Are Free Trade Agreements being Used?

Transaction Level Evidence for Colombia

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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. We conclude that eliminating non-tariff measures is key to achieving a better use of trade agreements and unlocking their economic potential.

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

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

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1. INTRODUCTION

In the last two decades, research has shown the different impacts of free trade agreements (FTAs) on firms. Literature has evidenced that the reduction of tariff rates attached to trade agreements leads to an increment in the exported volume of firms and brings forward the entrance of new products into the markets (Baier et al., 2014, Kuno et al., 2016; Baier et al., 2018), as well as longer export spells (Besedes et al., 2016; Recalde et al., 2016; Türkcan & Saygili, 2018; Nguyen & Duong, 2019). Even though preferential rates are available for all the exporters, these benefit are not automatic. Often, the exporting companies must demonstrate that their products comply with the rules of origin, 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.

The empirical literature has demonstrated that firms that comply with the rules of origin 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 the current trade agreements and the low rates of adoption of CO 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 in the use of the trade agreements, and the complicated procedures needed to obtain the CO (Hayakawa, 2011; Takahashi & Urata, 2009; Kohpaiboon, 2010; Wignaraja, 2014). Another reason explored in the literature is the *Spaghetti Bowl Effect*, which refers to the increase in non-tariff measures (such as the rules of origin) that are tied to FTA subscriptions. These subscriptions are tied to confusing—and even contradictory—bureaucratic measures, which makes difficult for the exporter to fully comply with the RO (Bhaqwati, 1995; Hayakawa, 2013; Schule & Kleisinger, 2016).

Although the number of trade agreements signed in Colombia between 2000 and 2020 tripled from 5 to 17 (MINCIT, 2021), their low utilization by firms is still notable. Particularly, Murillo & Leal (2021) identified that only 24% of Colombian exports have a CO with their business partners. These low utilization rates could be driving the slow increase in the share of exports in the GDP in the same period,[3] even though the number of trade agreements increased by 240%.

The purpose of the current study is to analyze the incidence of the FTAs signed by Colombia in the utilization of CO by national exporters, given that a CO is a necessary requirement to access preferential tariffs. To respond to this question, 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 a Difference-in-Difference specification with staggered treatments, exploiting the variation originated by the different FTAs signed by Colombia during this period. The understanding of this relation will allow for future research on the economic effects on firms acquiring a CO.

Estimates reveal two key results. First, FTAs have had a slightly negatively effect on the utilization of preferential tariffs by exporters. This is a counterintuitive result, but it can be explained if we consider that, even though the signing of trade agreements involves tariff reductions, it also imposes other non-tariff measures that are counterproductive for the effective use of trade preferences. Second, there is evidence of an illusion effect in the adoption of COs. In particular, the CO utilization rates increase the first two years after the entry into force of an FTA, but they start declining soon after and become negative by year 4 after the entry into force of the FTA.

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 when comparing exports of agricultural and manufacturing products, the latter being more likely to use a greater number of imported inputs. Second, more productive firms

[3] The participation of Colombian exports on the GDP changed by -18.9% between 2006 and 2019.

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.

This research adds to the growing literature studying the determinants of trade agreement utilization (Takahashi & Urata, 2009; Hiratsuka et al., 2009; Wignaraja et al., 2010; Kohpaiboon, 2010; Wignaraja, 2014; Hayakawa, 2015a; Kasteng et al., 2021). In these studies, papers 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), 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).

This research makes two more contributions to the literature. Firstly, it analyzes the incidence of the FTAs in commercial utilization using data at the firm–product–destination level. 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 mode detailed data allowed us to identify limitations in the utilization of preferential tariff by firms in different destinations and products. Second, we explore product- and firm-level differences in the utilization of the CO, with the goal of clarifying the peculiarities of the exporters that manage to take advantage of preferential trade.

The rest of this article is divided into five sections. The second section includes the theoretical framework about the incidence of trade agreements in the utilization of COs. In the third section, we describe or data and present descriptive analysis of utilization rates pre- and post-commercial agreement. Section 4 presents the empirical

model used in this paper. The fifth section displays the econometric results and, finally, the sixth section presents the conclusions and discussions.

2. THEORETICAL FRAMEWORK

This section presents a conceptual and theoretical framework that describes the possible mechanisms behind the firms' decision of using an agreement's preferential tariffs, and thus, the Certificate of Origin. Among others, we consider the literature's hypotheses about firm heterogeneity (Melitz, 2003; Demidova & Krishna, 2008), the *Spaghetti Bowl Effect* (Bhaqwati, 1995; Hayakawa, 2013; Schule & Kleisinger, 2016), and firm networks to lay the theoretical foundations of the study.

An exporter firm evaluates the decision of using 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 will be the incentive to use these preferences. Moreover, to use an FTA's preferences, the firm must comply with the rules of origin 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. In fact, Hayakawa et al (2019) estimates an increase of around 4% to 8% in fixed costs associated with the utilization of preferential tariffs. Additionally, when using these preferential tariffs and the 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. The lower these additional costs, the larger will be the incentive for a company to acquire a CO and, thus, being benefit from the tariff preferences (Hayakawa, 2013).

Based on these tradeoffs, and considering the models of firm heterogeneity (Melitz, 2003), Demidova & Krishna (2008) mention that the most productive exporters will be the ones to use the preferential tariff schemes in their exports, given that they can afford to pay for the associated costs. Under this framework, and based on survey data, Takahashi & Urata (2009) show that the largest firms have the highest probability of using the trade agreements relative to smaller ones. Other authors have also confirmed a positive correlation between firm size, productivity, and the utilization of the 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 the number of trade agreements between countries entails two extra factors that are determinant in the firm's decision to use the tariff preferences. First, rules of origin that differ from or intersect with each other, like spaghettis in a bowl, and second, more restrictive regulations on product origin compliance (Shule & Kleisinger, 2016; Melitz et al., 2022). Estevadeoral (2000) show that, while the oldest trade agreements used rules of origin that were general for all sectors, current FTAs incorporate or modify the rules of origin 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 biggest restrictions. Likewise, Sytsma (2022) found that the rules of origin reduce in three quarters the preferential margin for garments exporters in Bangladesh. When the European Union relaxed the rules, the number of exporters increased.

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

Under this framework and having considered the existence of different decision mechanisms that the firms have for the utilization of the tariff preferences (benefits, costs, firm heterogeneity, product rule of origin restrictions, difficulties in normative understanding, among others), the present research aims to test how an FTA affects the utilization of commercial preferences.

3. DATA

In this section, we describe the main database used in this paper, some of its singularities and the sample selection process. Moreover, we present several descriptive statistics of

the changes in the utilization rates of certificates of origin over time and across the different FTAs signed by Colombia in the last decade

3.1. Data Description

We use data obtained from 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). This database collects all the monthly export transactions performed from Colombian exporters, at the firm-product-destination level. Each record includes information about the tax identification of the exporter, shipped product (classified with the harmonized tariff subheading NANDINA-10 digits), the value of the transaction, the destination country, and the state of origin of the firm. Since DIAN is the entity in charge of reviewing and approving the COs that companies process in order to qualify for preferential rates, these data include information identifying the firms that report a CO for a specific product and destination.

In this study, 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.

Despite the richness of the DANE-DIAN export microdata, there are some subtleties that must be considered before using the data. Thanks to interviews conducted with technical teams of the Ministry of Commerce, DANE, and DIAN conducted interviews, we identify some data nuances that influenced the selection of our sample. First, following Tovar & Martínez (2011), we excluded transactions that, in practice, cannot be considered as 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 destination are other 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 CO (CAN, ALADI, SGP, ATPA, CARICOM, and G-3).[4] Since our variable of interest is CO utilization, it is important that it is correctly identified. When exploring the data, we found transactions that accredited the possession of one of the six CO, but the exports were directed to countries that didn't belong to the said certificate. For example, exports with an ATPA certificate of origin that were destined to countries other than the United States. This behavior is related to probable re-exports of the product. Therefore, a correction of the variable is made by redefining transactions that use the CO as those that have the CO that corresponds to the expected destination, otherwise, we assumed that the transaction does not have the certificate.

Thirdly, and given that the treatment variable of this paper is the year of entry of the FTAs in Colombia (see Section 4 for more details), we consider only those FTAs with a starting year inside the analyzed period, with the aim of having a pre- and post-treatment period.[5] Therefore, we exclude those countries belonging to FTAs that took effect before the study period (CAN, Mercosur and ALADI), since they represent transactions that were already treated. In this sense, the CO and trade agreements that we analyze are: (i) the FTA between Colombia and Mexico, whose CO is G-3, and entered into force in 2011; (ii) the FTA between Colombia and the United States that entered into force in 2012, whose CO is ATPA; and (iii) the FTA between Colombia and the member countries of the European Union (in force since 2013) and the FTA between Colombia and Canada (in force since 2011), whose CO is SGP in both cases.[6]

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

[5] During the analysis period, 10 trade agreements with Colombia took effect. However, this study only considers 4 FTAs (the ones with Mexico, Canada, the United States, and the European Union). The rest of the trade agreements are excluded from the sample since there is no information available on the CO variable of interest for these FTAs.

[6] There are 13 countries that belong to the General System of Preferences (European Union, Australia, Belarus, Canada, United States, Japan, Kazakhstan, New Zealand, Russia, Turkey, countries of the European Union). Therefore, these countries are considered to have CO if they report holding the GSP CO.

Finally, we drop countries whose participation in Colombia's total exports in 2019 were 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 which are equivalent to 98% of Colombia's annual average exports. Once the data was refined, our final sample consists of 330,687 firm-product-destination transactions, of which 13.9% report a CO. In this final sample, there is a total of 19,702 exporting companies, 4,138 products at the HS-6 level, and 102 destination countries.

3.2. Descriptive Statistics

In this subsection, we present a descriptive analysis of the data related to the rate of use of tariff preferences, which can be defined as the percentage of transactions that use CO within the total exports. We also analyze the behavior of variables such as the share of the value exported, number of companies and products of the transactions that use CO.

Table 1 shows the utilization rate of tariff preferences in export transactions, as well as the percentage of the exported value, firms and products that use CO for each FTA, for before and after the respective trade agreement. It can be observed that the post-agreement utilization rate of the FTAs is, on average, lower relative to the pre-agreement period. Specifically, the share of transactions that accredit the possession of the G-3 CO decreased by 32.4 percentage points (pp) after the entry into force of the Colombia-Mexico FTA. Similarly, for the Colombia-United States and Colombia-European Union FTAs there were decreases of 7.4 pp and 17.6 pp, respectively. This behavior holds even after groups of products (either agricultural or manufacturing),[7] which we present in Table A1 of the appendix. On the other hand, the positive change in the CO utilization rate for Canada can be explained by a higher adoption of COs for agricultural products.

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

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

		Canada (2011)	Mexico (2011)	USA (2012)	European Union (2013)
Utilization rate (%)	Pre-trade agreement	11.7	48.4	16.8	31.9
	Post-trade agreement	13.1	16.0	9.4	14.3
Exported value with CO (%)	Pre-trade agreement	4.8	57.6	21.7	29.9
	Post-trade agreement	5.3	38.5	12.1	13.9
Firms with CO (%)	Pre-trade agreement	12.8	41.6	18.3	30.8
	Post-trade agreement	15.7	18.1	12.9	17.5
Products with CO (%)	Pre-trade agreement	17.4	40.4	23.0	25.2
	Post-trade agreement	11.8	21.0	15.6	14.4

Source: Own elaboration with data from the DANE – DIAN. Note: The entry into force of the Colombia-Canada and Colombia-Mexico FTA was in 2011, therefore, the pre-trade agreement period is 2006-2010 and the post-trade agreement period is 2011-2019. The pre-trade agreement period for the Colombia-United States and Colombia-European Union FTA are 2006-2011 and 2006-2012, respectively; and the post-trade agreement periods are 2012–2019 and 2013–2019, respectively.

For both product groups (agricultural or manufactured), Table 2 explores the dynamics of tariff preferences utilization pooling the four analyzed FTAs. The data indicate that the average CO adoption rates in the post-agreement period of FTAs between Colombia and its trading partners are lower relative to the pre-agreement period, regardless of the product group. Specifically, the use of tariff preferences in the transactions of agricultural products group decreases by 6.8 pp after the entry into force of the FTAs between Colombia and its trading partners; in the case of manufacturing transactions, it decreases by 16.8 pp.

On the other hand, Figure A1 in the appendix shows the evolution of the utilization rate in transactions directed to Canada, Mexico, the United States, and countries belonging to the European Union. In general, these figures show that, in the first years after a given FTA takes effect, there is a slight increase in the use of tariff preferences. Nonetheless, in subsequent years there is a decline in the utilization rates.

Table 2. Utilization rates of FTAs before and after the trade agreement, by product group

Sector	Variable		FTAs grouped	
			%	Difference (pp)
Agricultural	Utilization rate (%)	Pre-trade agreement	25.5	-6.8
		Post-trade agreement	18.7	
	Exported value with CO (%)	Pre-trade agreement	24.7	-7.6
		Post-trade agreement	17.1	
	Firms with CO (%)	Pre-trade agreement	27.4	-6.7
		Post-trade agreement	20.8	
	Products with CO (%)	Pre-trade agreement	29.2	-5.5
		Post-trade agreement	23.7	
Manufacture	Utilization rate (%)	Pre-trade agreement	25.7	-16.8
		Post-trade agreement	9.0	
	Exported value with CO (%)	Pre-trade agreement	34.6	-16.4
		Post-trade agreement	18.2	
	Firms with CO (%)	Pre-trade agreement	23.5	-12.0
		Post-trade agreement	11.4	
	Products with CO (%)	Pre-trade agreement	25.7	-11.9
		Post-trade agreement	13.8	

Source: Own elaboration with data from the DANE – DIAN. Note: The grouped FTA variable is the aggregation of the pre- and post-trade agreement periods of the FTAs under analysis.

These trends motivate our inquire about the entry into force of FTAs as a possible determining factor in the use of tariff preferences. Since new trade agreement reduces tariff barriers, it would be intuitive if more exporting firms started to use the preferential tariffs after it comes into force. However, if the increase in non-tariff barriers is larger, it would discourage firms from taking advantage of such agreements. We test this hypothesis with the econometric exercise presented in Section 4.

4. EMPIRICAL METHODOLOGY

To analyze the impact that FTAs have on the use of tariff preferences for Colombian exports, we will follow a Difference-in-Differences (DD) through a Two-Way Fixed Effects (TWFE) model. This model allows exploring the temporal and individual variation from the entry into force of different FTAs. This way, we can compare the use of tariff preferences between those transactions that are directed to countries that signed an FTA with Colombia and those that did not, during the period between 2006 and 2019, before and after the signing of the treaty. 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. It is important to recall that a CO is the support for compliance with the rules of origin 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 between both countries already existed a previous trade agreement.

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 (United States, Canada, Mexico and countries within the European Union). 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 $t \geq 2011$; or if it is made to the United States in $t \geq 2012$; or towards the countries of the European Union in $t \geq 2013$.

The terms $\eta_{fpd}, \rho_{pt}, \psi_d$ y δ_t represent different fixed effects. First, η_{fpd} denotes firm-product-destination fixed effects which aims to control for time invariant characteristics at the firm, product and destination level. Second, δ_t represents year fixed effects that control for aggregate shocks that affects all exporters each year, e.g., inflation, peso depreciation, etc. These two sets of fixed effects are the baseline of any TWFE model. Third, 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 stochastic error measure. Standard errors are clustered at the country of destination level, which allows for correlation in the errors by assuming that there are some factors at the destination country that affect they are independent between countries.

Note that the entry into force of the FTAs is totally exogenous to the decisions and behavior of firms and their transactions, given that the negotiations and signing of a trade agreement take place between the politicians of each country and usually takes a long time. Therefore, firms do not tend to affect these negotiation processes, neither

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 as 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 effects are heterogeneous and have variations over time (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 (Goodman-Bacon, 2019; Callaway & Sant'Anna, 2021; Chaisemartin & D'Haultfoeuille, 2022). In our case, the treatment takes place in different periods, given that the signing of the four FTAs considered took place in three different years. As this issue could bias the linear TWFE estimator, a DD method with variation in the time of treatment (staggered treatment) is used. In particular, we use the estimator proposed by Callaway & Sant'Anna, (2020), who propose a methodology where the final estimator is derived as the weighted average of different estimators resulting from comparisons across treated, not-yet treated and untreated groups.

In this sense, our data presents staggered treatments divided into three stages: the first one including Mexico and Canada, whose treaties were both signed in 2011; the second being the United States with entry into force in 2012; and thirdly, the countries belonging to the European Union, whose treaty took effect in 2013. Therefore, each treatment group is composed by those transactions directed to countries in which an FTA has been signed with Colombia during a given year, and the control group is made up of those exports made to countries that had not yet signed an FTA with Colombia in that year, even if they will belong to an FTA in a future year.

The main assumptions behind Callaway & Sant'Anna (C&S) estimator are the irreversibility of treatment, a random sampling and the conditional parallel trends based on a "Never-Treated" group or "Not-Yet-Treated" groups. The irreversibility of treatment refers to the fact that once a unit becomes treated, it remains treated in the rest of the periods. 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 no agreement 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 estimate an Event Study specification, which will also allow to analyze the dynamics of the impacts before and after the treatment.

5. RESULTS

In this section, we present the results of the equations described previously. Firstly, we show the incidence of FTAs in the use of CO, together with their respective dynamic effects. Secondly, and based on the theoretical discussions from Section 2, we perform different heterogeneity analysis that aim to pin down some of the possible mechanisms driving the main results.

5.1. Incidence of FTAs in the use of preferential export trade

In this subsection, we present the results of the econometric specifications discussed in Section 4, which are related to the incidence of FTAs in the use of preferential rates. As shown in Table 3, both using TWFE or the methodology proposed by C&S, the use of CO in Colombian exports decreases after the signing of FTAs. Specifically, for the estimation using TWFE (column 1), the start of a trade agreement reduces the use of CO by 0.05 pp, a result that is statistically significant. This coefficient is robust to the inclusion of product*year fixed effects which aim to control for fluctuation in good prices over time. When we use the C&S estimation, we find a reduction of approximately 0.01 pp (column 3); however, this last coefficient is not significant.

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 hold, we estimate an event study specification. We present the results of such estimates in Graph 1, where we use the methodology proposed by C&S. This figure shows the estimates with both robust standard errors (left panel) and clustering at the county of

destination (right panel). 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 groups of treatment and control, which suggest parallel trends before the FTAs.

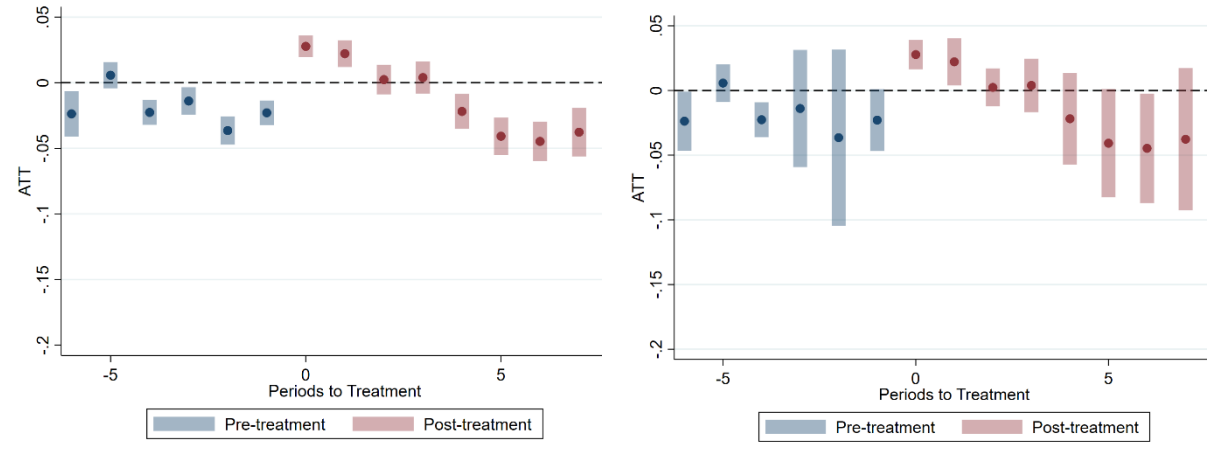
Table 3. Incidence of the FTAs on the use of certificates of origin

	TWFE		C&S
	(1)	(2)	(3)
$Post_t * FTA_d$	-0.058**	-0.053**	
	(0.025)	(0.027)	
ATT			-0.006
			(0.011)
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

Note: Significance of *** p<0.01, ** p<0.05, * p<0.1. All estimates have robust standard errors at the country-cluster level.

Figure 1. Event Study

I. Robust standard errors *II. Country-cluster standard errors*



Note: The graph shows the estimated parameter with Callaway & Sant'Anna, (2020) for the years before and after the entry into force of the FTA. The estimates have robust standard errors and robust standard errors at the country-cluster level.

Moreover, an interesting dynamic of FTAs is observed. In the first years after the entry into force of the trade agreement, there is a positive effect in the use of CO in exporting transactions, ports. Nonetheless, after the third period, the effect is reversed, causing the reduction in the use of preferential trade. In short, the results suggest that the entry into force of an FTA has a null effect on the use of CO from Colombian exports. However, there is a dynamic behavior that evidence an "illusion effect" of preferential trade, since the utilization of tariff preferences by exporters increases when the FTA takes effect, and then decreases in subsequent years until they become negative. These results are in line with the premises of the *Spaghetti Bowl Effect*, meaning that although the signing of trade agreements entails tariff reductions, it also imposes other non-tariff measures that are counterproductive for the effective use of trade.

Table 4. Incidence of FTAs on the utilization of certificates of origin according to treatment groups

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

Note: Significance of *** p<0.01, ** p<0.05, * p<0.1. Estimates obtained with the method of Callaway & Sant'Anna (2020). All estimates have robust standard errors at the country-cluster level.

To delve into the previous result and to look for the sources of heterogeneity in the treatment, we use the C&S estimation to distinguish between the treatment groups: Mexico and Canada (FTAs signed in 2011), USA (signed in 2012), EU (signed in 2013). We present these results in Table 4, which suggest that the entry into force of the FTAs signed by Colombia has no effect on the use of CO by national exports, regardless of the FTA.

5.2. Heterogeneity Analysis

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 rules of origin. For instance, these ROs could be more beneficial for agricultural products relative to manufactured products, given that the former use fewer inputs, both in total and imported. On the other hand, the production of manufactured goods uses more intermediate goods in their fabrication, 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, following the division presented in Table 2.

Columns 1 and 2 from Table 5 present the results of these estimations. The results suggest that the entry into force of a Colombian FTA on the use of tariff preferences differs according to the group of exported products. The use of CO from exports of agricultural products increases by 0.04 pp after the signing of an FTA, while for manufacturing products it decreases by 0.04 pp. This result holds when we analyze the three different treatment groups (see Table A2 in the appendix). As discussed above, these findings can be explained by the compliance requirements of the ROs related to local inputs that industrial and manufacturing products must comply with, hindering the use of preferential trade (ITC, 2015; Systma, 2022). Particularly, it may not be profitable for a manufacturing company to take advantage of lower tariff barriers if they imply sacrificing cheaper foreign inputs for more expensive domestic, which would make them less competitive.

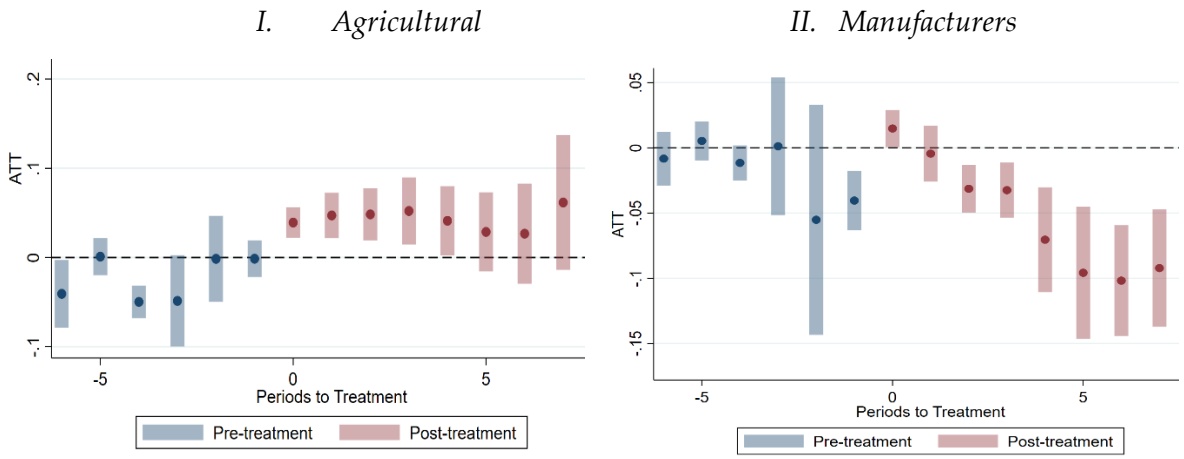
Table 5. Heterogeneities in the incidence of FTAs on the use of certificates of origin

	I. Product groups		II. Average initial export value		II. Business networks	
	Agricultural	**Manufacturers**	**Small and Medium**	**Large**	**One firm**	**More than one firm**
	(1)	(2)	(3)	(4)	(5)	(6)
ATT	0.043***	-0.043***	-0.028*	-0.003	-0.044***	0.024
	-0.016	-0.01	(0.014)	(0.011)	(0.013)	(0.015)
Observations	56,196	98,480	24,952	131,914	54,685	86,337

Note: Significance *** p<0.01, ** p<0.05, * p<0.1. Estimates obtained with the method of Callaway & Sant'Anna (2020). All estimates have robust standard errors at the country-cluster level.

We also estimate the event study specification for both groups. Figure 2 shows 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, which seems to confirm the assumption of parallel trends. Moreover, for both groups we observe the same hump-shaped dynamics presented in Figure 1. Nonetheless, the decrease for agricultural products is minor compared to the large decrease of almost 10% for manufactured products 5 years after the signing of the FTA.

Figure 2. Event Study by product groups



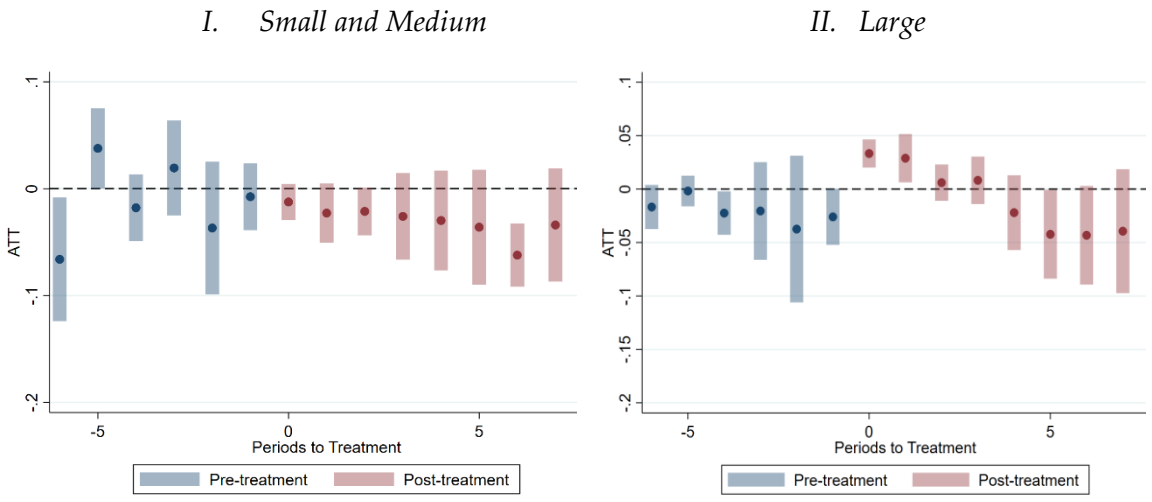
Note: The graph shows the estimated parameter with Callaway & Sant'Anna, (2021) for the years before and after the entry into force of the FTA. All estimates have robust standard errors at the country-cluster level.

As mentioned in Section 2, more productive exporters might be more likely to acquire a CO as they can cover the required costs more easily; this result can be implied from models studying firm dynamics, such as Melitz (2003) and Demidova & Krishna (2008). Since we cannot observe, not estimate exporter-level productivity, we proxy productivity using the average yearly exported value by an exporter before the entry of an FTA (the pre-treatment period); that is, exports to countries that do not have or have not yet had an FTA with Colombia. We use this baseline value as to avoid endogeneity concerns since higher market access brought by an FTA can lead to improvements in productivity. Using this value, we separate the exporters into two groups: (i) those firms

that are in the first three quartiles of the distribution, which can be considered small and medium-sized exporters; (ii) and the firms in the top quartile in the distribution, which can be considered large exporters with a relatively high productivity level.

We estimate our main specification separately for both groups of firms and present the results in columns 3 and 4 from Table 5. The results show that small and medium-sized firms present a decrease in CO utilization after the entry into force of the FTAs, while the incidence that the FTAs have in the use of CO within large firms is almost zero. However, this effect is weak and imprecisely estimated as the coefficients are not significantly different from zero. This leads 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 shall they decide to adopt a CO. These results by size category are the same, regardless of the treatment groups for small exporters as shown in Table A.3. Finally, Figure 3 shows that the same hump-shape holds for large exporters, while for small and medium exporters is always negative, although imprecisely estimated.

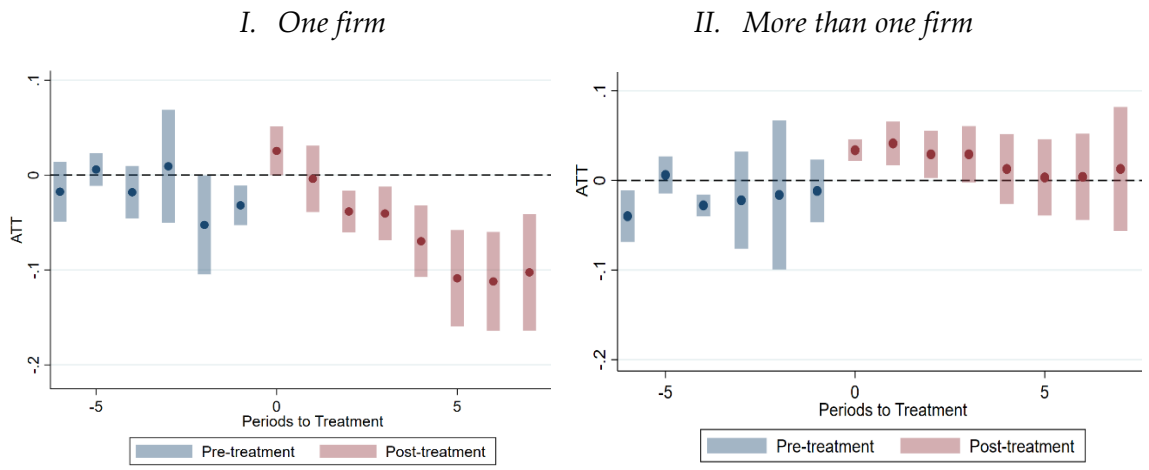
Figure 3. Event Study by average initial export value of the firm



Note: The graph shows the estimated parameter with Callaway & Sant'Anna, (2021) for the years before and after the entry into force of the FTA. All estimates have robust standard errors at the country-cluster level.

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 the usual mechanisms explored in the literature: labor pooling, input-output sharing and knowledge spillovers (Rosenthal & Strange, 2004). Thicker commercial 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 commercial networks, we estimate our econometric 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 the state.[8]

Figure 4. Event Study by size of Business Network



Note: The graph shows the estimated parameter with Callaway & Sant'Anna, (2021) for the years before and after the entry into force of the FTA. All estimates have robust standard errors at the country-cluster level.

Results shown in Columns 5 and 6 from Table 5 suggest that the entry into force of an FTA has a negative impact on the use of CO by firms without a commercial network for that product-destination pair. In particular, the estimated effect correspond to a 4.4% reduction in the average CO utilization rate. On the other hand, the effect is positive—

[8] Colombia has 32 states or *departamentos*. This is the smallest geographical unit of analysis available in our data.

but not significant—on those transactions related to a commercial network. These result hold by the three different treatment groups (Table A4). When exploring the dynamic effects, Figure 4 shows that the same hump-shaped effect with a more pronounced decresed for those firms without a commercial network. However, the reduction after the fourth year is not significantly different from zero for those firms with a commercial network. These results confirms the importance of agglomeration economies and commercial networks determining the use of COs.

6. CONCLUSIONS AND DISCUSSION

In the last few decades, there has been a monumental increase in the signing of new free trade agreements between countries. In particular, in Colombia there were 12 new trade agreements between 2000 and 2020. However, accessing to the tariff preferences entailed in these agreements is not an easy endeavor as it is necessary to comply with several rules and non-tariff measures that are consolidated in the use of a certificate of origin by exporting companies.

In this study, we use transaction level data for Colombia between 2006 and 2019 to investigative how the utilization rates of certificates of origin in exports are affected after the signing of FTAs. Our results suggest that 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, we find that the aggregated effect is imprecisely estimated due to large heterogeneity between exporters. In particular, exports of agricultural products, large exporters and exporters with commercial networks present an increase in the use of CO. 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, small and medium exporters and exporters without a commercial network experience a large decline in CO utilization rates of almost 10% five years after the entry into force of an FTA.

These findings have several policy implications. First, it seems that FTAs favorably affect the use of preferential trade only during the initial years, as the utilization rates of CO fall three years after. These effects suggest that the reduction of tariff is not enough to guarantee that all exporters will receive the preferences brought by trade agreements. In fact, recent studies warn that tariffs are no longer the main barrier to accessing new markets by firms in developing countries. Instead, non-tariff measures (such as ROs) are the ones that constitute the *"invisible barrier"* faced by these firms (ITC, 2015; Limão, 2016).

On the other hand, we detected specific sector level limitations for obtaining COs being manufacturing products the ones with the most difficulties to comply with ROs. It would be useful 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 that firms without networks are incurring in suboptimal decisions: by trying to take advantage of tariff preferences, these firms end up buying more expensive and less competitive national inputs, just to learn that they would be better off by not taking advantage of such preferences.

Further research must aim to further 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 awake greater interest by academics and policy makers in order for them to bring these elements to the negotiation of new agreements or the renegotiation of existing ones.

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APPENDIX

A1. ADDITIONAL TABLES AND FIGURES

Table A1. Export performance by FTA according to the CUCI product group, an average period before and after the trade agreement

			Canada (2011)		USA (2012)		Mexico (2011)		European Union (2013)	
				Difference		Difference		Difference		Difference
Agricultural	Utilization rate (%)	Pre-trade agreement	11.18	6.58	20.75	-2.75	30.25	-13.57	39.84	-17.53
		Post-trade agreement	17.76		18.01		16.68		22.31	
	Exported value with CO (%)	Pre-trade agreement	2.61	3.04	19.33	-7.83	47.52	-9.81	29.37	-15.65
		Post-trade agreement	5.65		11.51		37.71		13.71	
	Firms with CO (%)	Pre-trade agreement	12.1	7.33	24.7	-3.86	30.4	-14.20	42.4	-15.86
		Post-trade agreement	19.4		20.9		16.2		26.6	
	Products with CO (%)	Pre-trade agreement	24.1	-3.76	29.0	-4.22	35.1	-11.26	28.7	-2.94
		Post-trade agreement	20.3		24.8		23.9		25.8	
Manufacture	Utilization rate (%)	Pre-trade agreement	12.70	-6.22	15.42	-8.95	49.19	-33.23	25.58	-18.69
		Post-trade agreement	6.49		6.46		15.96		6.89	
	Exported value with CO (%)	Pre-trade agreement	15.70	-11.88	26.08	-12.33	59.29	-20.30	37.32	-20.92
		Post-trade agreement	3.82		13.75		39.00		16.40	
	Firms with CO (%)	Pre-trade agreement	14.1	-5.27	15.0	-6.23	42.6	-24.15	22.2	-12.50
		Post-trade agreement	8.8		8.7		18.4		9.7	
	Products with CO (%)	Pre-trade agreement	15.6	-6.89	22.1	-7.90	40.7	-19.92	24.6	-13.06
		Post-trade agreement	8.7		14.1		20.8		11.5	

Source: Own elaboration with data from the DANE – DIAN. Note: The entry into force of the Colombia-Canada and Colombia-Mexico FTA was in 2011, therefore, the pre-trade agreement period is taken as 2006-2010 and the post-trade agreement period is between 2011 and 2019. The pre-trade agreement period for the Colombia-United States and Colombia-European Union FTA are 2006-2011 and 2006-2012, respectively; and the post-trade agreement periods are 2012–2019 and 2013–2019, respectively.

Table A2. Incidence of the FTAs in the utilization of certificates of origin, treatment groups according to product group

	Agricultural			Manufacturing		
	2011	**2012**	**2013**	**2011**	**2012**	**2013**
	(1)	(2)	(3)	(4)	(5)	(6)
ATT	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: Significance of *** p<0.01, ** p<0.05, * p<0.1. All estimates have robust errors by country-cluster.

Table A3. Incidence of the FTAs in the utilization of certificates of origin, treatment groups according to average initial export value of the firm

	Small and Medium			Large		
	2011	**2012**	**2013**	**2011**	**2012**	**2013**
	(1)	(2)	(3)	(4)	(5)	(6)
ATT	-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			10,126		

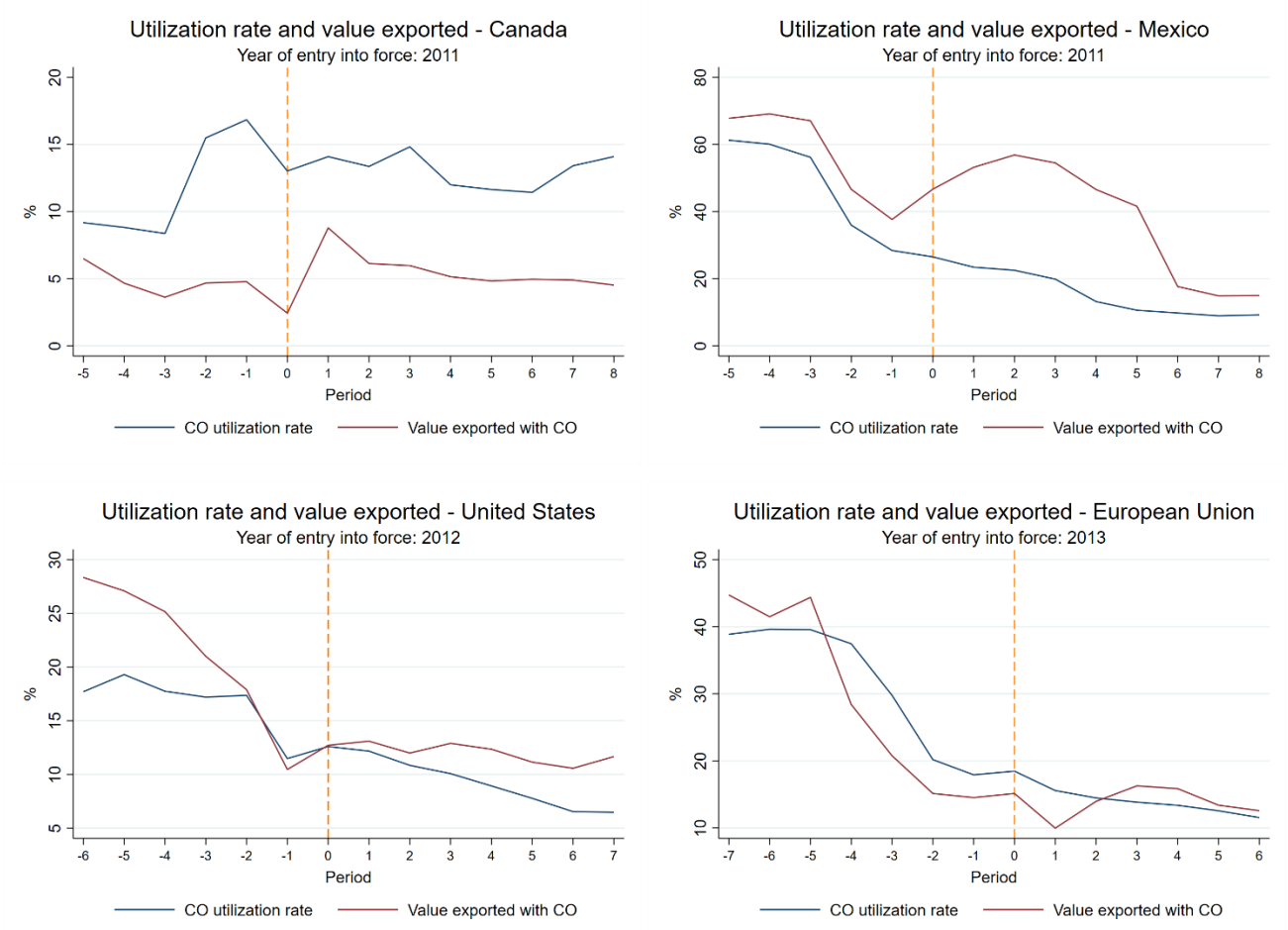
Note: Significance of *** p<0.01, ** p<0.05, * p<0.1. All estimates have robust errors by country-cluster.

Table A4. Incidence of the FTAs in the utilization of certificates of origin, treatment groups according to number of networks

	One firm			More than one firm		
	2011	**2012**	**2013**	**2011**	**2012**	**2013**
	(1)	(2)	(3)	(4)	(5)	(6)
ATT	-0.074***	-0.018	-0.047**	0.047	0.020**	0.007
	(0.015	-0.017	-0.021	-0.044	-0.01	-0.018
Observations	54,685	54,685	54,685	86,337	86,337	86,337

Note: Significance of *** p<0.01, ** p<0.05, * p<0.1. All estimates have robust errors by country-cluster.

Figure A1. Evolution of the utilization rate and exported value with CO, according to the FTA



Source: Own elaboration with data from the DANE – DIAN.