1.002311	0.8694525	0.9650707	1.04547	1.054755
	(0.0000366)***	(0.0000778)***	(0.0769759)***	(0.0853818)***	(0.0851093)***	(0.0845257)***
GDP_share_exp	200810.1	213663.6	231502.4	235131	239507.9	238654.1
	(2.707248)***	(3.773221)***	(11549.7)***	(11493.29)***	(11413.88)***	(11322.35)***
GDP_share_imp	1112277	1134723	1135106	1088974	56546.4	1131240
	(19.17355)***	(23.59032)***	(473018.3)***	(74236.41)***	(79883.16)***	(68067.2)***
FTA				0.9628378		
				(0.1893469)***		
Inten_fta					2.97074	
					(0.1710424)***	
Extent_fta					-0.1609245	
					(0.2133725)	
Inten_ch						4.919988
						(0.2522215)***
Exten_ch						1.140485
						(0.3118008)***
Inten_k						0.2615237
						(0.4080742)
Exten_k						-1.551991
						(0.1811161)***
Control vector	No	Yes	Yes	Yes	Yes	Yes
Observations	2,258,080	2,186,232	2,186,232	2,186,232	2,186,232	2,186,232
Pseudo R^2	0.4081	0.4266	0.4345	0.4366	0.4528	0.4671
Year fixed-effects	No	No	Yes	Yes	Yes	Yes

Notes: 1. Dependent Variable: Exports.
  2. Robust error in parenthesis. *$p<0.1$, **$p<0.05$, ***$p<0.001$.
  3. Control vector includes: MFN tariffs, countries' trade openness, exporter's governance indicators, importer's governance indicators.
Source: Authors' calculations.

for Korean exports, it can be observed that it comes negative and significant. This can be interpreted as that the impact for Chile is stronger than for Korea. This is consistent with both the literature and the stylized facts, as Chile had a much lesser protectionist scheme before the agreements. Therefore, preferential margins derived from the CKFTA where smaller than those given by Korea. Secondly, it must be

recalled that, for Korea, Chile is a minor trading partner, and the consecution of the agreement was not necessarily focused on the expansion of trade, but on the political economy of the agreement.

5. ROBUSTNESS CHECK

In order to test the robustness of the previous estimates, this section presents the results of two alternative estimation techniques: synthetic control method and a logistic regression. These alternative methods provide empirical evidence to assess two complementary approaches towards the research problem. First, what would happen with a counterfactual; and second, whether the CKFTA had an impact on the probability of exporting product to be exported towards the partner country.

For the first approach, following Muñoz *et al.* (2022) a synthetic control model is used to estimate the impact that the non-subscription of the FTA would have over a counterfactual synthetic control country. This method proposes the creation of a synthetic control built as a weighted combination of potential control countries to approximate the most relevant characteristics of the country affected by an intervention (in this case the CKFTA) (Billmeier & Nannicini, 2013; Muñoz *et al.*, 2022). This model was calculated for the Chile's exports towards Korea, using Argentina, Brazil, Ecuador, Mexico, Panama, and Uruguay for the construction of the synthetic control country. As shown in Figures 5 and 6, while the impact on the intensive margin of trade is positive and significant, in the case of extensive margin (new products), the results are non-conclusive. This supports the hypothesis that the CKFTA had a stronger effect over existing trade relations than on the addition of new products on the export baskets.

Second, to test if the CKFTA had a positive impact on the probability of exporting towards the partner country, a logistic model was estimated. For this model, the dependent variable was defined as a binary variable X_{ijt} denoting if a specific product was traded in a given year, such that:

$$P\,(X_{ijt} = 1) = Pr\,(X_{ijt}{}^* > 0 \mid X) = F\,(Xb)$$

This model allows to identify which factors determine the odds of a product to be traded among the two economies. In particular, the objective of this section would be to estimate if the CKFTA had a positive and significant effect on these odds. In order to test this hypothesis, and following the literature (Gulczyński & Nilsson, 2019; Hayakawa, Laksanapanyakul, & Urata, 2016; Nilsson, 2011), the model can be described as follows:

$$X_{ijt} = \alpha + \beta_1 Log\_GDP_{i,t} + \beta_2 Log\_GDP_{j,t} + \beta_3 CKFTA_{j,t} + \beta_m \theta_{i,j,t} + \varepsilon_{i,j,t}$$

FIGURE 5

INTENSIVE MARGIN. CHILE – SYNTHETIC CHILE. (1996-2018)
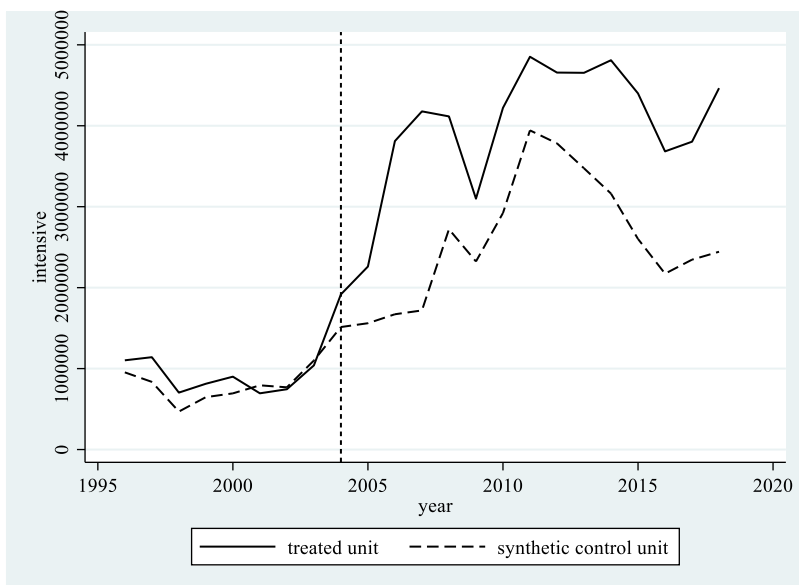
Source: Authors' calculations and (Muñoz *et al.*, In press).
         Outcome: intensive margin of trade.
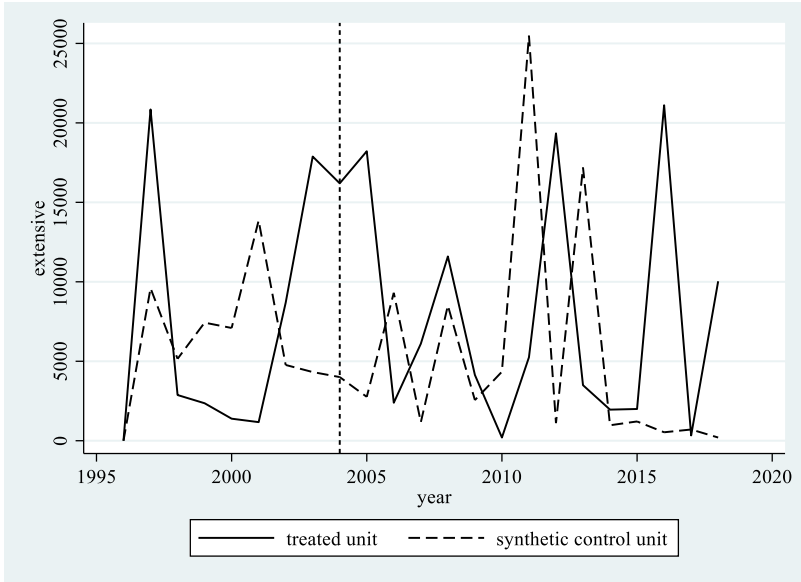   Covariates: Total exports, number of products, population
         Synthetic country Chile: Brazil (.621), Ecuador (.379).

In this case, the model includes both partner economies GDPs, a dummy variable representing the existence of the FTA, and a control vector, $\theta_{i,j,t}$, of both specific country and year effects. The model was estimated for the sample 1996-2017 and included year-fixed effects. Table 5 presents the results of the logistic regression, which show a non-conclusive relation between the CKFTA and the odds of exporting between both countries.

Hence, both alternative methods support the main results of this paper. This is that the CKFTA had a stronger impact over the intensive margin of trade, defined as the growth of existing products in the bilateral trade relation, than on the extensive margin (new products added to the export basket).

FIGURE 6

EXTENSIVE MARGIN. CHILE – SYNTHETIC CHILE. (1996-22018)

Authors' calculations (Muñoz *et al.*, In press).
Outcome: Extensive margin of trade.
Covariates: Total exports, number of products, population, distance, GDP, GDP per capita.
Synthetic country Chile: Argentina (.076), Mexico (.116), Panama (.245) & Uruguay (.564).

TABLE 5

LOGISTIC ESTIMATION RESULTS

VARIABLES	(1)
	Pr_X_{ijt}
GDP_exp	-.8621
	.87427
GDP_imp	1.6396*
	.8930059
CKFTA	.29512
	1.3773
Observations	225,808
Year fixed-effects	Yes

Notes: 1. Dependent Variable: Existing export relation.
         2. *p<0.1, **p<0.05, ***p<0.001.
Source: Authors' calculations

6.   FINAL REMARKS

The subscription of free trade agreements has become a relevant trade policy instrument for most economies, particularly since the deterioration of the multilateral trading system negotiations. With the objective of strengthening bilateral relation between the economies, FTAs provide a legal framework and remove trade barriers amongst members. Chile and Korea have relied on these instruments to guide their integration into the international markets, and the bilateral agreement between them become a milestone in their respective trade agendas.

The objective of this paper was to assess the FTA between Chile and Korea, as after 17 years it is possible to evaluate its trade effects. As expected, the CKFTA had a positive impact over bilateral trade flows, allowing for an expansion of traded goods between both economies. Nevertheless, this effect is not homogenous amongst different products. Through the differentiation of old and new products in the bilateral relation, the paper explores the impact of the CKFTA in the intensive and extensive margins of trade. Hence, it finds that the impact is stronger for those products already being traded between both economies. Similarly, it finds that the effect is stronger for Chilean exports, which can be explained as the Korean market was much more protected at the time the agreement was negotiated, giving Chilean exports a higher preferential margin.

These differentiated effects between products and countries may be explained from different perspectives. First, the essential comparative advantages each country has, and while the FTA reduces the trade frictions amongst economies, it does not change trade patterns, as those are given by the preexisting conditions in each economy. Second, FTAs are instruments that facilitate trade, but not necessarily create it, as other conditions arise, particularly for newcomers. Despite trade preferences (tariffs or others), building a trade relation relies on a series of business networks and commitments, which are responsibility and result of the own firms (Sohn, 2001). Incumbent products (those being traded before the FTA) had already set in place these requirements, and therefore, are able to benefit sooner from the preferences given by the agreement. Newcomers, who may benefit from the preferences given by the CKFTA, need to establish these networks. This may also support that most trade creation coming from the agreement is led by intensive margins, the rise of already existing exports, and that although also positive the extensive margin (new products into the relation), it is smaller. This hypothesis is further explored through qualitative assessments in the literature (Muñoz *et al.*, 2021).

Finally, as currently both governments are in the process of renegotiating the agreement, some policy recommendations may be derived. First, although the agreement has a positive effect over bilateral trade flows, if the objective is to diversify or add value to exports, complementary policies shall be implemented. FTAs are instruments which create favorable conditions for trade but are not sufficient to create trade. Second, trade between economies is not only the result of removing barriers, as trade networks,

infrastructure, business links shall be created. This implies that both public and private sectors, of each country, much be able to use the references derived from such kind of agreements. The complementarity between both economies provides an interesting scenario for the development of a more complex trade relation, but for this, the sole subscription of the CKFTA (or its renegotiation) is not enough. Finally, considering the current post-pandemic economic scenario, strengthening trade relations, and updating their instruments to cover aspects such as digital economy, environment, or gender, becomes imperative to ensure a sustainable development for both economies.

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