Are Free Trade Agreements being Used?

Transaction Level Evidence for Colombia

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WORK IN PROGRESS – COMMENTS ARE WELCOME

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Abstract

This paper analyzes the incidence of free trade agreements (FTAs) on the use of certificates of origin (CO) of exports in Colombia. Using firm-product-destination level data, together with Difference-in-Differences models with a staggered treatment, we find that the use of CO slightly decreases after the signing of an FTA; that is, the use of preferential tariffs does not increase after the entry into force of the agreement. Furthermore, we find evidence of an initial illusion effect: a positive impact in the initial two years, followed by a subsequent decrease. Eliminating non-tariff measures is critical to better-using trade agreements and unlocking their economic potential.

Keywords: rules of origin, trade agreements, utilization rates, staggered treatment, Colombia.

JEL classification: F13, F14, L25, O24, O19

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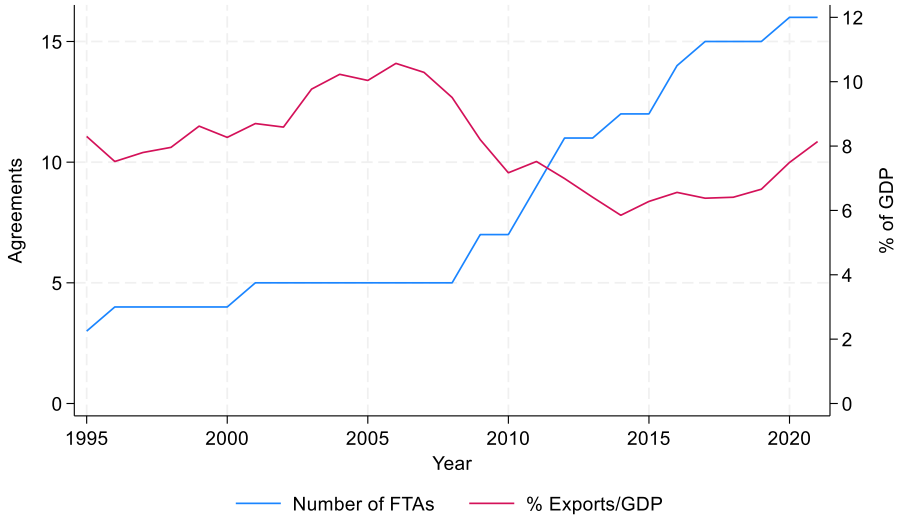
1. INTRODUCTION

In the last three decades, there has been a proliferation of trade agreements worldwide (Deardoff, 2018). Specifically, the number of trade agreements (FTAs) signed by Colombia has increased from 3 in 1995 to 16 in 2021, covering 16 and 67 countries, respectively. Nonetheless, as Figure 1 shows, Colombia's share of exports to GDP stayed around 8% during the same period.

Figure 1. Trade Agreements and Exports in Colombia



Note: This figure shows the evolution of the number of trade agreements signed by Colombia between 1995 and 2021 (left axis) and the evolution of the ratio of exports to GDP over the same period (right axis). Data on the number of trade agreements was taken from Colombia's Ministry of Commerce, Industry and Tourism at https://www.tlc.gov.co/acuerdos/, while the export and GDP data was taken from the National Administrative Department of Statistics (DANE).

Given the extensive literature documenting the positive effects of trade on firm-level outcomes,[3] the fact that aggregate exports are not increasing in Colombia could be considered a puzzle. However, although preferential rates from an FTA are available for all exporters, these benefits are not automatic. Often, exporting companies must demonstrate that their products comply with rules of origin (RO), the needed criteria to determine a product's national provenance, and for which they must issue a certificate of origin (CO) to the respective customs authorities. Only 24% of Colombian exports have a CO with their business partners (Murillo &

[3] On export volumes and higher firm entry (Baier et al., 2014; Kuno et al., 2016; Baier et al., 2018), and longer export spells (Besedes et al., 2016; Recalde et al., 2016; Türkcan & Saygili, 2018; Nguyen & Duong, 2019).

Leal, 2021). These low utilization rates could be driving the weak evolution of aggregate exports over time.

In this paper, we study the incidence of the FTAs signed by Colombia in the utilization of CO by national exporters, given that a CO is a requirement to access preferential tariffs. For such purpose, we use the export microdata of the National Administrative Department of Statistics (DANE, by its Spanish acronym) and the Directorate of National Taxes and Customs (DIAN, by its Spanish acronym) at the firm, product, and destination levels, for the period 2006-2019. We estimate Difference-in-Differences specifications with staggered treatments, exploiting the variation originating from the different FTAs signed by Colombia during this period. Understanding this relation will allow future research on the economic effects on firms acquiring a CO.

Our estimates reveal two key results. First, FTAs have had a slightly negative effect on exporters' utilization of preferential tariffs. This is a counterintuitive result, but it can be explained if we consider that even though signing trade agreements involves tariff reductions, it also imposes counterproductive non-tariff measures to use trade preferences effectively. Second, there is evidence of an illusion effect in the adoption of COs: their utilization increases the first two years after the entry into force of an FTA but starts declining soon after and becomes negative by year four.

Different mechanisms can explain such results. First, it might be that FTAs are imposing strong RO compliance requirements related to the locally sourced inputs used in products, hindering the use of preferential trade. We find evidence of this channel by showing that utilization rates are higher among firms that do not import inputs than firms with different import intensities. We reaffirm this finding by comparing exports of agricultural and manufacturing products, with the latter being more likely to use more imported inputs and having lower CO utilization rates.

Second, more productive firms could be more likely to adopt a CO since they can more easily cover the implied costs. We test this mechanism by estimating the changes in CO utilization for large firms and small and medium firms separately. Although we do not find an increase in the CO utilization rate for large exporters, there is some evidence of a reduction in CO adoption

by small and medium exporters. Finally, we find evidence suggesting that agglomeration economies could improve the use of CO. Agglomeration may facilitate the diffusion and exchange of information about customs procedures and technical knowledge related to the RO, as well as the reduction of administrative costs.

The empirical literature has demonstrated that firms that comply with the ROs have higher trading volumes, a minor exit risk, and an increase in their sales when compared with those that are not beneficiaries (Hayakawa et al., 2014; Hayakawa, 2015b; Murillo & Leal, 2021; Sytsma, 2022). Even with all these potential benefits, the low utilization of current trade agreements and the low CO adoption rates are notable. On average, it is estimated that the utilization rates of the preferential tariff lie between 65% and 80% for the FTAs signed by the USA (Baldwin, 2006; Ulloa & Wagner, 2012) and between 15 and 35% for South-East Asian countries (Takahashi & Urata, 2009; Kohpaiboon, 2010).

Among the probable causes for these low utilization rates, we can list the administrative costs of gathering information about the inputs' origin, the lack of instructions on the use of the trade agreements, and the complicated procedures needed to obtain the CO (Carrere & de Melo, 2004; Hayakawa, 2011; Takahashi & Urata, 2009; Kohpaiboon, 2010; Wignaraja, 2014). In the case of exporters from Bangladesh, Demidova et al. (2012) show that the patterns in the use of preferences are consistent with the existence of both fixed and marginal costs of ROs. Anson et al. (2005) calculate that administrative costs arising from ROs can amount to 47% of the preference margins, which, together with high transportation costs from trade diversion, make ROs hard to rationalize (Felbermayr et al., 2019).[4]

Another reason explored in the literature is the *Spaghetti Bowl Effect*, which refers to the increase in non-tariff measures (such as ROs) tied to FTAs. These agreements are tied to confusing—and even contradictory—bureaucratic measures, which makes it difficult for the exporter to fully comply with the RO (Bhagwati, 1995; Hayakawa, 2013; Schule & Kleisinger, 2016). More recent research has considered the role of IO linkages in the firms' decision to access

[4] Ornelas & Turner (2023) present a model with property rights that includes ROs, innovation, and sourcing. They show that strict ROs can lead to positive welfare effects when tariffs arising from trade diversion are not too high, providing an efficiency rationale for ROs.

preferential trade and the changes in their sourcing decisions and trade in intermediate goods (Conconi et al., 2018; Sytsma, 2002; Moran & Cebreros, 2023). The proliferation of FTAs with complicated ROs is often associated with reduced aggregate welfare (Deardoff, 2018).

This research adds to the growing literature studying the determinants of trade agreement utilization and RO. These studies analyze the incidence of factors such as firm size and productivity (Takahashi & Urata, 2009; Hiratsuka et al., 2009; Wignaraja et al., 2010; Kohpaiboon, 2010; Hayakawa, 2015a), the size of the tariff reduction (Hayakawa et al., 2014; Nilsson, 2016), firm experience (Hayakawa, 2015a; Wignaraja, 2014; Krishna et al., 2021), business networks (Wignaraja, 2014), and even monetary and financial characteristics of firms and destinations (Piotr & Stefan, 2019; Kasteng et al, 2021; Hayakawa et al., 2017).

Our paper makes two more contributions to the literature. Firstly, it analyzes the incidence of FTAs in commercial utilization using data at the firm–product–destination level for a whole country and for more than ten years. These granular data contrast other recent studies that only use survey data at the firm level (Takahashi & Urata, 2009; Hiratsuka et al., 2009; Wignaraja et al., 2010; Kohpaiboon, 2010; Hayakawa, 2015a; Kasteng et al., 2021). Our more detailed data allowed us to identify limitations in the utilization of preferential tariffs by firms in different destinations and products.

Second, we explore product- and firm-level differences in FTA utilization to clarify the peculiarities of exporters who take advantage of preferential trade. These differences allow us to test different mechanisms and lay out interesting facts for future theoretical or structural studies. Moreover, as most of the literature on this area focuses on Mexican exporters and NAFTA, our paper adds to this literature by studying ROs in another country: Colombia.[5]

The rest of this article is divided into five sections. The second section includes a conceptual theoretical framework. In the third section, we describe our data and present descriptive statistics. Section 4 presents the empirical model. The fifth section displays the results; finally, the sixth section concludes.

[5] Exceptions include Augier et al. (2005) for Europe; Matto et al. (2002) for Africa; Demidova et al. (2012) and Sytsma (2022) for Bangladesh; Krishna et al. (2021) for exports to Colombia from Argentina and Peru.

2. THEORETICAL FRAMEWORK

This section presents a conceptual framework that describes the possible mechanisms behind a firm's decision to use an agreement's preferential tariffs and, thus, acquire a CO. An exporter firm evaluates the decision to use the preferential tariffs by comparing the benefits and costs of its utilization. The benefits are related to the size of the tariff margin, that is, the difference between the tariff under the agreement and that of the most favored nation. The bigger the margin, the higher the incentive to use these preferences.

In addition, to use an FTA's preferences, the firm must comply with the ROs of the product, which adds extra fixed and administrative costs for the exporter; these costs are related to the payment of the CO, the recompilation of information about the product's origin, among others (Carrere & de Melo, 2004; Anson et al., 2005; Hayakawa, 2019). Additionally, when using these preferential tariffs and their CO, the exporter may also pay higher variable costs as she might have to change her suppliers or production plants towards some national suppliers to comply with the RO (Krishna & Krueger, 1995; Ju & Krishna, 2005; Hayakawa, 2013; Moran & Cebreros, 2023). The lower these additional costs, the larger the incentive for a company to acquire a CO and, thus, benefit from the tariff preferences.

Based on these tradeoffs and considering the models with firm heterogeneity (e.g., Melitz, 2003), the most productive (Demidova & Krishna, 2008) and larger exporters (Takahashi & Urata, 2009) will be the ones to use the preferential tariff schemes in their exports, given that they can afford to pay for the associated costs. Other authors have also confirmed a positive correlation between firm size, productivity, and the utilization of FTAs, including Hiratsuka et al. (2009) for the case of Japanese multinational companies, Wignaraja et al. (2010) and Kohpaiboon (2010) for Thai companies, Hayakawa (2015a) for Japanese subsidiaries, and Kasteng et al. (2021) for Swedish companies.

Moreover, the literature studying the *Spaghetti Bowl Effect* states that the increase in trade agreements between countries entails two extra factors determining the firm's decision to use the tariff preferences (Bhagwati, 1995). First, ROs that differ from or intersect with each other, like spaghetti in a bowl, and second, more restrictive regulations on product origin compliance (Shule & Kleisinger, 2016; Head et al., 2022). Moreover, Estevadeoral (2000) shows that, while the oldest

trade agreements used ROs that were general for all sectors, current FTAs incorporate or modify the ROs that already exist in previous trade agreements between countries, at the product-by-product level, being the foodstuffs, textiles, and clothing the ones that face the most significant restrictions.

In this sense, when a country subscribes to an FTA, firms face the normative frictions associated with the ROs and their complex understanding. Finally, the literature has found that networks between companies allow for the diffusion and exchange of information about customs procedures and the technicalities around rules of origin. This information exchange can reduce administrative costs (Tovar & Martínez, 2011; Wignaraja, 2014; Arguello et al., 2020).

3. DATA

We use the export microdata published by the National Administrative Department of Statistics (DANE, by its Spanish acronym) and the Directorate of National Taxes and Customs (DIAN, by its Spanish acronym). These data contain all the monthly transactions of Colombian exporters at the firm-product-destination level. Each record includes the tax identification of the exporter, shipped product (classified with the harmonized tariff subheading NANDINA-10 digits), transaction value, destination country, and state of origin. Since DIAN is responsible for reviewing and approving the COs companies have to process to qualify for preferential rates, these data include information identifying the firms that report a CO for a specific product and destination.

We use data from the period between 2006 and 2019. We used this period since the microdata is homogeneous and comparable to each other as of 2006. Using these data, we build a panel at the firm, product, and destination level, aggregating the transactions at the yearly and 6-digit Harmonized System (HS) product classification.

Through several interviews conducted with technical teams of the Ministry of Commerce, DANE, and DIAN conducted interviews, we identified some data nuances that influenced the selection of our sample. First, following Tovar & Martínez (2011), we excluded transactions that, in practice, cannot be considered exports of a firm seeking commercial benefits. In particular, we drop those transactions i) that correspond to the shipping of personal belongings of individuals

abroad, ii) reporting an annual value of less than 1,000 USD, and iii) whose destinations are other tariff-free zones within the country. Additionally, we drop mining transactions due to the particularities of this sector, including possible problems related to the variation in oil prices.

Second, the database has information for six COs (CAN, ALADI, SGP, ATPA, CARICOM, and G-3).[6] Since our variable of interest is CO utilization, it must be correctly identified. When exploring the data, we found transactions that accredited the possession of one of the six COs, but the exports were directed to countries that did not belong to such certificates. For example, exports with an ATPA certificate that were destined to countries other than the United States (USA). Therefore, we corrected the variable by redefining transactions with a CO as those with it and exporting to the respective destination.

Third, given that our treatment variable will be the year of entry of the FTAs in Colombia, we consider only FTAs with a starting year inside the study period, as we need pre- and post-treatment periods. Moreover, as we need clear information on the specific COs of each agreement, we keep only four agreements: (i) Colombia and Mexico, which entered into force in 2011; (ii) Colombia and USA that entered into force in 2012; and (iii) Colombia and the European Union (EU – in force since 2013) and Colombia and Canada (in force since 2011).[7]

Finally, we drop countries whose participation in Colombia's exports in 2019 was less than 0.002%, as well as Venezuela, to avoid the variation associated with the political quarrels between both governments during the last decade. The resulting sample contains 102 countries, equivalent to 98% of Colombia's annual average exports. Our final sample consists of 330,687 firm-product-destination transactions (around 23,620 annually), of which 13.9% report a CO. In this final sample, there is a total of 19,702 exporting firms, 4,138 products at the HS-6 level, and 102 destination countries.

[6] The CAN corresponds to the Andean Community (Bolivia, Ecuador, and Peru); ALADI corresponds to the Latin American Integration Association; GSP corresponds to the General System of Preferences; ATPA corresponds to USA; CARICOM corresponds to the Caribbean Community; and the G-3 corresponds to Mexico and Venezuela, who exited the agreement in 2006.

[7] These two FTAs abide by the General System of Preferences (GSP) and include Australia, Belarus, Canada, USA, Japan, Kazakhstan, New Zealand, Russia, Turkey, and the countries of the EU. The EU includes the United Kingdom as our data ends in 2019, and Brexit's withdrawal agreement was signed in 2020.

Table 1 shows the utilization rate of tariff preferences in export (i.e., % of transactions with CO) and their percentage of the exported value, firms, and products that use CO before and after an agreement for the four FTAs of interest. Notice that the post-agreement utilization rate is, on average, 14.5 percentage points (pp) lower than the pre-agreement period. This reduction is larger for exports to Mexico (32.4 pp), but it is positive for Canada (a 1.3 pp increase), which is explained by a large increase in the adoption of COs for agricultural products. We also observe these decreasing numbers for the percentage of the exported value with CO (10.6 pp), firms using CO (8.6 pp), and products using CO (7.6 pp). These results hold for agricultural and manufacturing exports separately. In addition, in Figure A1, we show the evolution of CO utilization rates in transactions directed to Canada, Mexico, the USA, and the EU. Note that, in the first years after a given FTA takes effect, there is a slight increase in the use of tariff preferences, followed by a decline in the subsequent years.

Table 1. Utilization rates of FTAs before and after the trade agreement

		All FTAs	Canada (2011)	Mexico (2011)	USA (2012)	EU (2013)
Utilization rate (%)	Pre-trade agreement	26.6	11.8	49.5	17.0	32.1
	Post-trade agreement	12.1	13.1	15.9	9.2	14.1
Exported value with CO (%)	Pre-trade agreement	26.2	4.8	57.6	21.4	29.2
	Post-trade agreement	15.4	5.2	37.4	12.0	13.9
Firms with CO (%)	Pre-trade agreement	26.5	17.6	41.0	20.9	29.7
	Post-trade agreement	17.9	19.2	22.4	15.5	17.9
Products with CO (%)	Pre-trade agreement	30.0	21.9	38.7	27.9	26.9
	Post-trade agreement	22.4	17.0	27.3	22.4	18.8

Note: This table shows the percentage of export transactions that use a certificate of origin (CO) between Colombia and four trade partners: Canada, Mexico, USA, and the EU, as well as the percentage of the exported value with CO, the percentage of exporting firms using CO, and the percentage of products exported with CO, both before and after the respective trade agreements. The first column shows the aggregate. The entry into force of the Colombia-Canada and Colombia-Mexico FTA was in 2011. The pre-trade agreement periods for the Colombia-US and Colombia-EU FTA are 2006-2011 and 2006-2012, respectively.

Since new trade agreements reduce tariff barriers, it would be intuitive if more exporting firms started using the preferential tariffs after they came into force if acquiring a CO was cheap enough. However, if the increase in non-tariff barriers is substantial, it can discourage firms from taking advantage of such agreements. In the following section, we formally test the change in CO utilization after an FTA enters into force.

4. EMPIRICAL METHODOLOGY

To analyze the impact that FTAs have on the use of tariff preferences for Colombian exports, we use a Two-Way Fixed Effects (TWFE) model, exploiting the temporal and product level variation from the entry into force of different FTAs. Thus, we can compare the use of tariff preferences between those transactions directed to countries that signed an FTA with Colombia and those that did not, between 2006 and 2019, before and after a treaty's signing. We estimate the following model:

$$y_{fpdt} = \alpha + \beta * \boldsymbol{POST}_t \cdot \boldsymbol{FTA}_d + \eta_{fpd} + \rho_{pt} + \psi_d + \delta_t + \varepsilon_{fpdt} \qquad (1)$$

where y_{fpdt} is a binary variable that takes the value of 1 if the exports of firm f and product p towards destination country d in year t report a CO, or 0, otherwise. Recall that a CO is the support for compliance with the ROs of any trade agreement between two countries. Therefore, an exporting firm may report the possession of a CO with a partner country even before signing the FTA if a previous trade agreement existed between both countries.

The Difference-in-Difference estimator is $\boldsymbol{\beta}$ and captures the effect of the interaction between $\boldsymbol{POST}_t$, which takes the value of 1 for the years following the entry into force of a FTA; and $\boldsymbol{FTA}_d$, which takes the value 1 for the countries that belong to one of the four FTAs in question (USA, Canada, Mexico and EU). In this sense, the interaction $\boldsymbol{POST}_t \cdot \boldsymbol{FTA}_d$ takes the value of 1 if the export is made to Canada or Mexico in 2011 or after; or if it is made to USA in 2012 or after; or towards the countries of the EU in 2013 or after.

The remaining terms denote different sets of fixed effects. First, η_{fpd} denotes firm-product-destination fixed effects, which control for time-invariant characteristics at the firm, product, and destination level. Second, δ_t are year fixed effects that control for aggregate shocks that affect all exporters each year, e.g., inflation, peso depreciation, etc. These two sets of fixed effects are the baseline of any TWFE model. In addition, ψ_d controls for time-invariant destination characteristics, such as market size or specific demand and tastes from a given destination. Fourth, we include product-year fixed effects (ρ_{pt}) that aim to capture yearly changes in the international prices of different goods. Finally, u_{fpdt} is the error term. Standard errors are clustered at the country of destination level.

Note that the entry into force of the FTAs is exogenous to the decisions and behavior of most, if not all, firms and their transactions, as the negotiations and signing of a trade agreement take place between the politicians of each country and usually take a long time. Therefore, firms do not tend to affect these negotiation processes, nor should short-run fluctuations in the demand or prices of different products. In this sense, the period of entry into force of the trade agreements can be considered a valid treatment, and the estimator can have a causal interpretation.

Although TWFE is usually the most widely used method to analyze policy effects, its limitations have recently been discussed, especially when treatment is staggered and treatment effects might be heterogeneous (Roth et al., 2022). The literature has shown that if the units of analysis are treated at different points in time, the coefficients of the TWFE models may not represent a direct average of unit-level treatment effects, and the coefficients may even have the opposite sign of the true effects due to the presence of negative weights (Callaway & Sant'Anna, 2021; Chaisemartin & D'Haultfoeuille, 2022).

Therefore, we also estimate our model following the methodology proposed by Callaway & Sant'Anna (2020), C&S, as our treatment is staggered in three stages: the first in 2011, including Mexico and Canada; the second in 2012 (USA) and the third in 2013 (EU). Therefore, each treatment group is composed of those transactions directed to countries in which an FTA was with Colombia in that year, and the control group corresponds to all exports made to countries that did not have an FTA with Colombia in that year, even if they do in the future.

The main assumptions behind the C&S estimator are the irreversibility of treatment, random sampling, and conditional parallel trends. The irreversibility of treatment refers to the fact that once a unit becomes treated, it remains treated for the rest of the period. In our case, this assumption holds since the entry into force of an FTA entails that all transactions that export to these countries do so in the post-trade agreement period, and none of these agreements has been withdrawn or renegotiated during this period. The random sampling assumption implies that the variables are independent and identically distributed. We believe this assumption holds in our case as we observe the whole universe of exports from Colombia. Finally, the parallel trends assumption suggests that, prior to the signing of the FTA between Colombia and its trading partners, there should be no significant differences in the trends of CO utilization between

transactions belonging to treatment and control groups. To prove this assumption, we will also estimate an Event Study specification, allowing us to analyze the dynamics of the impacts before and after the treatment.

5. RESULTS

In this section, we present the results of our estimations. Firstly, we show the incidence of FTAs in the use of COs, together with their respective dynamic effects. Secondly, based on the discussions from Section 2, we perform heterogeneity analyses that aim to pin down some of the possible mechanisms driving the main results.

5.1. Incidence of FTAs in the use of preferential trade

As Table 2 shows, the use of CO in Colombian exports decreases after the signing of FTAs. This decrease holds when we estimate the model using TWFE or the C&S methodology. Specifically, when using TWFE (column 1), we find that the start of a trade agreement reduces the average use of CO by around 6 pp in the post-agreement period, a statistically significant result. This coefficient is robust to including product*year fixed effects, which aim to control for price fluctuation over time. When we use the C&S methodology, we find a reduction of approximately 1 pp (column 3); however, this last coefficient is not significant. The number of observations in column 3 is significantly lower as the C&S estimator uses only observations (product-firm-destination) that appear both before and after the treatment year. In Table A1, we estimate the model for the three treatment groups separately: Mexico and Canada (FTAs signed in 2011), the USA (in 2012), and the EU (in 2013). The main results hold.

Table 2. Incidence of the FTAs on the use of COs

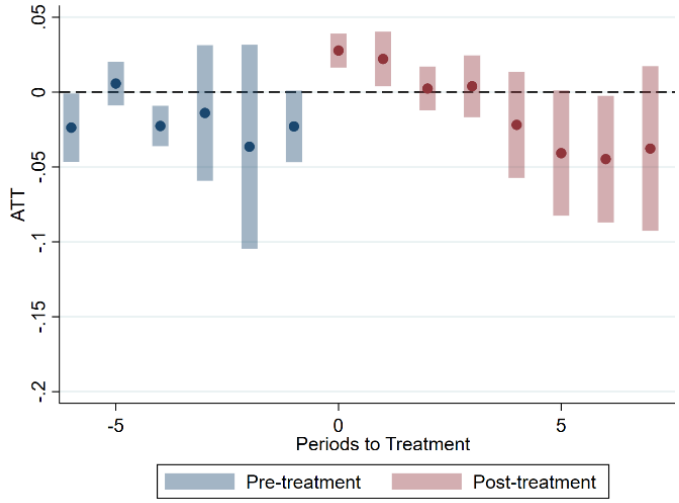
	TWFE		C&S	
	(1)	(2)	(3)	(4)
Effect	-0.058**	-0.053**	-0.006	-0.027
	(0.025)	(0.027)	(0.011)	(0.020)
Firm-product-destination FE	Yes	Yes		
Year FE	Yes	Yes		
Destination FE	Yes	Yes		
Product-year FE	No	Yes		
Observations	246,500	236,871	156,866	330,687

Note: This table shows the estimation results of regressions on the incidence of a new trade agreement on adopting a certificate of origin. Column (1) uses a two-way fixed effect model (TWFE) with firm-product-destination, year, and destination fixed effects. Column (2) uses adds product-year fixed effects. Column (3) estimates the model using the methodology proposed by Callaway & Sant'Anna (2021), only considering firm-product-destination pairs observed before and after the respective FTAs. Column (4) estimates the model using the methodology proposed by Callaway & Sant'Anna (2021), treating the data as a series of repeated cross-sections to allow for the inclusion of the whole sample. Significance of *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the country of destination level.

To understand the dynamic effects of the FTA on the adoption of CO and to study whether the assumption of parallel trends between treatment and control groups holds, we estimate an event study specification using the C&S estimator. Figure 2 shows the estimates of this event study. Our results show that, before the year of entry into force of the Colombian FTAs, there were no significant differences in the possession of CO between treatment and control groups, which suggests parallel trends before the FTAs.

Moreover, we observe an interesting dynamic after an FTA. In the first years after the entry of the trade agreement into force, there is a positive effect on the use of CO in export transactions. Nonetheless, the average effect is reversed two years later, becoming null and then negative. We call this dynamic behavior an "illusion effect" of preferential trade. These results align with the *Spaghetti Bowl Effect:* Although trade agreements entail tariff reductions, they also impose other non-tariff measures that are counterproductive for the effective use of trade (Bhagwati, 1995). Figure A2 presents two robustness checks for this event study specification. In Panel I, we include robust standard errors. Even though parallel trends before treatment are not as strong, the illusion effect after is more visible. In Panel II (and in column (4) from Table 1), we estimate the model as a series of repeated cross-sections to allow for the inclusion of the whole sample—observations that only appear before or after the treatment. The main results hold.

Figure 2. Incidence of the FTAs on the use of COs – Event Study



Note: These figures show the estimation results of event study regressions on the incidence of a new trade agreement on adopting a certificate of origin using the methodology developed by Callaway & Sant'Anna (2020). Standard errors are clustered at the country of destination level. The size of the bin indicates a 95% confidence interval.

5.2. Possible Mechanisms

5.2.1. Use of imported inputs

The entry into force of an FTA could affect the use of CO differently for different exporters or products, given the complexities and the diverse requirements of the ROs. For instance, ROs could be more beneficial for agricultural products relative to manufacturing products, given that the former might use fewer inputs, both total and imported. On the other hand, the production of manufactured goods uses more intermediate goods, some of them imported, either by choice or because the local market does not supply them.

To explore this hypothesis, we estimate our empirical model for both groups of products separately.[8] Columns 1 and 2 from Table 3 present the results of these estimations. The results suggest that the entry into force of a Colombian FTA on the use of tariff preferences for agricultural products increases by 4 pp after the signing of an FTA. In contrast, for manufacturing products, it decreases by 4 pp. This result holds when we analyze the three treatment groups (see

[8] We follow the Standard International Trade Classification (SITC). *Agricultural products* include 0) Food and live animals; 1) Beverages and tobacco; 2) Crude materials, inedible, except fuels; 4) Animal and vegetable oils, fats, and waxes. *Manufacturing* includes 5) Chemicals and related, 6) Manufactured goods classified chiefly by material, 7) Machinery and transport equipment, and 8) Miscellaneous manufacturing.

Table A2). These findings can be explained by the compliance requirements of the ROs related to local inputs that manufacturing products must comply with, hindering the use of preferential trade (ITC, 2015; Systma, 2022). It may not be profitable for a manufacturing company to take advantage of lower tariff barriers if that implies sacrificing cheaper foreign inputs for more expensive domestic ones, making them less competitive.

Table 3. Incidence of FTAs on the use of CO by product group and import intensity

	I. Product Group		II. Import Intensity			
	Agricultural	**Manufacturing**	**Non-Importers**	**Low**	**Medium**	**High**
	(1)	(2)	(3)	(4)	(5)	(6)
Effect	0.043***	-0.043***	0.018*	-0.029	-0.021	-0.015
	(0.016)	(0.010)	(0.009)	(0.028)	(0.027)	(0.015)
Observations	56,196	98,480	52,746	27,239	33,383	43,498

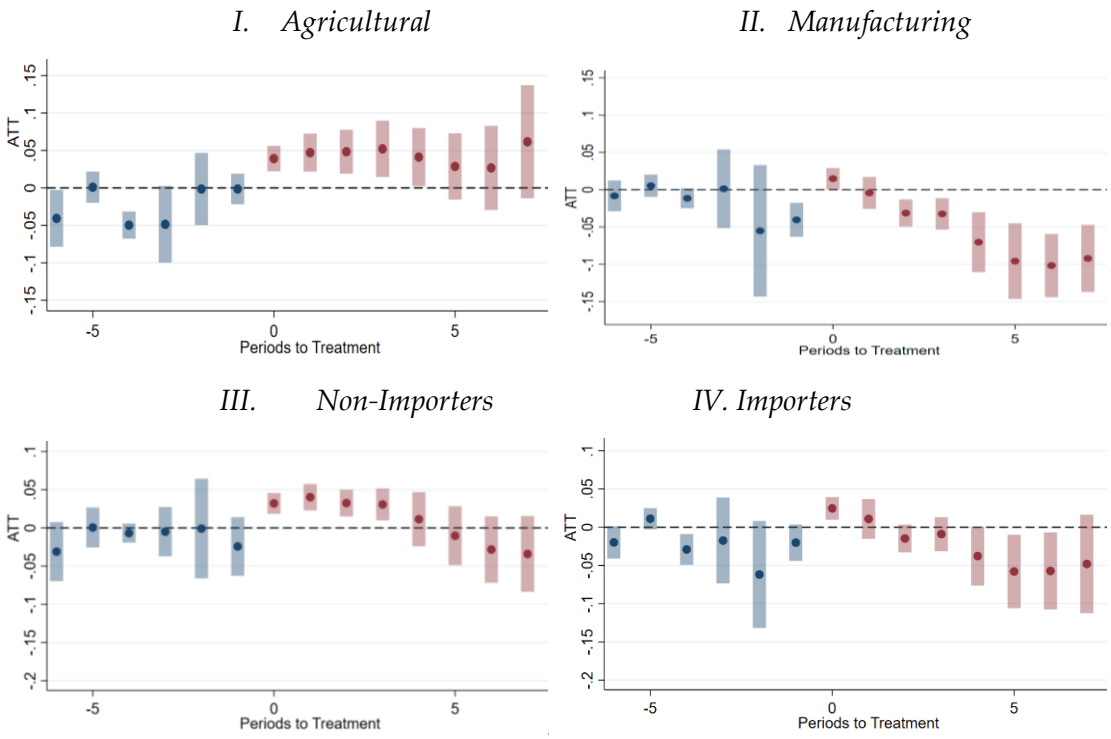
Note: This table shows the estimation results of regressions on the incidence of a new trade agreement on adopting a certificate of origin using the methodology proposed by Callaway & Sant'Anna (2021) for different partitions of our sample. The first two columns split the exported products into agricultural or manufacturing, depending on their SIC classification. Columns (3) to (6) split transactions based on the import intensity of the exporter, built from the DIAN-DANE import database: non-import exporters and three tertiles of the distribution (low, medium, high, respectively). Significance of *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the country of destination level.

We delve deeper into this issue using import data at the product-firm-origin level, which we also retrieve from the DANE-DIAN repositories. We start by computing the average imported value for each exporter and country pair from our export data. Then, for each exporter and destination pair in our export data, we find the total value of these mean imports across all origins except for the destination country. Using this indicator, we divide exporters into four groups based on their reliance on imported products (non-importers and by tertiles of the distribution).

Columns 3 to 6 from Table 3 present the estimation results divided by these four groups. We highlight two results. First, the use of COs increases by around 2 pp, while the average effect is negative (although not significant) for all other types of firms, regardless of their import intensity. Second, even though the differences among importers are not statistically different, the reduction in CO utilization is larger for importers with low import intensity. This u-shaped effect is similar to the one Moran and Cebreros (2023) found. In Table A3, we present these results by treatment group.

We also estimate the event study specification using both classifications. In the first two panels from Figure 3, we show that before the year of entry into force of the Colombian FTAs, there were no systematic differences in the possession of CO, regardless of the group of products (agricultural or manufacturing), confirming the parallel trends assumption. Moreover, we observe the same hump-shaped dynamics presented in Figure 1 for both groups. Nonetheless, the decrease for agricultural products is minor compared to the significant decrease of almost 10% for manufactured products five years after the signing of the FTA.

Figure 3. Event Study by Product Groups and Import Intensity



Note: These figures show the estimation results of event study regressions on the incidence of a new trade agreement on adopting a certificate of origin using the methodology developed by Callaway & Sant'Anna (2020). All standard errors are clustered at the country of destination level. The size of the bin indicates a 95% confidence interval. The top figures split the exported products into agricultural or manufacturing, depending on their SIC classification. The bottom figures split transactions based on whether the exporter is also an importer.

Similarly, in the two figures from the bottom panel, we observe the positive utilization of FTAs among non-importer exporters during the first years of the agreement and the almost immediate and negative effect for importer firms. All these results indicate that the reductions in tariffs coming from FTAs are not significant enough to compensate for the change in the sourcing patterns of inputs and the high implicit costs of complying with the ROs.

5.2.2. Productivity Differences

More productive exporters might be more likely to acquire a CO as they can easily cover the required costs (Demidova & Krishna, 2008). These productivity advantages could come from inside or outside the firm (e.g., agglomeration economies). Since, given our data, we cannot observe nor estimate exporter-level productivity, we proxy productivity using the size of the exporter. We build this variable by taking the average exported value by a firm in non-treated periods-destination pairs, i.e., in not-yet-treated or never-treated countries.[9] Using this value, we separate the exporters into two groups: (i) those firms that are in the first three quartiles of the distribution (small and medium-sized exporters) and (ii) firms in the top quartile of the distribution (large exporters).

We estimate our main specification separately for both groups of firms and present the results in columns 1 and 2 from Table 4. The results show that small and medium-sized firms reduce their use of COs after the entry into force of the FTAs by around 3 pp (although imprecisely estimated), while they have no incidence on average in the use of CO among large firms. These results seem to contradict the productivity hypothesis and lead us to contemplate the existence of other forces that alter the firm's decision. For example, large companies probably have greater access to imported inputs, which could imply an increase in their costs should they decide to adopt a CO (Moran & Cebreros, 2023). These results remain regardless of the treatment group (Table A4). Finally, in the top panel of Figure 4, we show that the hump shape holds for large exporters. In contrast, it is always negative for small and medium exporters, although imprecisely estimated.

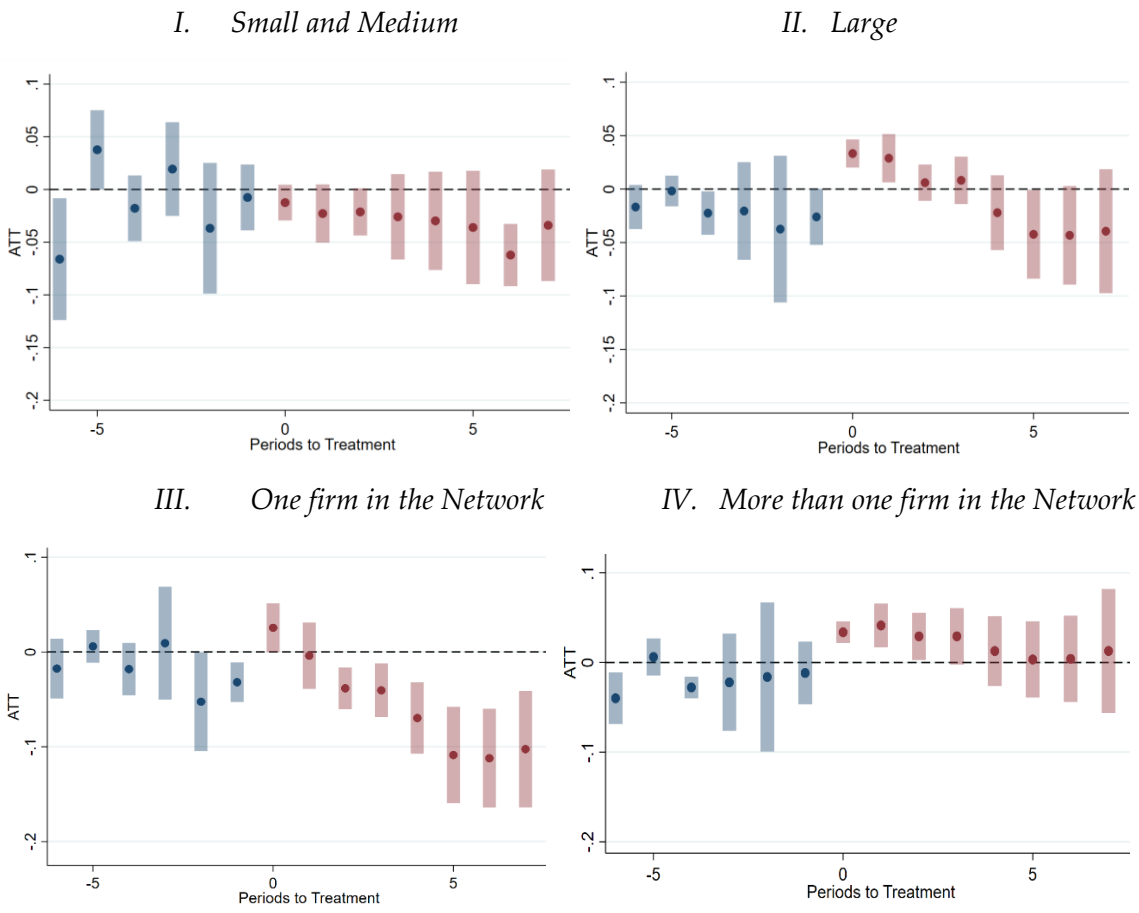
[9] We use this value to avoid endogeneity concerns since higher market access brought by an FTA can lead to improvements in firm size.

Table 4. Incidence of FTAs on the use of CO by exporter size and business networks

	I. Exporter size		II. Business networks	
	Small and Medium	Large	One firm	More than one firm
	(1)	(2)	(3)	(4)
Effect	-0.028*	-0.003	-0.044***	0.024
	(0.014)	(0.011)	(0.013)	(0.015)
Observations	24,952	131,914	54,685	86,337

Note: This table shows the estimation results of regressions on the incidence of a new trade agreement on adopting a certificate of origin using the methodology proposed by Callaway & Sant'Anna (2021) for different partitions of our sample. Columns (1) and (2) estimate the regressions splitting the sample by the size of the exporting firms before the entry into force of their respective trade agreement, with large being those in the top quartile of the distribution. Columns (3) and (4) estimate the regressions splitting transactions based on whether more than one firm exports the same product in the same state. Significance of *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the country of destination level.

Figure 4. Event Study by exporter size and business networks



Note: These figures show the estimation results of event study regressions on the incidence of a new trade agreement on adopting a certificate of origin using the methodology developed by Callaway & Sant'Anna (2020). All standard errors are clustered at the country of destination level. The size of the bin indicates a 95% confidence interval. The top figures split the exporting firms by their size before the entry into force of their respective trade agreement, with large being those in the top quartile of the distribution. The bottom figures split transactions based on whether more than

one firm exports the same product in the same state.

Lastly, we consider the role of agglomeration economies moderating the effects of an FTA on CO utilization rates. Agglomeration economies can generate productivity advantages through labor pooling, input-output sharing, and knowledge spillovers (Rosenthal & Strange, 2004). Thicker business networks can contribute to reducing information asymmetries between firms and allow the exchange of information on customs procedures and technical knowledge of the ROs, as well as the cost and benefits of acquiring a CO (Tovar & Martínez,2011; Wignaraja, 2014; Arguello et al., 2020). To explore the role of business networks, we estimate our model separating exporters into two groups: (i) whether a firm is the only exporter in a state exporting a given product to a particular destination, and (ii) whether the firm is not the only exporter of that product to a particular destination in a state.

Results shown in columns 3 and 4 from Table 4 suggest that the entry into force of an FTA negatively affects the use of CO by firms without a business network for that product-destination pair. In particular, the estimated effect corresponds to a 4.4 pp reduction in the average CO utilization rate. On the other hand, the effect is an increase of 2.4 pp—but not significant—on those transactions from firms with a business network. These results hold for the three different treatment groups (Table A5). When exploring the dynamic effects, the bottom panel from Figure 4 shows the same hump-shaped effect but with a more pronounced reduction for those firms without a business network. However, the reduction after the fourth year is not significantly different from zero for those firms within a network. These results confirm the importance of agglomeration economies and business networks determining the use of COs.

6. CONCLUSIONS

There has been a monumental increase in the signing of new free trade agreements between countries in the last few decades. Between 1995 and 2020, Colombia signed 13 new trade agreements. However, accessing the tariff preferences in these agreements is not an easy endeavor. Exporting firms must comply with several rules and non-tariff measures, particularly certificates, to demonstrate the origin of their product.

In this study, we use transaction-level data for Colombia between 2006 and 2019 to investigate how CO utilization rates change after FTAs are signed. Our results suggest that, on average, trade agreements have a null effect on the use of preferential trade. Additionally, we confirm the existence of an "illusion effect" of preferential trade since in the year in which the FTA takes effect, the use of tariff preferences by the exporters increases, followed by a decline in subsequent years.

Moreover, the aggregated effect is imprecisely estimated due to the considerable heterogeneity between exporters. Exports of agricultural products, non-importers, large exporters, and exporters with commercial networks present an increase in the use of CO and, thus, access to preferential tariffs. These results can be explained by the fewer restrictions in the rules of origin, productivity advantages, and the diffusion and exchange of information on customs procedures and technical knowledge of the ROs among firms, respectively. On the other hand, exports of manufactured products, firms that import inputs, relatively small exporters, and exporters without a commercial network experience a significant decline in CO utilization after FTAs enter into force.

These findings have several policy implications. First, it seems that FTAs favorably affect the use of preferential trade only during the initial years, as CO utilization rates fall three years later. These effects suggest that reducing tariffs is not enough to guarantee that all exporters receive the preferences of trade agreements. Recent studies warn that tariffs are no longer the main barrier to firms in developing countries accessing new markets. Instead, non-tariff measures (such as ROs) are the ones that constitute the *"invisible barrier"* faced by these firms (ITC, 2015; Limão, 2016). Thus, our results shed light on the potential winners and losers from the proliferation of trade agreements.

On the other hand, we detect specific sector-level limitations for obtaining COs, manufacturing products the ones with the most difficulties in complying with ROs. It would be interesting to identify whether this behavior is due to regulations on tariff preferences being too demanding regarding the conditions for the origin of inputs or to the Colombian industry being insufficient in providing the necessary inputs to produce articles that comply with the ROs. We also found a weak effect of networks on the use of FTA preferences. This may suggest that firms

without networks are incurring suboptimal decisions. By trying to take advantage of tariff preferences, these firms buy more expensive and less competitive domestic inputs to learn that they would be better off by not taking advantage of such preferences. More work on the role of learning and experience, such as Krishna et al. (2021), is needed.

Further research must aim to understand the low usage of trade agreements and its effects on businesses, consumers, and the aggregate economy. The identification and proper understanding of trade and non-trade barriers should awaken greater interest by academics and policymakers for them to bring these elements to negotiate new agreements or renegotiate existing ones.

REFERENCES

Anson, J., Cadot, O., Estevadeordal, A., De Melo, J., Suwa-Eisenmann, A., & Tumurchudur, B. (2005). Rules of origin in North-South preferential trading arrangements with an application to NAFTA. *Review of International Economics*, *13*(3), 501–517

Arguello, R., Garcia-Suaza, A., & Valderrama, D. (2020). Exporters' agglomeration and the survival of the export flows: Empirical evidence from Colombia. *Review of World Economics, 156*, 703-729.

Augier, P., Gasiorek, M., & Lai-Tong, C. (2005). The Impact of Rules of Origin on Trade Flows. *Economic Policy*, *20*(43), 568–624.

Baier, S., Bergstrand, J., & Clance, M. (2018). Heterogeneous effects of economic integration agreements. *Journal of Development Economics*, 587-608.

Baier, S., Bergstrand, J., & Feng, M. (2014). Economic Integration Agreements and the Margins of International Trade. *Journal of International Economics, 93(2)*, 339-350.

Baldwin, R. (2006). Multilateralizing regionalism: Spaghetti bowls as building blocks on the path to global free trade. *The World Economy, 29*, 1451-1518.

Besedes, T., Moreno-Cruz, J., & Nitsch, V. (2016). Trade integration and the fragility of trade relationship: Theory and empirics. *(Working Paper) Georgia Tech*.

Bhagwati, J. (1995). US Trade Policy: The Infatuation with FTAs, 1994-1995. *Discussion Paper Series 726*.

Callaway, B., & Sant'Anna, P. (2021). Difference-in-Differences with multiple time periods. *Journal of Econometrics, 225*, 200-230.

Carrère, C., & De Melo, J. (2004). *Are Different Rules of Origin Equally Costly? Estimates from NAFTA* (4437; CEPR Discussion Paper Series).

Chaisemartin, C., & D'Haultfœuille, X. (2022). Two-Way Fixed Effects and Differences-in-Differences with Heterogeneous Treatment Effects: A Survey. *NBER Working Paper No. 29691*.

Conconi, P., García-Santana, M., Puccio, L., & Venturini, R. (2018). From Final Goods to Inputs. *The American Economic Review*, *108*(8), 2335–2365.

Deardorff, A. V. (2018). Rue the ROOs: Rules of origin and the gains (or losses) from trade agreements. *The International Trade Journal*, *32*(5), 399-413.

Demidova, S., & Krishna, K. (2008). Firm heterogeneity and firm behavior with conditional policies. *Economics Letters, 98*, 122-128.

Demidova, S., Kee, H. L., & Krishna, K. (2012). Do trade policy differences induce sorting? Theory and evidence from Bangladeshi apparel exporters. *Journal of International Economics*, *87*(2), 247–261.

Estevadeordal, A. (2000). Negotiating Preferential Market Access: The Case of the North American Free Trade Agreement. *Journal of World Trade, 34*, 141–166.

Felbermayr, G., Teti, F., & Yalcin, E. (2019). Rules of origin and the profitability of trade deflection. *Journal of International Economics*, *121*.

Hayakawa, e. a. (2019). Impact of Free Trade Agreement Use on Import Prices. *The World Bank Economic Review, 33*, 643–660.

Hayakawa, K. (2011). Measuring fixed costs for firms' use of a free trade agreement: Threshold regression approach. *Economics Letters, 113*, 301–303.

Hayakawa, K. (2013). Does the use of multiple FTAs force firms to raise local input share?: Evidence of the spaghetti bowl phenomenon. *Economic Modelling, 33*, 458–461.

Hayakawa, K. (2015a). Does firm size matter in exporting and using FTA schemes? *The Journal of International Trade & Economic Development*, 883–905.

Hayakawa, K. (2015b). Impacts of FTA utilization on firm performance. *B.E. Journal of Economic Analysis and Policy, 15(3)*, 1325-1352.

Hayakawa, K., Kim, H., & Lee, H. (2014). Determinants on Utilization of the Korea–ASEAN Free Trade Agreement: Margin Effect, Scale Effect, and RoO Effect. *World Trade Review 13(3)*, 499–515.

Hayakawa, K., Kim, H., & Yoshimi, T. (2017). Exchange rate and utilization of free trade agreements: Focus on rules of origin. *Journal of International Money and Finance, 75*, 93-108.

Head, K., Mayer, T., & Melitz, M. (2022). The Laffer Curve for Rules of Origin. *Work in Progress.*

Hiratsuka, D., Hayakawa, K., Shiino, K., & Sukegawa, S. (2009). Maximizing benefits from FTAs in ASEAN. En J. Corbett, & S. Umezaki, *Deepening East Asian economic integration* (págs. 407–545). Jakarta: ERIA research project report 2008-1.

ITC. (2015). The invisible barriers to trade: How businesses experience non-tariff measures.

Ju, J., & Krishna, K. (2005). Firm behaviour and market access in a Free Trade Area with rules of origin. *Canadian Journal of Economics*, *38*(1), 290–308.

Kasteng, J., Kokko, A., & Tingvall, P. (2021). Who Uses the EU's Free Trade Agreements? A Transaction-Level Analysis of the EU–South Korea FTA. *World Trade Review, 21(1)*, 93-108.

Kohpaiboon, A. (2010). *Exporters' Response to FTA Tariff Preferences: Evidence from Thailand.* RIETI Discussion Paper Series 10-E-039.

Krishna, K., & Krueger, A. (1995). *Implementing free trade areas: Rules of origin and hidden protection* (4983; NBER Working Papers).

Krishna, K., Salamanca, C., Suzuki, Y., & Volpe Martincus, C. (2021). *Learning to Use Trade Agreements* (29319; NBER Working Papers).

Kuno, A., Urata, S., & Yokota, K. (2016). Estimating the Impacts of FTA on Foreign Trade: An analysis of extensive and intensive trade margins for the Japan-Mexico FTA. *RIETI Discussion Paper Series 16-E-003*.

Limão, N. (2016). Preferential Trade Agreements. *Handbook of Commercial Policy, 1B*, 279–367.

Mattoo, A., Roy, D., & Subramanian, A. (2003). The Africa Growth and Opportunity Act and its rules of origin: Generosity undermined? *World Economy*, *26*(6), 829–851.

Melitz, M. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica, 71*, 1695-1725.

Morán, J. R., & Cebreros, A. (2023). *Rules of Origin and the Use of NAFTA* [Ph.D. Thesis - University of Michigan - Ann Arbor].

Murillo, M., & Leal, C. (2021). Tratados de libre comercio y duración de las exportaciones: evidencia a nivel de firma para Colombia. *Revista Desarrollo y Sociedad* , Vol. 88. Pág. 201-238.

Nguyen, T., & Duong, T. (2019). Diversion effect of economic integration agreements. *VNU Journal of Science: Economics and Business*, Vol. 35. 12-25.

Nilsson, L. (2016). EU Exports and Uptake of Preferences: A First Analysis. *Journal of World Trade 50(2)*, 219–252.

Ornelas, E., & Turner, J. L. (2024). The costs and benefits of rules of origin in modern free trade agreements. *Journal of International Economics*, *147*, 103874.

Piotr, L., & Stefan, L. (2019). Which Factors Determine the Utilization of Preferential Tariff Rates? *Beiträge zur Jahrestagung des Vereins für Socialpolitik*.

Recalde, M., Florensa, L., & Degiovanni, P. (2016). Latin American integration and the survival of trade relationship. *17th European Trade Study Group (ETSG)*.

Rosenthal, S. S., & Strange, W. C. (2004). Evidence on the nature and sources of agglomeration economies. In *Handbook of Regional and Urban Economics (Vol. 4, pp. 2119-2171)*. Elsevier.

Roth, E. A. (2022). What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature. *Working paper*.

Schüle, U., & Kleisinger, T. (2016). The "Spaghetti Bowl": A case study on processing rules of origin and rules of cumulation. *UASM Discussion Paper Series No. 2*.

Sytsma, T. (2022). Improving Preferential Market Access through Rules of Origin: Firm-Level Evidence from Bangladesh. *American Economic Journal: Economic Policy, 14 (1)*, 440–472.

Sytsma, T. (2022). Improving Preferential Market Access through Rules of Origin: Firm-Level Evidence from Bangladesh. *American Economic Journal: Economic Policy*, *14*, 440–472.

Takahashi, K., & Urata, S. (2009). *On the Use of FTAs by Japanese Firms: Further Evidence.* RIETI Discussion Paper Series 09-E-028.

Tovar, J., & Martínez, L. (2011). Diversification, networks and the survival of exporting firms. *Uniandes-CEDE*.

Türkcan, K., & Saygili, H. (2018). Economic integration agreements and the survival of exports. *Journal of Economic Integration 33*, 1046-1095.

Ulloa, A., & Wagner, R. (2012). *Why don't all Exporters Benefit from Free Trade Agreements? Estimating Utilization Costs.* IDB working paper series, 388.

Wignaraja, G. (2014). The determinants of FTA use in Southeast Asia: A firm-level analysis. *Journal of Asian Economics, 35*, 32-45.

Wignaraja, G., Olfindo, R., Pupphavesa, W., Panpiemras, J., & Ongkittikul, S. (2010). How Do FTAs Affect Exporting Firms in Thailand? *ADBI Working Paper Series*.

APPENDIX A – ADDITIONAL TABLES AND FIGURES

Table A1. Incidence of FTAs on the use of COs, by treatment groups

	Mexico & Canada (2011).	USA (2012)	EU (2013)
	(1)	(2)	(3)
Effect	-0.016	0.005	-0.014
	(0.024)	(0.007)	(0.016)
Observations		156,866	

Note: This table shows the estimation results of regressions on the incidence of a new trade agreement on adopting a certificate of origin using the methodology proposed by Callaway & Sant'Anna (2021) and for the three treatment groups separately. These groups are based on the respective trade agreement's year of entry into force. Significance of *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the country of destination level.

Table A2. Incidence of the FTAs on the use of CO by treatment and product groups

	Agricultural			Manufacturing		
	2011	2012	2013	2011	2012	2013
	(1)	(2)	(3)	(4)	(5)	(6)
Effect	0.093**	0.055***	0.014	-0.059***	-0.023***	-0.072***
	(0.037)	(0.012)	(0.018)	(0.006)	(0.009)	(0.027)
Observations		56,196			98,480	

Note: This table shows the estimation results of regressions on the incidence of a new trade agreement on the adoption of a certificate of origin using the methodology proposed by Callaway & Sant'Anna (2021), splitting the exported products into agricultural or manufacturing, depending on their SIC classification, and for the three treatment groups separately. These groups are based on the respective trade agreement's year of entry into force. Agricultural products include 0) Food and live animals; 1) Beverages and tobacco; 2) Crude materials, inedible, except fuels; 4) Animal and vegetable oils, fats, and waxes. Manufacturing includes 5) Chemicals and related, 6) Manufactured goods classified chiefly by material, 7) Machinery and transport equipment, and 8) Miscellaneous manufacturing. Significance of *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the country of destination level.

Table A3. Incidence of the FTAs on the use of CO by treatment groups and import intensity

Import Intensity	Non-Importers			Low		
	2011	2012	2013	2011	2012	2013
	(1)	(2)	(3)	(4)	(5)	(6)
Effect	0.037	0.009	0.024	0.030	-0.080***	-0.019
	(0.030)	(0.009)	(0.018)	(0.043)	(0.030)	(0.022)
Observations		52,746			27,239	
Import Intensity	**Medium**			**High**		
	2011	2012	2013	2011	2012	2013
	(7)	(8)	(9)	(10)	(11)	(12)
Effect	-0.048*	0.025	-0.060*	-0.052***	0.010***	-0.011
	(0.028)	(0.018)	(0.034)	(0.007)	(0.003)	(0.014)
Observations		33,383			43,498	

Note: This table shows the estimation results of regressions on the incidence of a new trade agreement on the adoption of a certificate of origin using the methodology proposed by Callaway & Sant'Anna (2021), splitting transactions based on the import intensity of the exporter, built from the DIAN-DANE import database: non-import exporters and three tertiles of the distribution (low, medium, high, respectively). Significance of *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the country of destination level.

Table A4. Incidence of the FTAs on the use of CO by treatment groups and size

	Small and Medium			Large		
	2011	**2012**	**2013**	**2011**	**2012**	**2013**
	(1)	(2)	(3)	(4)	(5)	(6)
Effect	-0.077***	-0.016*	-0.009	-0.009	0.007	-0.014
	(0.007)	(0.008)	(0.024)	(0.025)	(0.008)	(0.016)
Observations	24,952			131,914		

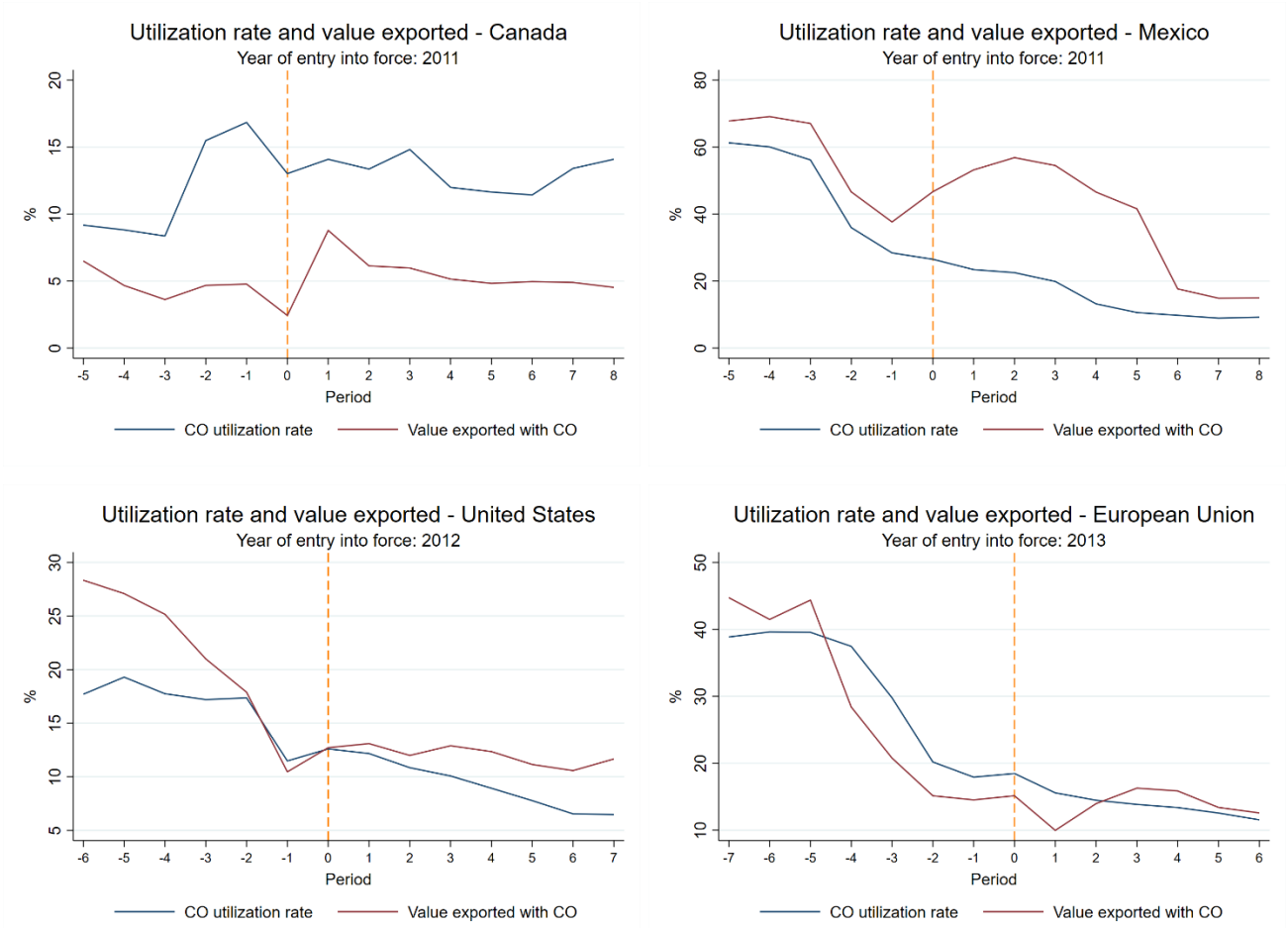
Note: This table shows the estimation results of regressions on the incidence of a new trade agreement on the adoption of a certificate of origin using the methodology proposed by Callaway & Sant'Anna (2021), splitting the exporting firms by their size before the entry into force of their respective agreement, and for the three treatment groups separately. These groups are based on the respective trade agreement's year of entry into force. Significance of *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the country of destination level.

Table A5. Incidence of the FTAs on the use of CO by treatment groups and business networks

	One firm			More than one firm		
	2011	**2012**	**2013**	**2011**	**2012**	**2013**
	(1)	(2)	(3)	(4)	(5)	(6)
Effect	-0.074***	-0.018	-0.047**	0.047	0.020**	0.007
	(0.015)	(0.017)	(0.021)	(0.044)	(0.010)	(0.018)
Observations	54,685			86,337		

Note: This table shows the estimation results of regressions on the incidence of a new trade agreement on the adoption of a certificate of origin using the methodology proposed by Callaway & Sant'Anna (2021), splitting the exporting firms by whether there is more than one firm exporting the same product in the same state or not, and for the three treatment groups separately. These groups are based on the respective trade agreement's year of entry into force. Significance of *** p<0.01, ** p<0.05, * p<0.1. All standard errors are clustered at the country of destination level.

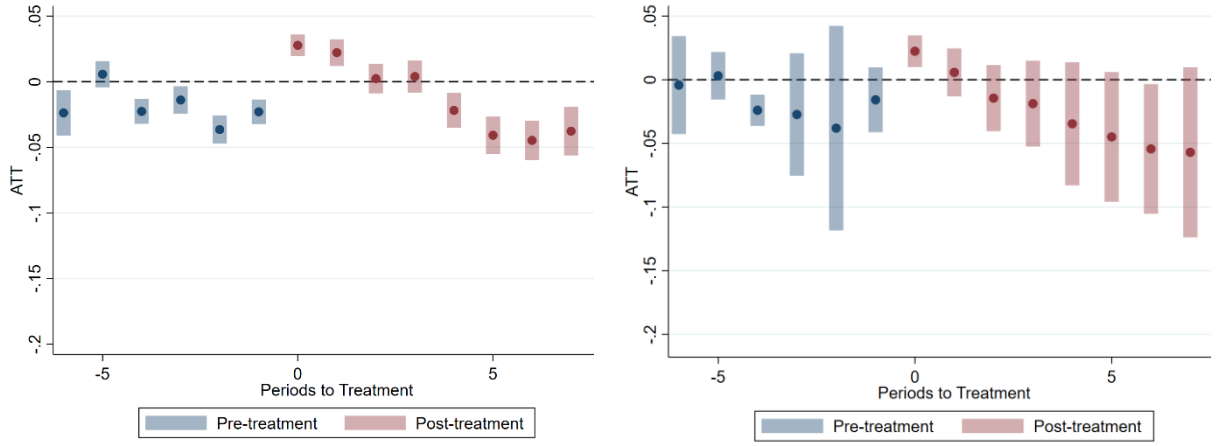
Figure A1. Evolution of the utilization rate and exported value with CO by FTA.



Note: These figures show the evolution of the utilization rate of certificates of origin (CO) for exports between Colombia and four different trade partners in a window of years around the entry into force of the respective trade agreement (orange dashed line). The blue line represents the percentage of export transactions declared to have a CO, while the red line represents the share of value exported accounted for by these transactions.

Figure A2. Incidence of the FTAs on the use of COs – Event Study

I. Robust standard errors *II. Country-cluster standard errors – All Sample*



Note: These figures show the estimation results of event study regressions on the incidence of a new trade agreement on adopting a certificate of origin using the methodology developed by Callaway & Sant'Anna (2020). The left panel uses robust standard errors and includes firm-product-destination transactions observed before and after the treatment year. The right panel clusters standard errors at the country of destination level and treats data as a series of repeated cross-sections to allow for the non-balanced observations of the data. The size of the bin indicates a 95% confidence interval.