IDB WORKING PAPER SERIES No. IDB-WP-388

Why don't all Exporters Benefit from Free Trade Agreements?

Estimating Utilization Costs

Alfie Ulloa†
RodrigoWagner‡

July 2012

Inter-American Development Bank
Integration and Trade Sector

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Alfie Ulloa†
RodrigoWagner‡

Harvard University
University of Chile

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2012

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Ulloa, Alfie A.
Why don't all Exporters Benefit from Free Trade Agreements? / Alfie Ulloa, RodrigoWagner.
p. cm. (IDB working paper series ; 388)
1. Commercial treaties—Case studies. 2. Export trading companies—Case studies. 3. Chile—Commerce—United States. 4. United States—Commerce—Chile. I. Wagner, Rodrigo. II. Inter-American Development Bank. Integration and Trade Sector. III. Title. IV. Series.
IDB-WP-388

Authors acknowledge the valuable conversations with Andres Rodriguez-Clare, Carolyn Robert, Ricardo Hausmann and Sebastian Bustos; as well as seminar participants at Tufts, IADB and IIOC in Boston. Patrick O'Hallaran provided superb research assistance while Erick Feijoo helped with data support at IADB. A portion of this research was supported by grant by the Inter-American Development Bank and benefited from data sharing by Chilean Customs (Servicio Nacional de Aduanas) through the Chilean Ministry of Finance. Usual disclaimers apply

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†University of Chile, Law School and ZBU.

‡Assistant Professor at Tufts University, Economics Dept.; Associate at Center for International Development (Harvard University) ; Affiliate to the Entrepreneurship & Firm Growth (SME) research group at Innovations for Poverty Action (IPA).
Corresponding author: Rodrigo.Wagner@Tufts.edu - 8 Upper Campus Road, Medford MA. 02155. USA.

Abstract

Free Trade Agreements (FTA) attract significant interest, but after these treaties are signed not all exporters use them. We provide a model of heterogeneous utilization, also developing a novel method to estimate treaty-utilization costs. We later apply the model to estimate the evolution utilization costs for the FTA between the US and a small open economy, Chile. Consistent with other studies, we find that utilization is indeed partial (on average 67% on the first year of the treaty, with 10 percentage points more at the third year). This made tariff revenues to the US 10% higher than expected with full utilization. Our simple structural model identifies costs by exploiting the indifference condition for the smallest firm that uses the treaty. Empirically we find that estimated costs were very heterogeneous across products. For almost half the products the cost was not binding for any exporter. However, when the FTA started, the 75-th percentile of utilization cost was around US$3,000, requiring shipments above $80,000 to justify using the treaty. These costs decreased by 60-80% in the following years, consistent with models of learning about treaty use. As remarked in our model, small exporters that do *not* use the trade agreement could even suffer when large firms have the option of using the treaty, since the latter increase exports and may push up factor prices for the industry.
JEL classification: F1
Key words: Heterogeneous effects of trade agreements, Small and Medium Enterprises (SME), Policy implementation.

1 Introduction

As of January 2012, the World Trade Organization records 251 active Regional Trade Agreements (RTA) between two countries or blocks of countries, the highest number in modern history. The entry into these agreements have been particularly exciting for exporters in small economies, especially when they start an agreement with a large and developed area, like the US or the EU. In fact, many governments push the approval of these agreements selling it as a substantial developmental milestone that could help firms that currently export to these large markets, as well as to the many firms that will start doing it in the future.[1] In fact many papers analyze the benefits and costs of these trade agreements, but the overwhelming majority of these analyses *assume* that trade agreements are used by all exporters. In this paper we try to unpack utilization rates, which is the fraction export value that takes advantage of the trade agreement and pays lower tariffs. Thus, we center our work in a process that starts "the day after" the treaty begins, where government authorities usually like firms to take full benefit of the TA.[2]

In this paper we first explore the implications of heterogeneous utilization of a treaty with a simple model. The model argues that a fixed cost of utilization can rationalize partial utilization within the same industry. Furthermore, the model shows that these costs could even make smaller exporters worse off after the trade agreement, since these smaller firms will not use it, while larger firms would take advantage of it this pushing up factor prices. After introducing the relevance of these utilization costs, we offer a novel and simple structural model to estimate treaty utilization costs, a methodology that we later apply to understand the early years of a trade treaty between Chile and the US. Our empirical findings start first as basic aggregate stylized facts that motivate our model, while later we focus on identifying the fixed costs.

First, utilization is large - especially when compared to ASEAN countries described in the literature - but it is far from complete. The average utilization rate of a product in the FTA began at around two thirds at the moment the treaty started, when weighting all products equally, irrespective of their trade volume. In the following two or three years of the treaty, the utilization rate reached a "plateau" of around 80-85%. In short, for the average product that arrives to US Customs and

[1] Consider for example the following statement by the Chilean president during a speech analogous to the "State of The Union". "*Es el Chile que logró un Tratado de Libre Comercio con la principal potencia del mundo, los Estados Unidos de América, el cual está en vías de ser ratificado por ambos Congresos. Estos acuerdos, que serán seguidos por otros, son una sólida garantía para nuestro desarrollo. Las oportunidades que se abren son enormes. Cuando la economía mundial entre en un ciclo ascendente estaremos preparados para no dejar escapar estas nuevas oportunidades*" Ricardo Lagos, May 21st 2003; months before the beginning of the US-Chile treaty in Jan 1 2004.

[2] In the very recent case of Colombia, for example, after signing the FTA treaty with the US they nominated a Presidential Delegate for FTA utilization. In the case of Chile, 8 years after the treaty with the US started, both the President and the Association of Entrepreneurs have expressed concerns that the FTA with the US has not been used as much as they would like.

The Recently Formed Association of Chilean Entrepreneurs met the Chilean President and gave him a list of ten priorities for them. The ninth was about the "visibility" of FTA for entrepreneurs "*9. A pesar de los tratados comerciales firmados y de abrir las fronteras comerciales, las tasas de ocupación de las cuotas otorgadas por diversos países a productos chilenos, son todavía bajas. Por eso, Asech promueve la creación de plataformas de trabajo en Chile y el extranjero, que hagan visibles a los emprendedores nacionales las oportunidades que ofrecen los Tratados de Libre Comercio (TLC).*"

after various years, one in seven products still do not use the treaty, meaning that they are paying higher tariffs to the US as if they treaty did not exist. When we weigh the use by the volume of exports we found that in the first year of the treaty, Chilean exporters did not use around 10% of the tariff benefits. This figure of "surprising" government revenue for the US decreased to 3% and then took off during the financial crisis; reaching again around 10% in 2010.

Second, as expected, the higher the tariff preferences the higher the utilization rate. When looking at within product variation, a one percentage point gap between the lower FTA tariff and the standard "Most Favored Nation"(MFN) rate is associated with slightly more than one percentage point of additional utilization. It is interesting, though, that we do not find significant effects for having small non-zero tariff preferences, like 0.1 percentage points preferences. This is consistent with a model where there is a fixed cost of utilization and, without enough benefits, firms still prefer to use the standard MFN regime and avoid the fixed cost.[3]

After these two sanity checks: that utilization is partial and that tariffs matter, we develop a simple methodology to calculate product-specific fixed costs of utilization using data usually available for governments, so the method could be of independent interest for other researchers. We focus on the marginal firm that is indifferent between using the treaty or not. Using the empirical distribution of export volume by firm in a product, as well as the empirical utilization rate u, we calculate fixed costs as the amount that rationalizes not taking the tariff benefits. The estimated cost is very heterogeneous across products. For the 75-th percentile of our sample it was around three thousand dollars, with a sharp decline of more than 60-80% in the following two years. This decline is consistent with models of learning in early stages of a treaty; although it is less clear whether this knowledge is internal or external to firms.

There are more than thousand papers about free trade agreements and other forms of regional economic integration, with various reviews including the handbook chapter by Baldwin and Venables (1995) and the more recent survey by Freund and Ornelas (2010). Our work, however, adds to a much less advanced literature that focuses on how firms utilize these treaties. Various strategies have been used to explore them.

The least data intensive strategy to understand utilization looks at aggregate trade flows, indirectly

[3]To explore some plausible determinants of these fixed costs, like Anson, Cadot, Estevadeordal, Melo, Suwa-Eisenmann, and Tumurchudur (2005) and Carrere and de Melo (2004), we tried to see whether tougher rules of origin are related to lower utilization rates. Nonetheless, we found the opposite, that products with tougher rules of origin are consistently those which use the treaty the most; and since there is no plausible reason for a positive causal effect of restrictions on utilization, we interpret this fact as evidence that in the negotiation of the FTA, Rules of Origin are imposed as a burden to sectors that may appear ex ante as more competitive. These tougher rules of origin could be interpreted as a way to delay the effect of a free trade agreement on domestic firms that compete with new exporters. Maybe as a *de facto* way to implement delayed tariff reduction as suggested by models like Maggi and Rodríguez-Clare (2007) , although in our data we do not find relevant time variation within product in the RoO requirements. That is why we focus on estimating product level barriers and explore their evolution over time, as tariffs change.

Rather than using a single synthetic index for RoO restrictiveness, as Anson, Cadot, Estevadeordal, Melo, Suwa-Eisenmann, and Tumurchudur (2005) do, Carrere and de Melo (2004) include various types of rules and explore how these impact the Mexico-NAFTA trade. We follow them including various types of indicators for rules of origin.

inferring magnitudes of interest, like fixed costs of utilization or the impediments generated by rules of origin. Hayakawa (2011) calculated reduced-form estimates of the fixed cost of using a FTA using a standard gravity equation with aggregate data, and then adding as explanatory variables both the tariff and the interaction between tariffs and FTA to exploit a discontinuity. Their estimate for the average fixed cost of using trade agreement in the world is equivalent to a 3% tariff. This would be a very large cost, since many times the average tariff reductions in modern FTA are not far from that level. Anson, Cadot, Estevadeordal, Melo, Suwa-Eisenmann, and Tumurchudur (2005) also use aggregate data in a gravity regression, but now attempting to disentangle the effect of tariffs and rules of origin (RoO), finding some support for the idea that some RoO may undo the tariff benefits.[4] In any case, the main complication of using only aggregate data is that it mixes together the selection effects with the causal effects of FTAs on firm behavior. Our work, aware of data limitations, tries to exploit the information in the utilization shares and the distributions, to estimate fixed costs, in the spirit of what has been done in the industrial organization literature (e.g. Olley and Pakes, 1996).

A second research strategy - more intensive in micro data collection - asks firms whether they use treaties or not. In two companion papers Takahashi and Urata (2008, 2009)use a survey of sixteen hundred Japanese firms made in 2008 (with 15% response rate), where they find that 32.9% of Japanese exporters to Mexico used the treaty, noting that this is almost twice as much as the reported use in 2006, two years before. This increased utilization might be consistent with the utilization increasing over time as in learning models.[5] Trying to unpack the heterogeneity across firms, Hayakawa, Hiratsuka, Shiino, and Sukegawa (2009) use firm level data but restrict their analysis to a survey of a few hundred Japanese affiliates in the ASEAN region, finding that the scale of the firm is an important determinant of the likelihood of utilizing the FTA, even among this sample of multinationals. Nonetheless, they have serious limitations dealing with heterogeneity across products. Given their data is by firm, when they analyze destinations, they do not work with product specific tariffs but, instead, they rank countries by their average tariff rate (e.g. China having higher tariffs than Japan, and so on). This is important since many the utilization costs - paperwork, certification, etc - are product specific rather than firm specific.

Our empirical approach is different from these exercises for Japanese firms in a number of ways.

[4] Anson, Cadot, Estevadeordal, Melo, Suwa-Eisenmann, and Tumurchudur (2005) focus on how Rules of Origin (RoO) constrain exports within a FTA zone. They argue that in many cases RoO can partially or totally undue the tariff preference. Their central point is that in the negotiation process of a North-South FTA, the North imposes RoO even up to the point of leaving the South-country exporters indifferent between using or not using the treaty. First they run a global gravity regression adding coefficients for Trade Agreements, and also adding an index of RoO that goes from 1 to 7. The negative coefficient on RoO supports the idea that RoOs put sand on the wheels of a Free Trade Area. Then the authors use product level data for Mexican Exports to the US before and after NAFTA to study the specific case. Their empirical strategy assumes that products with utilization rates of the treaty strictly between zero and one (i.e. partial use of the treaty,$0 < u_{it} < 1$) are the products for which firms are indifferent between using and not using the treaty. The authors acknowledge this is not the only possible interpretation. In fact, the partial use when data is aggregated at the product level may reflect that some firms are using the FTA while some others are not; which would be the case when firms are heterogeneous in either the costs or the benefits of use, as shown theoretically by Ju and Krishna (2002) and Demidova and Krishna (2007).

[5] They also find that 23.7% Japanese exporters to Chile use the FTA.

The first reason is because we are arguably working with the population of all exports from Chile to the US, rather than a survey. Second, we have product specific information, indicating the use of products in a particular product line. This is very important since a lot of exporting is done by multi- product firms and also because the tariff benefits are defined with fine granularity. One limitation, though, is that we do not know exactly which firms used the FTA, because that is usually confidential data of the importer country.[6] Nonetheless, using micro data from the exporter country and a few assumptions we could get an estimate of the marginal user of the treaty.

We have to acknowledge one paper that has simultaneously utilized micro-data for a population of exporters and products. Kohpaiboon (2008) explore FTA use by Thai manufacturers, benefiting from the fact that exporters in Thailand must apply to Thai customs to get a certificate of origin (instead of a self-certification plus a submission at the importer's customs, which is the case for US imports and for many other modern treaties). They find that Rules of Origin are equivalent to an additional 2% tariff in their effect on utilization, but uses standard regressions rather than looking at the marginal user as we are doing. While our paper has micro-data on firms but not on utilization, we believe our method could be more broadly applied to many real policy evaluation of FTA implementation, because the data observed in Thailand will unlikely be available to researchers in most other countries.

A final relevant difference of our paper is our setting. Most of the papers analyzing utilization of FTA are disproportionally looking at economies producing manufacturing goods, usually with the value chain split across nearby countries (e.g. ASEAN, Mexico-US *maquila*)[7] In contrast, due to distance from main markets and production mix, in our setting we need to worry less about exporting after intermediate processing of imported inputs. Moreover, unlike in many ASEAN economies and Mexico in NAFTA, a large fraction of Chilean goods are not manufacturing, but products which inputs are more likely to be sourced domestically (think of Copper, Pulp paper and Wines). Maybe for these reasons we fail to find negative correlation between rules of origin and volumes.

After clarifying the contributions and limitations of our work, we draw a map for the rest of the paper. Section 2 describes a simple framework of treaty heterogeneous utilization. Section 3 takes

[6]Papers analyzing utilization rates by product, likeJames (2007), usually go to the United States International Trade Commission database and download utilization rates, calculated as the share of value that enters US docks claiming the FTA. The numerator of that share is straightforward, since it is just the amount claimed. The key for the interpretation of the results is what you put in the denominator of that share, because of at least two important considerations. First, a significant fraction of products have free MFN tariff rate even before the treaty start, so we would never expect any use and of course it was never meant to be an "impact" of the treaty. We take care of this issue by simply excluding these products from the analysis. Second, the treaties usually do not involve immediate tariff reduction, but sequential reductions depending on their staging category. For products where staging has not yet created a wedge between the MFn and the FTA tariffs, then in practice the treaty has not began for those products. We also exclude these groups from most of our analysis. As a result, we focus on products that are meant to be used in a FTA, and any difference in at least some use could be attributed to either compliance costs (including but not only those resulting from tough Rules of origin) and informational frictions.

[7]For example: Thailand in the ASEAN context (Kohpaiboon, 2008); Mexico (Anson, Cadot, Estevadeordal, Melo, Suwa-Eisenmann, and Tumurchudur, 2005; Carrere and de Melo, 2004); and Japanese affiliates in ASEAN (Hayakawa, Hiratsuka, Shiino, and Sukegawa, 2009).

the above mentioned model and shows the conditions under which one can estimate the fixed utilization costs. Section 4 describes our data and the treaty, outlining basic stylized facts. Following up, section 5 uses regressions to explore utilization dynamics and the role of tariff preferences. Section 6 estimates our simple structural model to back out fixed utilization costs by product over time using the Chile-US FTA. Section 7 we concludes with some remarks.

2 A framework of partial treaty utilization

This section describes a model where heterogeneous exporters endogenously decide whether to use a free trade agreement or not, which we denote as the binary decision *use*. If they use the agreement they have to pay a fixed cost f and get tariff free access, while if they do not use the agreement, they save on f but have to pay tariff τ. The industry has a single non-tradable input called L, which should not be interpreted as standard labor but something more industry specific that has a endogenous cost w per unit. There is only a single foreign market (the US) and, for simplicity, there are no domestic sales because the country does not consume what it produces. We also assume all firms export. We could add the prerequisite decisions to open a firm and to start exporting non-zero quantities, like Melitz (2003) does, but this would add more complexity to the derivations without an important payoff in terms of additional economic intuition, so we abstract from these features.

A firm of type j follows a production technology with decreasing returns to scale: $\varphi_j l^{\alpha}$, where φ_i is the heterogeneous productivity, l is the endogenous input choice of the firm and $\alpha \in (0,1)$ determines the returns to scale. Unlike in benchmark models of heterogeneous firms (i.e. Melitz, 2003) we assume that the limits to firm size come from production that is hard to scale, rather than from demand. Nonetheless that assumption is not essential and our argument could be adapted for models with constant returns to scale and CES demand. We assume the industry is in a small open economy that takes as given the destination market's price p of the good. A firm maximizing operational profits would have an input demand of $l(\varphi) = (\alpha p\varphi/w)^{1/(1-\alpha)}$, with export values $x(\varphi) = p\varphi^{1/(1-\alpha)} [\alpha p/w]^{\alpha/(1-\alpha)}$ and the operational profit function is[8] $[1-\alpha][\alpha/w]^{\alpha/(1-\alpha)} [p\varphi]^{\alpha/(1-\alpha)}$. If we further assume, without losing generality, that the tariff-free FOB price is $p = 1$, while the FOB price with tariff is $p = 1/(1+\tau)$, we get the profit function of using the treaty ($use = 1$) and not

[8] Replacing the input demand we get $p\varphi [\alpha p\varphi/w]^{\alpha/(1-\alpha)} - w [\alpha p\varphi/w]^{1/(1-\alpha)}$; which could be simplified as

$$
\begin{aligned}
&[p\varphi]^{1+\frac{\alpha}{1-\alpha}} \left[\frac{1}{w}\right]^{\alpha/(1-\alpha)} \alpha^{\alpha/(1-\alpha)} - w^{1-\frac{1}{1-\alpha}} [p\varphi]^{1/(1-\alpha)} \alpha^{1/(1-\alpha)} \\
&\qquad = \left[\frac{1}{w}\right]^{\alpha/(1-\alpha)} [p\varphi]^{\frac{1}{1-\alpha}} \left[\alpha^{\alpha/(1-\alpha)} - \alpha^{1/(1-\alpha)}\right] \\
&\qquad\qquad \left[\frac{1}{w}\right]^{\alpha/(1-\alpha)} [p\varphi]^{\frac{1}{1-\alpha}} \left\{\alpha^{\frac{\alpha}{1-\alpha}} [1-\alpha]\right\}
\end{aligned}
$$

using the treaty ($use = 0$), namely:

$$\begin{aligned} \pi(\varphi|use=1) &= [\varphi]^{\alpha/(1-\alpha)}[1-\alpha]\left[\tfrac{\alpha}{w}\right]^{\alpha/(1-\alpha)} - f \\ \pi(\varphi|use=0) &= \left[\tfrac{\varphi}{1+\tau}\right]^{\alpha/(1-\alpha)}[1-\alpha]\left[\tfrac{\alpha}{w}\right]^{\alpha/(1-\alpha)} \end{aligned}$$

Heterogeneous productivity distributes $G(\varphi)$, with $\varphi \in \left(\underline{\varphi}, \bar{\varphi}\right)$. Although we do not need it for our qualitative results, to simplify we will assume the distribution is Pareto with $\underline{\varphi} = 1$ and $\bar{\varphi} = \infty$; such that $\Pr(\tilde{\varphi} > \varphi) = \varphi^{-\gamma}$; so cumulative density $G(\varphi) = 1 - \varphi^{-\gamma}$ and density $g(\varphi) = \gamma\varphi^{-\gamma-1}$; with a technical restriction on the relation between γ and α so the mass of production does not go to infinity as φ goes to infinity. Namely $\eta \equiv \gamma - \frac{1}{1-\alpha}$ has to be positive.

The model has two aggregate endogenous variables: the wage rate w and the productivity of the cutoff treaty user$\hat{\varphi}$. To solve for these two unknowns the model has two equilibrium conditions: (i) the indifference condition for the marginal treaty user and the (ii) equilibrium in the input market.

The cutoff $\hat{\varphi}$defining the marginal user could be found graphically when the two profit functions intersect, as depicted in Figure 1. Algebraically, $\hat{\varphi}$ solves $\pi(\hat{\varphi}|use=0) = \pi(\hat{\varphi}|use=1)$; which implies

$$\hat{\varphi} = w\left[\frac{f}{\alpha^{\alpha/(1-\alpha)}[1-\alpha]\left[1-\left(\frac{1}{1+\tau}\right)^{\alpha/(1-\alpha)}\right]}\right]^{(1-\alpha)/\alpha} \tag{1}$$

; and as expected, the cutoff $\hat{\varphi}$ increases with conditions that discourage the marginal firm to use the treaty, like the fixed cost f and the wage w , while it decreases when it becomes more profitable to use it, namely when tariffs for non users τ are larger. Eq. 1 shows a monotonically *increasing* relation between the two endogenous variables w and $\hat{\varphi}$.

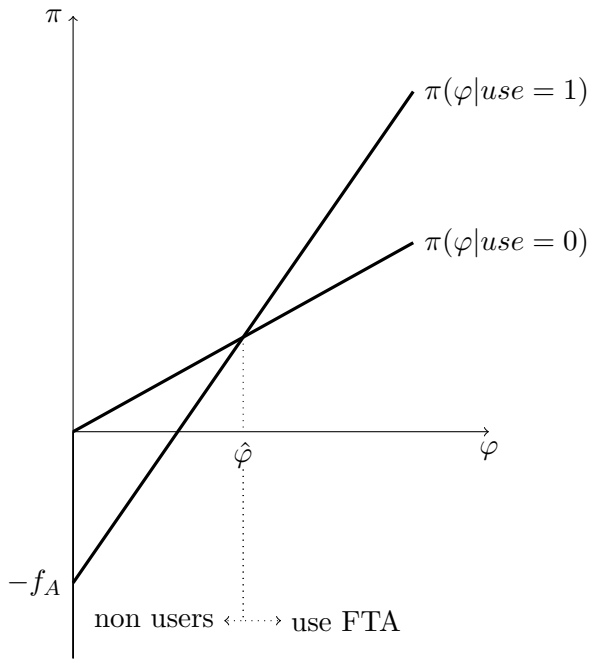


Figure 1. Cutoff productivity for using the Free Trade Agreement when $\alpha = 0.5$

Instead, the equilibrium in the non-traded input market would create a *downward* sloping relation between the two endogenous variables w and $\hat{\varphi}$. This equilibrium requires input supply L_S to match the aggregate demand for inputs L_D. It is now usual in the literature on heterogeneous exporters to focus on the case when input supply is inelastic, so $L_S^{'}(w) = 0$. Following this tradition we will not model explicitly input supply, but we would allow for any non-negative input-price elasticity $L_S^{'}(w) \geq 0$. To simplify we assume fixed costs are paid out of profits, so f does not enter directly into the input market clearing condition. Aggregate input demand L^D is computed integrating individual input demands over non-users and users of the treaty $L_D = \int_1^{\hat{\varphi}} l(\varphi|use=0)\, dG(\varphi) + \int_{\hat{\varphi}}^{\infty} l(\varphi|use=1)\, dG(\varphi)$; which after solving the integration becomes:

$$L_D = \frac{1}{\lambda(w)}\left[\left(1-\frac{1}{\tilde{\tau}}\right)\hat{\varphi}^{-\eta} + \frac{1}{\tilde{\tau}}\right]$$

; where $\eta = \gamma - 1/(1-\alpha) > 0$; $1/\tilde{\tau} \equiv [1/(1+\tau)]^{\frac{1}{1-\alpha}}$ with $1/\tilde{\tau} \in (0,1)$ and $1/\lambda(w) \equiv \frac{\gamma}{\eta}\left[\frac{\alpha}{w}\right]^{\frac{1}{1-\alpha}}$ with $\lambda(w) > 0$. Input market equilibrium needs $L_S = L_D$, which yields

$$L_S \lambda(w) = \frac{1}{\hat{\varphi}^{\eta}}\left[1-\frac{1}{\tilde{\tau}}\right] + \frac{1}{\tilde{\tau}} \tag{2}$$

; which, as anticipated before, is a *decreasing* relation between w and $\hat{\varphi}$, while it does *not* depend directly on the fixed utilization costs f.

Since both conditions in Eq. 1 and Eq. 2 have monotonic slopes, there will be a unique equilibrium

for the two endogenous variables, as depicted in Figure 2. This equilibrium would exist as long as [9] the fixed cost f should be large enough so at least some firms are left without utilization despite the benefits of not paying a tariff.

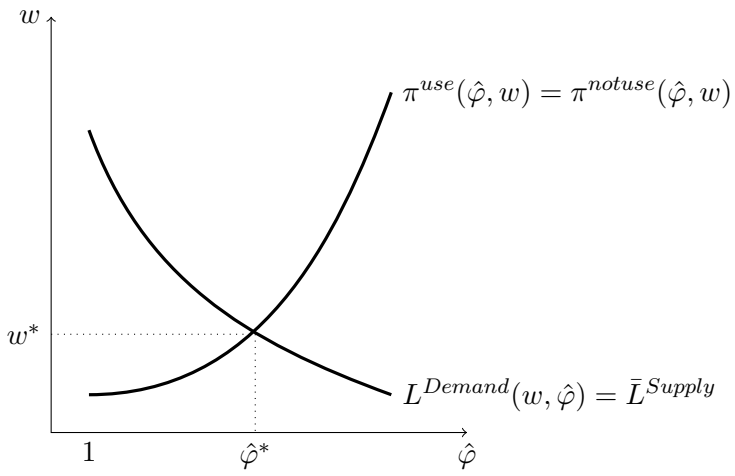


Figure 2. Endogenous determination of wage w and marginal user of the treaty $\hat{\varphi}$ using both the indifference condition for the marginal user of the treaty and the labor market clearing condition .

Note that the positive sloped relationship defined by the indifference shifts to the right when fixed utilization costs f increases (see Eq 1), while the downward sloped Labor Market does not depend on f (see Eq 2). We can understand a Free Trade Agreement as a decrease in f from infinity (so before the treaty no firm could use the treaty!) to a finite value where some firms starts using it. This would make then the price of inputs w increase as the $\pi^{use} = \pi^{non-use}$ curve moves to the left, leaving non users worse off than without the treaty, since they have to pay higher wages and they can't access the treaty. [10] Formally, the slope of the input market equilibrium line in Figure 2 is obtained by implicitly differentiating Eq 2, which yields.

$$\left.\frac{\partial w}{\partial \hat{\varphi}}\right|_{L_S = L_D} = \frac{-\left(1 - \frac{1}{\tilde{\tau}}\right)\hat{\varphi}^{-\eta-1}}{L_S'(w)\,\lambda(w) + L_S(w)\,\lambda'(w)} \leq 0$$

; this implies that there is an exception to our point that non-users lose from the treaty; because when the non-traded input supply L_S is perfectly elastic to w, so is $L_S'(w)$; then clearly the input market equilibrium has a flat wage. Thus, our main proposition goes as follows.

Proposition 1. Low productivity firms that in equilibrium would export but *not* use the treaty

[9] We need $\hat{\varphi} > 1$ and $w > 0$ as required by the model. To get $\hat{\varphi} > 1$ using the condition for the marginal user Eq 1 we need $\left[f_A / \left[\alpha^{\alpha/(1-\alpha)}\left[1-\alpha\right]\left[1 - \left(\frac{1}{1+\tau}\right)^{\alpha/(1-\alpha)}\right]\right]\right]^{(1-\alpha)/\alpha} > 1/w$.

[10] We have to highlight that in our simplified model there is no exit margin but it could be easily added. Nonetheless, this would not change our channel of interest of winners and losers from a free trade agreement with some utilization costs.

(meaning $\varphi < \hat{\varphi}(f_A, \tau)$) , would *decrease* their profits when the treaty starts, since input prices w would increase without any positive effect on profits. This happens except when input supply is perfectly elastic (meaning $L'_S(w) = \infty$), in which case non-users neither gain nor lose from having the treaty.

In short, these losses for non-users could be more important when inputs are highly non-tradable and in short supply within the country, while less relevant if the supply of inputs reacts to scarcity. As mentioned in the introduction, however, our goal in this paper will not be to test this proposition, which we leave for further research, but to use the framework as a lens to do econometric analysis and measure the evolution of fixed costs. Having developed the framework, the next section tells how we could build a simple structural model.

3 A simple structural model of treaty utilization

Using our model we can now define the utilization rate, u, following closely the method of calculation use by customs in importing countries (i.e. US Customs in our case). Thus u is the share of the FOB value exported using the treaty over FOB. Meaning

$$u = \frac{\int_{\hat{\varphi}}^{\infty} x(\varphi|use = 1)\, dG(\varphi)}{\int_{\underline{\varphi}}^{\hat{\varphi}} x(\varphi|use = 0)\, dG(\varphi) + \int_{\underline{\varphi}}^{\infty} x(\varphi|use = 1)\, dG(\varphi)}$$

; where as defined previously $x(\varphi)$ is the FOB value exported by each firm. After solving the integral and using the simplifications discussed before, we can express utilization rate as:

$$u = \frac{1}{1 + \frac{1}{\tilde{\tau}}\left[\hat{\varphi}^{\eta} - 1\right]} \tag{3}$$

so $u \in (0, 1]$ because when $\hat{\varphi} = \underline{\varphi} = 1$, then utilization if complete, $u = 1$; while when $\hat{\varphi} \to \infty$, like before the treaty is implemented, we have $u \to 0$. As expected $\partial u / \partial \hat{\varphi} < 0$; so the larger the cutoff the smaller the utilization rate. Note that for the special case in which input supply L_S is perfectly elastic, then we know from Eq 1 that $\partial \hat{\varphi} / \partial \tilde{\tau} < 0$; and applying this in Eq3 we can show that utilization raises with the tariff, meaning $\partial u / \partial \tau > 0$.

Although these utilization rates have been the dominant metric to understand the success of the treaty, the evolution of u within a product across time can give a misleading picture on whether it is getting easier or more difficult to use the treaty. Imagine for example a case where three firms export the product but only two of them use the treaty. If we also imagine that over time the two firms using it start exporting disproportionally more value, then the measured utilization rate of the product ($u_{i,t}$) would increase, because it is a value weighted statistic. Moreover, an increasing

utilization rate is consistent with the worsening of utilization costs. Thus, to have a better view of the barriers to use trade agreements we would like to know also whether the conditions for the *marginal* firm using the treaty are easing over time or not, meaning the evolution of the fixed cost f_A.

To estimate this we would like to know exactly who is using it and who is not. But for almost all countries, utilization measures are available only as aggregates at the product-level on importers' Customs, and it is not separated firm by firm.[11] But with this model in mind, and some assumptions, we can use data usually available to governments to estimate f. We just need importer (say US Customs) data on *aggregate* utilization rates u at the product level, and combine it with national data on the export size distribution of firms in a product, which is usually a database produced by Customs. [12]

From such a database of exporters sizes, one calculates the cumulative density of export values $\tilde{G}(x)$, which gives the probability that a dollar exported by the country comes from a firm of size smaller or equal to x, where size is measured only in terms of dollars and not domestic sales, since we assume the problems were separable for the firm. This cumulative export density $\tilde{G}(x)$ has $\tilde{G}(\bar{x}) = 1$ and $\tilde{G}(\underline{x}) = 0$; where for notational simplicity $\tilde{G}(\underline{x}) \equiv \tilde{G}\left(x\left(\underline{\varphi}\right)\right)$ and an analogous expression for $\bar{\varphi}$. Most important for our purposes, the cumulative export density $\tilde{G}(\hat{x})$for the marginal user of the treaty $\hat{\varphi}$ equals the complement of the utilization rates. Meaning

$$\tilde{G}(\hat{x}) = 1 - u \tag{4}$$

; as shown in Figure .

[11] As mentioned, one of the few exceptions is Thailand Kohpaiboon (2008); but their dataset is unlikely to be available in other countries, especially because many FTAs are moving towards self certification.

[12] This would make the method below useful for almost any government, including places like Peru or Colombia that recently signed a FTA with the US.

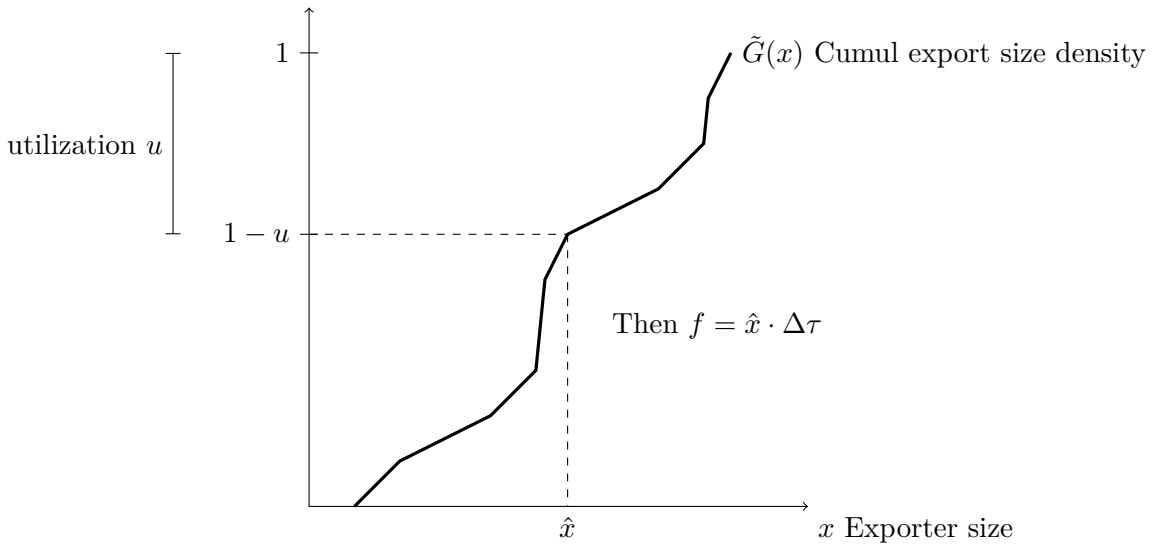


Figure 3. Solving for the marginal user $\hat{x}$ knowing the utilization rate u and the cumulative export density function $\tilde{G}(x)$. Once $\hat{x}$ is identified one calculates the utilization cost $f = \hat{x} \cdot \Delta\tau$

With this at hand we need three assumptions to identify the fixed cost f from the data:[13]

Assumption 1. At the margin of utilization, $\hat{\varphi}$, the change in profits is small enough so we can apply the Envelope theorem, so $\partial\pi(\varphi)/\partial\tau = x(\varphi)$

Assumption 2. Pecking order use. All firms above the cutoff use the treaty while firms below the cutoff do not use the treaty.

Assumption 1 allows us to use the Envelope theorem and, at the margin, keep the optimized exported quantities constant while just changing the price received due to the changes in tariffs. This step is not essential, since we could use the full model in Section 3 to predict how quantity changes when the after-tariff price changes, but the assumption greatly simplifies the mapping from observed export volumes to fixed costs. In particular, when using the envelope theorem our calculation does not need as input any additional parameter (like α , γ or even w). This allows us to measure f just as a function of u, $\tilde{G}(x)$ and tariffsτ , all these quantities are observed directly from the data. Importantly, the fact that we consider the change in quantities (and factor demands) as small around the cutoff is not contradictory to our conclusions in Section 3's model, since out of the cutoff these differences in profits could be meaningful.

Assumption 2 about pecking order use is essential for our procedure, since almost all databases lack firm level information on utilization. We follow the literature (e.g. Melitz, 2003) assuming that large exporters would use the treaty first and then in strict decreasing order. One can relax this

[13] As the rest of the literature we assume f is constant across firms. This assumption is not essential for the calculation, since we always can interpret the measured f, called $\hat{f}$, as just a local fixed cost rather than the constant fixed cost, but this assumption clarifies our interpretation. Also, we are assuming that the cost is per firm each year. In the appendix we discuss the potential biases when reality deviates from this assumption. Extending this to dynamic settings where expectations about future exports matter will be the subject of future research.

assumption and allow for some noisy relation between export size, but this correlation needs to be explicitly included in the calculation. These types of assumptions are similar to other papers that are bounded to use share data rather than micro-data (e.g. Berry, Levinsohn, and Pakes, 1995).

With the model and those assumptions we can fix the export volumes and costs; focusing on a simplified decision at the margin. For users, the revenues from using the FTA minus the fixed cost should be higher or equal than the profits without using the treaty. At this stage it is worthwhile remarking that the Free Trade Agreement does not mean zero tariffs immediately. So the tariff "free" is τ_i^{FTA} in the product, while the non users are subject to the so called "Most Favored Nation" τ^{MFN} , where $\Delta\tau_i \equiv \tau_i^{MFN} - \tau_i^{FTA} > 0$. This means that for product i and firm j

$$x_{i,j}\left[1-\tau_i^{FTA}\right] - f_i \geq x_{i,j}\left[1-\tau_i^{MFA}\right] \tag{5}$$

; or $x_{i,j}\Delta\tau_i \geq f_i$; thus the firm *indifferent between using and not using it* will have a volume such that

$$\hat{x}_i\Delta\tau_i = f_i \tag{6}$$

If we were to observe the usage directly, we would not need anything else. But since we only observe aggregate shares, we invert the cumulative exports function Eq. 4 and using Eq 6 we can calculate the fixed cost as

$$G_i^{-1}(1-u_i) = \hat{x}_i = \frac{f_i}{\Delta\tau_i}$$

; where $\hat{x}_i$could be stated as a function of $\hat{x}_i(u_i)$ and is interpreted as the level of (yearly) firm exports in a product that - according to our assumptions - would be indifferent between using and not using the treaty. In short, simply multiplying that cutoff level of exports $\hat{x}_i(u_i)$ times the change in tariffs yields an estimation of the fixed cost [14] As mentioned, while one could be tempted to estimate all parameters using a more sophisticated econometric technique, we believe our method can credibly identify the fixed utilization cost f with minimum assumptions, while the identification for other parameters would need many more assumptions about specific distributions. We decide to focus our paper only in the estimation of f which is the center of our research question.

Having described the nature and scope our method, we now turn into the specific case under study. The reader that is less interested in those specific aspects could jump to Section 6 where we estimate the fixed cost of treaty utilization.

4 Describing our data and the institutional context

[14] In Appendix 8 we discuss some challenges of estimation when (what we assume is) the marginal firm does not coincide exactly with a single firm, given our measurement constraints. In those cases we define a range.

4.1 Data description and definitions

We use data on US imports from Chile recorded by USITC 2004-2010. In particular, it has the value of each product in each year that entered the US under a Free Trade Agreement and under the standard MFN status. Our central analysis would about the utilization rate: the share of US imports from Chile under FTA in product i and year t , defined as

$$u_{it} = \frac{x_{it}^{FTA}}{x_{it}^{MFA} + x_{it}^{FTA}}$$

; where x_{it}^{FTA} is the FOB value of US imports from Chile under FTA and x_{it}^{MFA} is the analogous number, but without FTA.

For each eight digit HTS code we match this information with detailed tariff preference data and various indicators of Rules of Origin (chapter/sub-chapter change, processing requirements, Regional Content Value), all coming from the original treaty documents. For the benchmark MFN tariffs, used when products do not enter the US through the FTA, we used yearly data coming from TRAINS and combined them with both USITC data for MFN rates for the most complicated cases when the MFN rate is not expressed as an ad-valorem percentage but as specific tax (e.g. 3 cents per pound of live goat). The process of merging of various datasets is detailed in Appendix 9.1

On the other hand we used firm-product level data on exports from Chilean Customs for the same period. They are instrumental to calculate the size-distribution of exporters, needed to estimate fixed costs of utilization in section 6

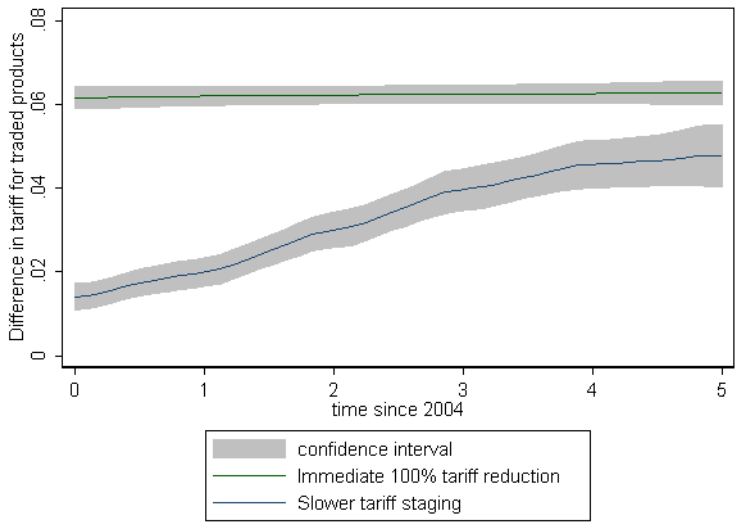
When analyzing exports arriving at US docks, we do not observe which firms in Chile used the FTA. So we construct product-specific indicators for each year that summarize the distribution of Chilean firms that export these products. We compute mean and standard deviation for the firms' total exports, exports to the US and exports of the product, as well as a proxies for firm age, export experience and export experience to the US (all in logs before taking the mean or standard deviation).

4.2 Institutional context: FTA treaty and the staging of tariffs

After the negotiations, the treaty between the US and Chile started on January 1, 2004 . Nonetheless, as usual, free trade status was not given immediately to all sectors. Of course, for some sectors the treaty is irrelevant, since the MFN rates were already zero for many products in 2004 (and others had positive MFN tariff rates and converged to zero later on). These free products are under staging list "F", which are almost 38% of all products in the HS8 digit classification. We discard them from the analysis. Products in list "A" get immediate free trade status, with $\tau_t^{FTA} = 0\%$, by January 1, 2004. They represent around 55% of all products in the classification. Lists "B" to "E" represent around 4% of the products and have some smaller preference starting from 2004, but

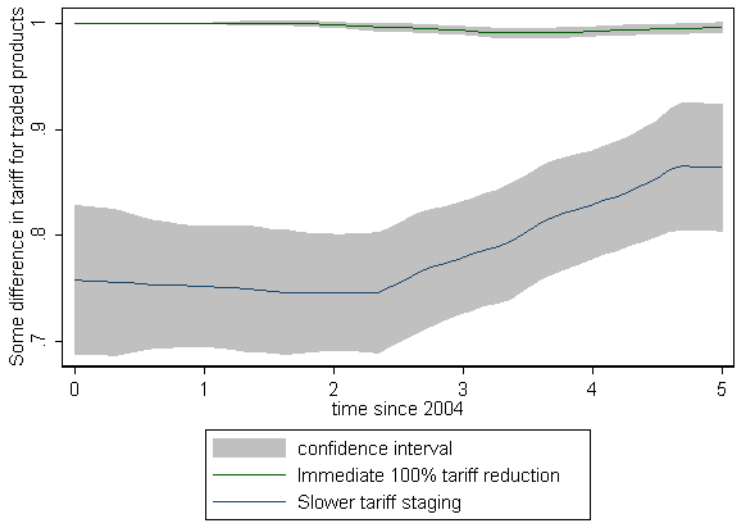
they take much longer to arrive to $\tau_t^{FTA} = 0$. Lists "G" and "H" are also slower to get to $\tau_t^{FTA} = 0$, but they differ in the fact that they start having some preference over the MFN rate only four or two years later, respectively. In any case, these products are a very small fraction of the total number of products. Table 9 in the Appendix details the various staging lists.

De facto, Figure 4 below shows how the average tariff benefit for traded products depends on the staging list. Here we do not consider whether the benefit was actually used or not, only the tariff rate difference: $\Delta\tau_t \equiv \tau_t^{MFN} - \tau_t^{FTA}$. For the immediate staging list, there has been a pretty steady average of 6 percentage points lower tariff, which remains almost constant over time. In fact, almost all products in the immediate staging list have some positive tariff benefit (as shown in Figure 4b), the few exceptions being when the benchmark MFN rate went to zero for reasons independent from the treaty. For the slower tariff staging lists the average benefit $\Delta\tau$ grows over time, starting slightly below 2 percentage points and increasing steadily until around 4 percentage points in 2008-2009. For these traded goods with slow staging, three quarters had some benefit from the beginning of the treaty, with this share increasing by additional ten percentage points starting in 2007.



Non parametric regression plot with the average difference in tariff rates by using the treaty$\Delta\tau_t \equiv \tau_t^{MFN} - \tau_t^{FTA}$ List A corresponds to100% tariff reduction, so for those products i $\Delta\tau_{i,t} = \tau_{i,t}^{MFN}$; for the other it changes over time. Excludes MFN free products.

(a) Evolution of the average tariff rate difference $\Delta\tau_t \equiv \tau_t^{MFN} - \tau_t^{FTA}$ among products actually traded. Non parametric regression plot by type of staging list. 95% confidence intervals.



Non parametric regression plot of a dummy variable $1[\Delta\tau_t > 0]$; so it represents the proportion of traded products for which there is some strictly positive tariff benefit when using the FTA (even if the product's utilization rate $u_{i,t}$is zero). Excludes MFN free products.

(b) Share of products with a strictly positive tariff rate difference $[\Delta\tau_t > 0]$; among products actually traded. Non parametric regression plot by type of staging list. 95% confidence intervals

Figure 4. De facto tariff rate differences for traded products during the first six years of the treaty

Certifying the Origin of Products The origin of the product is self-certified, by means of a document filled directly by the producer, the exporter or the importer; and they can claim the status up to one year after the product is received by US Customs. The certificate lasts for four years, and does not need to be a standard document[15] . Furthermore it could be prepared in English or Spanish. There are exceptions for shipments below 2,500 USD. All of these conditions suggest that the cost of documenting the origin is relatively low, *provided* that the rules are known and that the supporting documents are available. So the general costs for not using the treaty could be interpreted as either (i) costs of changing processes or sourcing to meet the standards, or (ii) costs of actually finding the supporting documents and walk through the administrative process in the US. Note that the inspectors at US Customs have the right to verify that the information provided in the self certification form, including the supporting material, are actually true. Moreover, they can even (randomly) visit the exporter's facilities to double check. If they find that the information is false in some substantial way, they activate various penalties, which could be significant - especially for exporters or importers that do frequent business with US Customs. Anecdotal perception suggests that this process of self-certification seems to align incentives for truthful reporting in most cases.

4.3 Descriptive Statistics

In Table 1 we show the descriptive statistics for the first year of the treaty (2004), the fourth (2007) and the seventh year (2010). The fraction of firms with strictly positive utilization rates (use$\equiv 1[u_{i,t} > 0]$ was 76% in the first year, and by the fourth year it climbed to 84%. Out of those products where at least one shipment uses the treaty, in 69% of the cases every firm used it in the first year; while by the fourth year the share of products with full use was 85%. Preliminarily, this is consistent with views where, first, only some firms in a product may find it profitable to use it; while over time other firms start using it, either because of additional net benefits of using it, or because they became aware of the treaty through information diffusion.

Despite the staging of tariff preferences (i.e. Table 9) , during the first seven years for our sample of products actually traded we see a steady 6 percentage points of tariff differential. Note that we excluded from the very beginning those products that were already tariff free before the treaty.

[15]although a form is provided here http://www.direcon.gob.cl/sites/rc.direcon.cl/files/bibliotecas/OrigenUSA.pdf

Table 1. Descriptive statistics for the first year of the treaty (2004), the fourth (2007) and the seventh (2010)

(a) Descriptive statistics for year 2004

	N	Mean	SD	p25	p50	p75	min	max
use	725	0.76	0.43	1	1	1	0	1
fulluse if used	553	0.69	0.46	0	1	1	0	1
logvalue	725	10.59	2.84	8.45	10.20	12.47	5.53	20.50
ratediff	722	0.06	0.06	0.02	0.04	0.07	0	0.64
regulation	725	0.56	0.20	0.42	0.61	0.61	0	1
persistence	725	0.42	0.49	0	0	1	0	1
RoO_nest	725	0.17	0.98	-0.62	1.09	1.09	-1.48	1.09
processing req	725	0.23	0.42	0	0	0	0	1
VCR	725	0.02	0.15	0	0	0	0	1
quota	725	0.02	0.13	0	0	0	0	1

(b) Descriptive statistics for the fourth year of the treaty (2007)

	N	mean	sd	p25	p50	p75	min	max
use	789	0.84	0.37	1	1	1	0	1
fulluse	664	0.85	0.36	1	1	1	0	1
logvalue	789	10.66	3.00	8.19	10.25	12.61	5.55	21.65
ratediff	781	0.06	0.06	0.02	0.04	0.08	0	0.45
regulation	789	0.57	0.20	0.42	0.61	0.66	0	1
persistence	789	0.51	0.50	0	1	1	0	1
RoO_nest	789	0.23	0.97	-0.62	1.09	1.09	-1.48	1.09
processingreq	789	0.24	0.43	0	0	0	0	1
VCR	789	0.03	0.16	0	0	0	0	1
quota	789	0.03	0.16	0	0	0	0	1

(c) Descriptive statistics for the seventh year of the treaty (2010)

	N	mean	sd	p25	p50	p75	min	max
use	744	0.76	0.43	1	1	1	0	1
fulluse if used	568	0.80	0.40	1	1	1	0	1
logvalue	744	10.56	3.00	8.27	10.01	12.63	5.53	21.50
ratediff	678	0.06	0.05	0.03	0.05	0.08	0	0.28
regulation	744	0.55	0.20	0.40	0.60	0.69	0	1
persistence	744	0.66	0.47	0	1	1	0	1
RoO_nest	744	0.23	0.97	-0.62	1.09	1.09	-1.48	1.09
processing req	744	0.25	0.43	0	0	0	0	1
VCR	744	0.03	0.18	0	0	0	0	1
quota	744	0.02	0.14	0	0	0	0	1

5 Estimating utilization dynamics and the role of tariff preferences

In this section we study utilization. Before regressions, we start by pointing out the value of the unused benefits. Then we explore the pattern of utilization across products and how that depends on the various aspects of the treaty. We find that although aggregating across all products utilization is relatively high, for some products it is still low. This is a black box which we will try rationalizing in the rest of the paper, although it will not be easy since a large fraction of the lack of use is due to product churning rather than obvious clusters of recalcitrant products that do not use the treaty.

5.1 How much money is "left"on the table?

To begin, we find that the aggregate amount left on the table in terms of unused tariffs is unlikely to be the most pressing issue, although it is not irrelevant either. To get a sense of the magnitude, in Table 2 we assume export volumes are given and calculate that in the first year, around a tenth of the theoretical value of tariff savings from the treaty was not used. This may imply a "surprising fiscal income" for US Customs or, in other words, that the treaty was 10% cheaper for the US than what one could have expected given the trade volume.[16] This share decreased over time, and by the fourth year of the treaty (2007) the unused benefits were less than 3% of the theoretical value. But during the Financial Crisis the rate of unused benefits bounced back. By 2010 it was approximately at a tenth, the same level than the first year of the treaty. At least partially, this is likely to be related by the massive changes in product composition and volume of trade to the US shown also in Table 2.

The unused benefits may look small, at a value of 2 to 3 million dollars per year; or between 0.1 and 0.2% of the total value of trade in the fast staging list and between 0.05 and 0.1% for all exports to the US, including those not affected by the treaty. But this small average difference in rates may hide important costs for emerging products or new exporters, which could grow over time and for which the barriers when using the treaty may be important. Given this evidence, in the next sections we will not weigh our estimates by the value of exports, but will keep the (unweighted) averages across products. This would naturally remark sectors that currently do not represent a large fraction of current exports but that we may care about in the future. We mention this upfront so the reader does not get confused on the nature of our future exercises.

[16] Not counting the administrative costs of verifying compliance with the treaty.

Table 2. Value of the unused benefits or "surprising" fiscal income for the importer

	Unused tariff benefits $\sum_i x_{i,t} \cdot \Delta\tau_{i,t}$ expressed as:				
	% of treaty benefits	Millions of Dollars	Average rate difference	Total Trade [Millions USD] $\sum_i x_{i,t}$	N products traded $\sum_i 1\left[x_{i,t} > 0\right]$
List A (100% tariff free in 2004)					
2004	9%	2.7	0.20%	1,370	651
2005	8%	2.8	0.15%	1,830	655
2006	5%	1.9	0.10%	1,990	726
2007	3%	1.4	0.08%	1,850	655
2008	5%	1.5	0.10%	1,550	617
2009	7%	1.5	0.11%	1,320	595
2010	11%	3.1	0.21%	1,490	644
All Non-Free Lists					
2004	10%	2.9	0.12%	2,520	725
2005	8%	2.9	0.13%	2,250	736
2006	4%	1.9	0.03%	5,620	807
2007	3%	1.6	0.07%	2,460	780
2008	4%	1.7	0.04%	4,530	735
2009	4%	1.8	0.05%	3,510	710
2010	7%	3.3	0.07%	4,440	742

The unused treaty benefit is calculated by adding up across products the multiplication of the tariff rate difference , the export volume and the non utilization rate: $\sum_i \left[(1-u_{i,t}) \cdot x_{i,t} \cdot \Delta\tau_{i,t}\right]$. This was expressed in value, as percentage of the theoretical value of benefits $\sum_i \left[x_{i,t} \cdot \Delta\tau_{i,t}\right]$ and as average rate difference, that means dividing by $\sum_i x_{i,t}$. Calculation assume that exports Total Exports of each firm $x_{i,t}$ do not depend on $\Delta\tau_{i,t}$. Parametric assumptions could be made about the shape of the function $x_{i,t}\left(\Delta\tau_{i,t}\right)$but usual assumptions would not change our qualitative results.

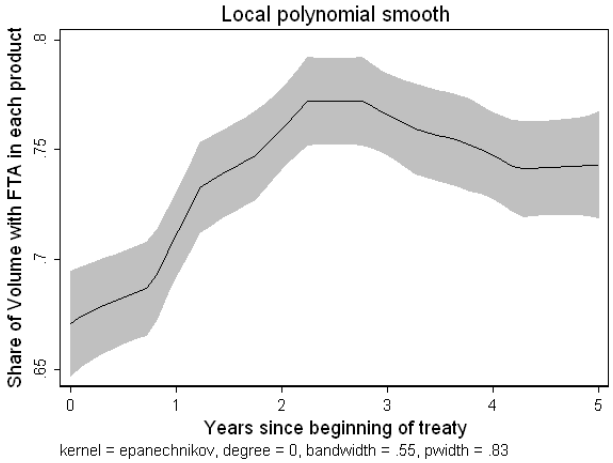
5.2 Utilization dynamics

Now we describe the broad patterns of utilization over time, first as averages for various years; and then the transition between not using the treaty and the various levels of use. Overall, many products use it, and it is hard to identify a clearly recalcitrant group.

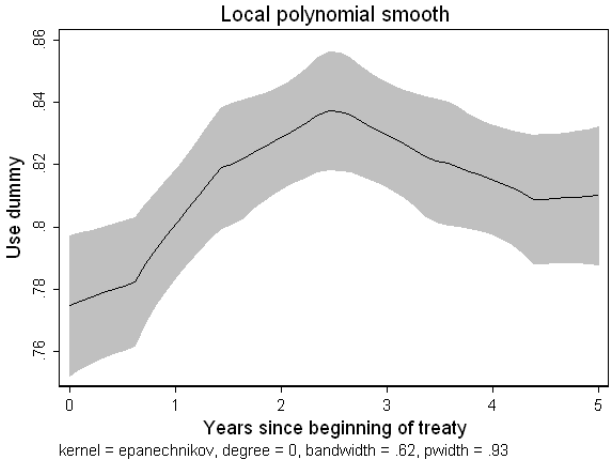
5.2.1 Utilization across products

Figure 5a shows that average utilization across products started at around 67% and then it grew up to a plateau of 75% after the second year of the treaty. This is of course a combination of some products that do not use the treaty and others where the use is not complete. Figure 5b describes the evolution of the extensive margin, that has moved between 78 and 83% of products using it,

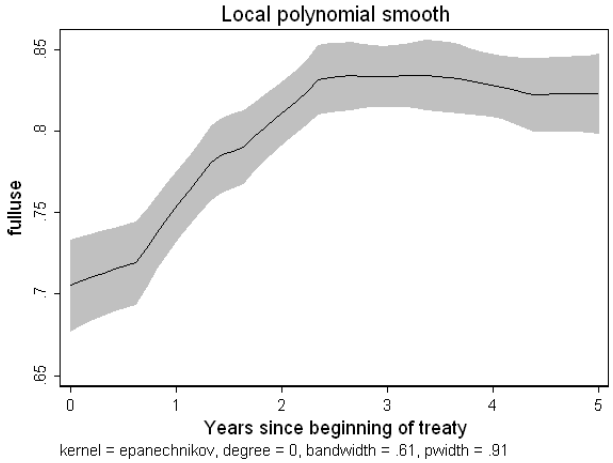
with the maximum around third year of the treaty (2006). Among those products that have some use; 70% used it completely ($u > 0.90$) in the first year; a figure that peaked at 83% in 2006.



(a) Average utilization rate over time (mean across products actually traded).

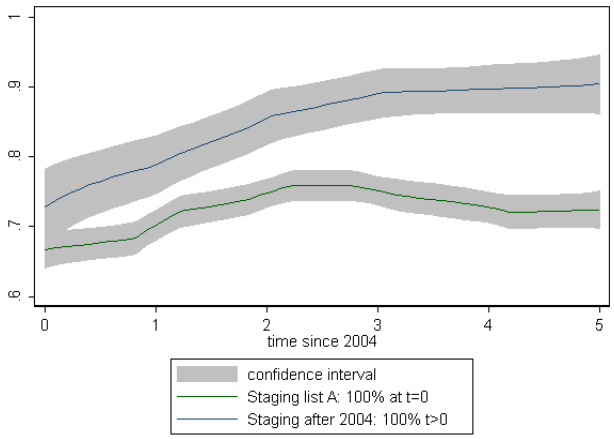


(b) Fraction of products with some use of the treaty $\Pr[u > 0]$(mean across products actually traded).

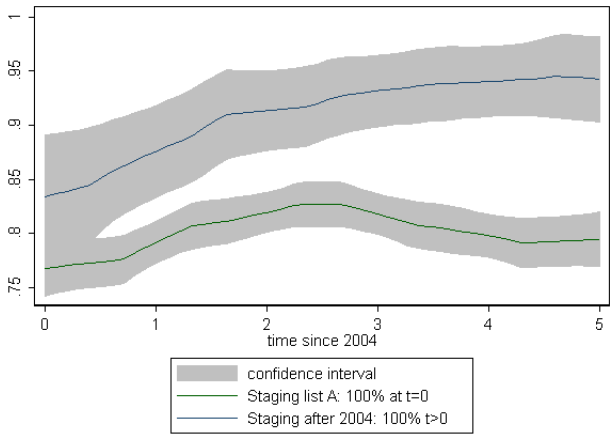


(c) Fraction of products that fully use the treaty benefits, given that they use it: $\Pr[u > 0.90 | u > 0]$(mean across products actually traded).

Figure 5. Utilization across products over time.

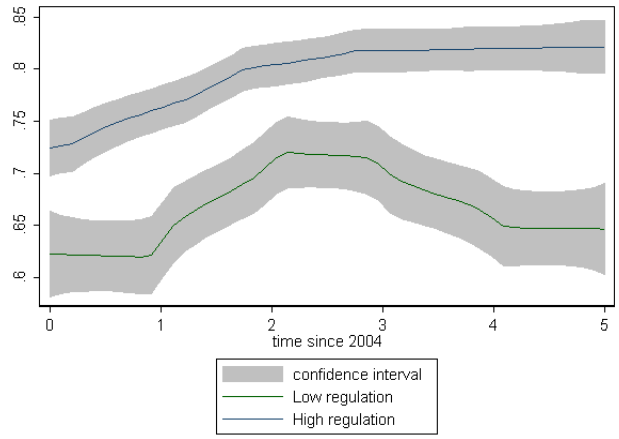


(a) Average utilization rate ($u_{i,t}$) by staging list, non-parametric regression plot

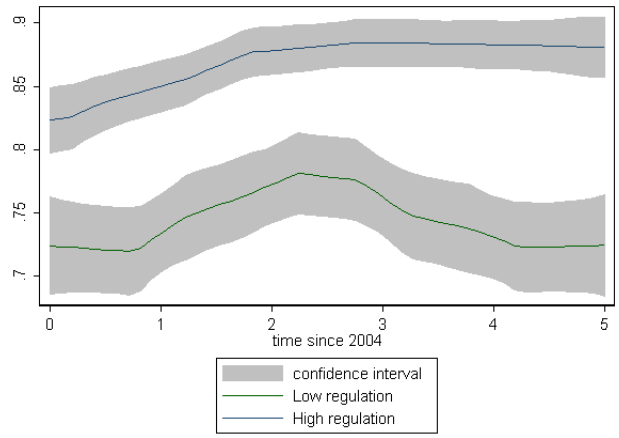


(b) Fraction of products with some use of the treaty $\Pr[u > 0]$(mean across products actually traded).by staging list, non-parametric regression plot

Figure 6. Utilization by type of staging list



(a) Average utilization rate ($u_{i,t}$) by Rules of Origin, non-parametric regression plot



(b) Fraction of products with some use of the treaty $\Pr[u > 0]$(mean across products actually traded).by level of Rules of Origin, non-parametric regression plot

Figure 7. Utilization by type of regulation (Rules of Origin)

5.2.2 Transition matrices

Taking the 10-20% of non-utilization discussed above, we may wonder whether it is always the same products that do not use the FTA or, in contrast, that there is quite a bit of churning in the process of utilization. To answer that question, we study transition matrices of products regarding their utilization status and find that there is a significant amount of movement in the products that do not use it. In Table 3a we see that 17% of the products exported in 2006 did not use the treaty at all; but more than half of them (10% out of 17%) was due to new products that were not exported in 2004. From those products that were exported in the past but did not use the treaty in 2006 , only half of them (3.7% over 6.6%) had null utilization rates in the past. Looking at the mirroring figure, out of the products that did not used the treaty in 2004 but were exported

in 2006, around two thirds started using the treaty in the next two years (5.79% over 8.68%). Table 3c includes all products exported in 2004 or 2006. From all the cohort of products that did not use the treaty at all in 2004 - despite its eligibility - around two fifths moved to some type of utilization, another two fifths exited and were not exported two years later, and only one fifth remained without use after two years. Repeating the exercise for other years tells us that there are no recalcitrant products; meaning that we found no products that are systematically exported (i.e. during all years of our sample) and at the same time have utilization rates always at zero. If there is tariff benefit ($\Delta\tau > 0$), at least one exporter firm has been able to use it.

Thus, the dominant picture here is one of churning, rather than recalcitrant products that are not using the FTA. [17] Unsurprisingly, the decision to not use the treaty is also correlated with smaller size of exports, as shown in Table 3b. While the average log_{10} dollars in exports for those not using the treaty was 3.87 in 2006 - an order of magnitude smaller than those with full use - , most of the low volume comes from the large share of new products. Once we look among those that export but did not use the treaty in the first year, the "recalcitrant" that do not use the treaty two years later are half and order of magnitude bigger, not smaller (4.67 vs. 4.11).

[17] Although the actual numbers change, making similar calculations including the other lists of products in the treaty does not alter the qualitative results (but of course increases the sample size in around 60-80 products).

Table 3. Dynamics in list in products with fast staging of tariff benefits, and average size for each utilization type

(a) Transition matrix showing the percentages in each utilization bin, for products in List A exported in 2006, depending on their status two years earlier. $N = 726$

		utilization in 2006 ($t = 2$)			
		full:	partial	null	Total
Utilization in 2004 ($t = 0$)	full: $u \geq 0.9$	24.79	3.31	2.34	30.44
	partial: $0 < u < 0.9$	10.88	4.55	0.55	15.98
	null: $u = 0$	2.89	2.07	3.72	8.68
	Not exported in 2004	29.20	5.23	10.47	44.9
	Total	67.77	15.15	17.08	100

(b) Average logarithm (base ten) of the value exported, by utilization bin defined in the Table above $N = 726$

		utilization in 2006 ($t = 2$)			
		full:	partial	null	Total
utilization in 2004 ($t = 0$)	full: $u \geq 0.9$	5.28	4.73	3.35	5.07
	partial: $0 < u < 0.9$	5.20	5.14	3.98	5.14
	null: $u = 0$	4.11	4.86	4.67	4.53
	Not exported in 2004	3.95	4.09	3.70	3.91
	Total	4.64	4.65	3.87	4.51

(c) Transition matrix showing the percentages in each utilization bin, for products in List A that were exported either in 2006 or 2004, with a total $N = 726$

		utilization in 2006 ($t = 2$)				
		full:	partial	null	Not exported in 2006	Total
Utilization in 2004 ($t = 0$)	full: $u \geq 0.9$	26.14	3.49	2.47	9.01	41.1
	partial: $0 < u < 0.9$	11.47	4.79	0.58	2.4	19.24
	null: $u = 0$	3.05	2.18	3.92	6.83	15.98
	Not exported in 2004	15.4	2.76	5.52	-	23.67
	Total	56.06	13.22	12.49	18.23	100

5.3 Explaining utilization with tariff preferences and regulations

To understand the role of tariffs and regulations, we start with a single cross section in the fourth year of the treaty and ask for the correlates of at least one firm using the treaty in the product (similar but quantitatively similar results are found regressing utilization rates and doing it for similar years). Table 4 shows that in fact higher aggregate exports (log value), tariff preferences ($\Delta\tau$) and being a product persistently exported are significantly associated with higher utilization rates. Unlike what one could expect, tougher regulations in terms of Rules of Origin are associated with more use, rather than less. In column (6) we take fixed effects by sector (at 2 digit HS granularity, broader than the 8 digit classification of our products) and find that the regulation coefficient is no longer significant, suggesting that the previous cross sectional estimate was driven by more regulated sectors using more the treaty, along the lines of our findings in Figure 7a. This preliminary exercise suggests that it is important to control for product heterogeneity, which precisely is what we do next.

Table 4. Linear regression of use on product characteristics (only non-free), 2007 data

	dependent variable is the dummy use: $1 \cdot [u_{i,t} > 0]$ only 2007 data						mean
	(1)	(2)	(3)	(4)	(5)	(6)	(sd)
use							0.844
							(0.363)
log value	0.0280***				0.0307***	0.0263***	10.66
	(0.00374)				(0.00468)	(0.00568)	(2.989)
ratediff $\Delta\tau$		0.585**			0.753***	0.609**	0.0610
		(0.228)			(0.275)	(0.284)	(0.0591)
regulation			0.247***		0.240***	-0.0186	0.570
			(0.0655)		(0.0699)	(0.217)	(0.199)
persistence				0.134***	0.0502*	0.0340	0.508
				(0.0257)	(0.0283)	(0.0288)	(0.500)
Constant	0.543***	0.808***	0.701***	0.774***	0.308***	FE	
	(0.0478)	(0.0205)	(0.0425)	(0.0212)	(0.0731)	by HS2	
Observations	789	781	789	789	781	781	781
R-squared	0.053	0.009	0.018	0.034	0.098	0.045	

Robust standard errors in parenthesis. Cross sectional estimate made for products actually exported in 2007 that do have some type of non-zero tariff benefit. The variable *regulation* is the first principal component of various types of rules of origin. The variable *persistence* takes the value of one if the product was exported during the years after 2007.

In Table 5 we also focus on understanding the sensitivity of utilization with respect to changes in the tariff benefits of the FTA. But here we use fixed effects by products; meaning that we only focus on the variation *within* a given product over time. This removes other sources of heterogeneity across products that hide the true role of tariff benefits. For example, Rules of Origin and similar

attributes are invariant over time, so they are ruled out of our estimates that have product-level fixed effects. All specifications (1) to (3) show very robust point estimates; indicating that when an average product gets a one percentage point additional tariff preference, then the utilization rate in the product would increase by 1.3 percentage points.

So jumping from having no preference whatsoever to the average preference of 5.5 pp is associated to an increase of around 7 pp in the utilization rate. To get a comparison with other mechanisms, we can use the estimates of specification (2).

Another way of expressing it is that a 1 pp increase in the tariff benefit $\Delta\tau_{i,t}$ elicits the same additional utilization of the treaty as increasing 77% the aggregate shipments of the product. Importantly, as remarked before, this estimate does NOT come from comparing different products (e.g. "oranges and apples"!) but within products.

In specification (3) we ask whether the utilization jumps discontinuously when there is *some* tariff benefit, even if very small. This could be the case, for example, if the entry of the FTA per se has some salient effect on firms, over and above its tariff effect. But the the coefficient on the discontinuous jump (1[tariff rate difference > 0]) is statistically and economically insignificant; while at the same time the main coefficient on the linear tariff preference is almost unaffected in its magnitude when we include the non linear term. This is, again, consistent with the view that it is mostly the magnitude of the preference which matters, as one would expect from models where there are fixed costs of using the treaty.

Table 5. Linear Panel regression of utilization rate by product in the first four years of the treaty, correcting by product (HTS 8 digit) fixed effects

	$u_{i,t}$: utilization rate		
	(1)	(2)	(3)
tariff rate difference $\Delta\tau_{i,t}$	1.368***	1.313**	1.369***
	(0.50)	(0.51)	(0.50)
log Value Exported		0.0229***	
		(0.01)	
1[tariff rate difference > 0]			-0.00824
			(0.02)
1[year=2005]	0.0345*	0.0278	0.0345*
	(0.02)	(0.02)	(0.02)
1[year=2006]	0.0895***	0.0838***	0.0895***
	(0.02)	(0.02)	(0.02)
1[year=2007]	0.101***	0.0933***	0.101***
	(0.02)	(0.02)	(0.02)
Constant	0.592***	0.358***	0.600***
	(0.03)	(0.09)	(0.04)
Observations	2993	2993	2993
R-squared	0.029	0.037	0.029
Number of HTSProductCode_num	1405	1405	1405

Robust standard errors in parenthesis clustered by product. It has FE so we are looking only at within product variation. Note that variation in $\Delta\tau_{i,t}$ comes from List A (immediate staging) only in cases where the MFN rate changed, because otherwise it does not show heterogeneity in tariffs during the treaty. For the other groups there is staging. We use the set of all products actually traded in the period and, as in the rest of the paper, exclude all MFN Free products. Regulations and other similar are excluded since they do not change within products over time.

5.4 Rules of Origin and staging of tariff preferences.

In this section we explore how the various types of policy restrictions are associated in the treaty. Table 6 shows how various rules of origin for the product correlate with the probability of being a product for which the tariff preferences are "slow", meaning that they do not get full free trade treatment from the very beginning of the treaty in 2004. In column (1) we use a synthetic index of regulation, coming from the first principal component of all three types of rules: "nesting" of RoO meaning changes of chapter and sub-chapter, processing requirements, and regional value content (RVC). This index of regulation is positively correlated with being granted free trade status in a later date. Nonetheless, when in (3) we allow for clustering of standard errors at the sector level (HS 2 digit), the coefficient on the regulation index becomes insignificant, suggesting that the

previous coefficient is due to variation across sectors rather than from products within a sector. In specifications (2) and (4) we unpack all three indexes independently. Processing requirements are statistically insignificant when we cluster standard errors. This is less of surprise since processing requirements are by far the most prevalent regulation in our sample, with around 23-24% of products having it. In contrast, the imposition of tariff line shifts (changes to chapter/sub-chapter or similar) is systematically correlated with receiving slow staging for tariffs benefits. In contrast, the presence of regional value content regulations is negatively correlated with having a slow staging of tariff preferences. Empirically, many times the regional value content goes together with a RoO of shifting tariff lines. When we consider both dummy variables together, the coefficients indicate that when a product has both (i) RoO of tariff line and also (ii) regional value content, then it is not necessarily more likely to have slower reduction of tariffs. In contrast, when there is tariff shift but the RVC is not a requisite, then it is more likely that the product ends up in a slow staging of the treaty. Given that the RVC requirement can potentially benefit US firms, which could lose more if the Chilean product is very competitive, then correlations seem again consistent with theories of endogenous policy, where the RVC and slow staging are substitutes in the goal to equalize benefits for the US.[18]

Table 6. Linear probability regressions of a dummy for the product being in slow staging lists (0% tariff by year>2004) explained by various measures of regulation /Rules of Origin (RoO).

	1[Product in Non-immediate Free Trade List]			
	(1)	(2)	(3)	(4)
Regulation (Principal Component)	0.274***		0.274	
	-0.0456		-0.201	
RoO Nesting (chapter/sub-chapter)		0.0689***		0.0689***
		-0.0113		-0.0198
1* (Processing Requirement)		-0.0595*		-0.0595
		-0.0344		-0.105
1* (RVC>0)		-0.0437***		-0.0437***
		-0.00984		-0.0156
Constant	-0.0552***	-0.0837***	-0.0552	-0.0837**
	-0.0214	-0.0228	-0.0837	-0.037
Standard Errors	Robust	Robust	Cluster HS2	Cluster HS2
Observations	807	807	807	807
R-squared	0.037	0.057	0.037	0.057

Standard Errors in parenthesis. We use a cross section including only the products actually traded in 2006 and, as in other specifications exclude all MFN Free products (List F).

[18] Although focusing on a different variables;Anson, Cadot, Estevadeordal, Melo, Suwa-Eisenmann, and Tumurchudur (2005) also look at policy substitutes between RoO and tariff preferences. We here remark the intertemporal staging of tariffs more than the total tariffs themselves.

6 How big are utilization costs?

After having reviewed the data and the main patterns of utilization, we can now come back to estimate the empirical model of Section 3. With those estimates we show how utilization costs have been decreasing over time, especially during the first four years of the treaty.

To simplify the interpretation, in most cases we restrict our sample to products in List A, that immediately entered the with duty free treatment in 2004, so we can see the evolution of the utilization costs f as the treaty matures, but not looking at the new products that are incorporated to the agreement. This and other data restrictions [19] leaves us with less than a fifth of the original sample of products, but a sample that kept the same average utilization rates as the full sample. When utilization was strictly between zero and one, then we just used $f = \hat{x}\Delta\tau$ as in the model. When utilization was at the corner, we assumed the lowest possible cost. Thus, when utilization is full in product i, so $\hat{x}_i = \underline{x}_i$, we assumed $f_i = 0$, despite the fact that the true f_i could be anywhere in the range $[0, \underline{x}\Delta\tau]$; but we cannot measure it exactly because the the density of exporters has no support at those small levels. Similarly, when utilization is zero, we assumed $f = \bar{x}\Delta\tau$; the lowest value of the range $[\bar{x}\Delta\tau, \infty)$. In short, we are measuring a lower bound for the utilization costs.

Table 7. Distribution of utilization cost f for Chilean exporters to the US in products that received tariff free treatment since the beginning of the treaty (List A)

	Moments of the distribution of utilization cost f over the years [USD]							
year	mean	std. dev	N	p25	p50	p75	p90	max
2004	17,778	92,651	97	0	211	2,756	11,943	757,961
2005	33,201	191,673	87	0	48	913	11,961	1,463,252
2006	68,350	334,006	96	0	16	378	6,172	2,481,164
2007	60,640	426,975	102	0	31	440	3,818	4,039,312
2008	83,835	554,836	87	0	44	499	2,612	5,086,743
2009	20,146	90,939	85	0	27	531	6,016	596,418
2010	73,897	528,753	65	0	20	694	3,373	4,251,477

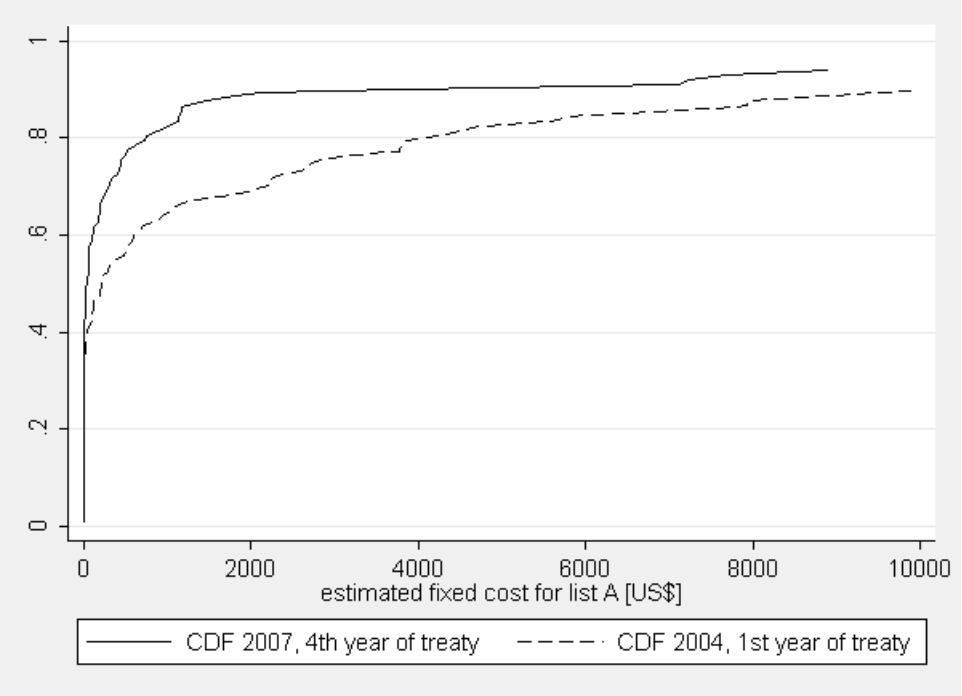
Only matched observations in List A were included.

Table 7 shows the distribution of measured f_{it} various products i during the various years t of the treaty. The mean f_{it} is very large, from 20 to 80 thousand dollars during the years of analysis, but the distribution is highly skewed so the mean is totally driven by the top of the distribution. In

[19] Given the less than perfect matching between US and Chilean classifications at HTS 8 digits, we can only work with the products where we simultaneously had the same 8 digit code and where the amounts exported and imported were within a 30 to 40% range. In principle, our methodology could be applied to monitor utilization costs in a more systematic product by product basis, provided a better match between 8 digit classifications is available; but at 8 digit granularity the matching is far from perfect. Regarding the properties of the matched sample we could not reject the null hypothesis that the matched sample and the total sample of products have the same utilization rates. In any case, the imperfect matching between classifications would be common in other countries and it is not a limitation stemming from our method. Developing a full match between the 8 digit classification of products in two countries is not essential to our goal in this paper, so we will not attempt to match the full population.

fact almost half of the products have f_{it}, as expected from full utilization. That is why we focus on both the median and the 75-th percentile. The median is still low, starting at around 200 USD, but the 75-th percentile is more than ten times larger. To have an idea of what this latter figure means we can take into account that the average tariff preference at that level was $\Delta\tau = 4\%$, which means that an exporter should ship least 70 thousand dollars to the US in order to find using the treaty worthwhile.

The high level of heterogeneity in costs can be visually represented by looking at the cumulative density. Figure 8 shows how the the whole distribution of fixed costs shifted towards lower values between 2004 and 2007, where a cost reduction was of course an heterogeneous phenomenon, but not driven only by outliers. The two distributions are statistically and economically different (p-value of the Kruskal-Wallis test = 0.02). As clear in the plot, the 25-th percentile did not change because it started already at the "zero lower bound" so it is not reasonable to expect that it will go down further.

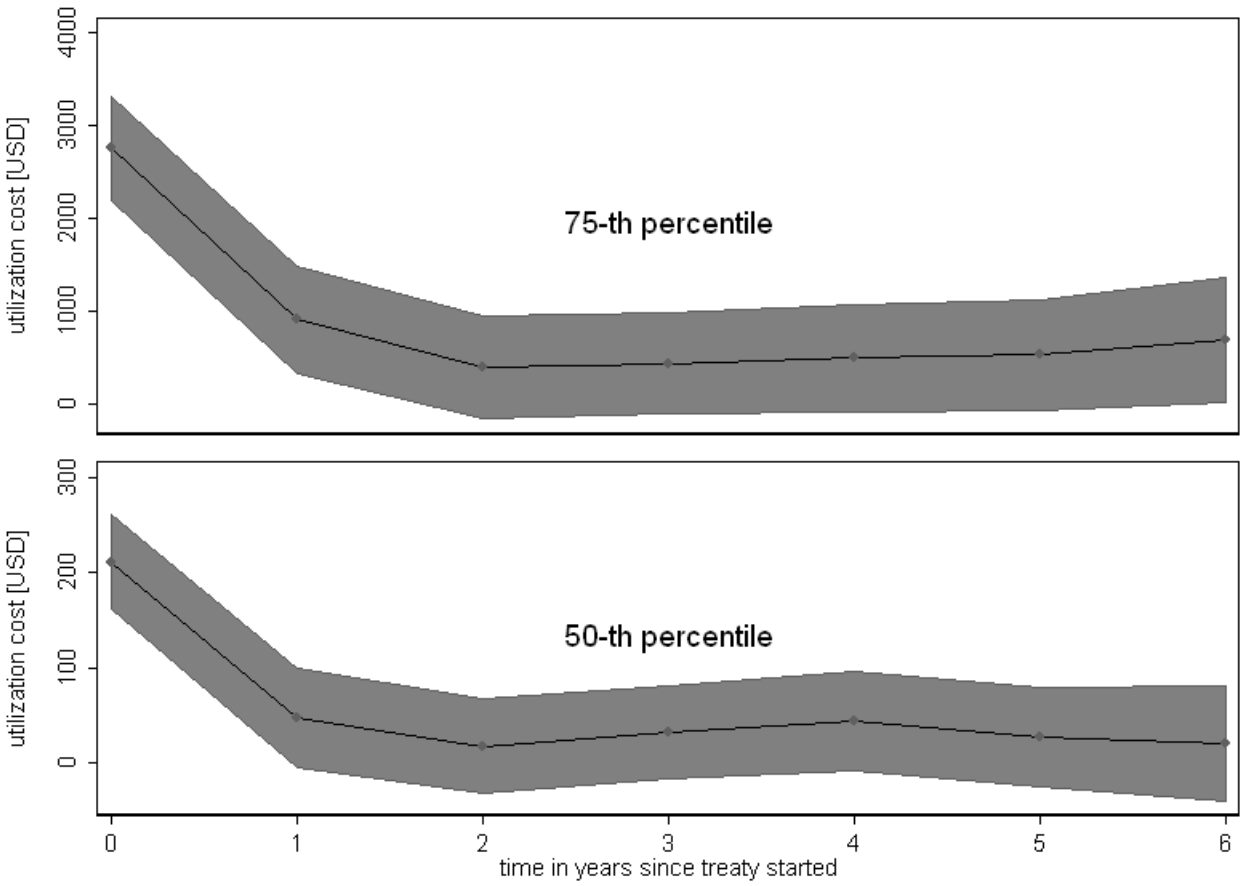


Cumulative density in 2004 and 2007 for f. The Kruskal-Wallis test of equality of the two cumulative distributions has a p-value of 0.02. The distribution for 2010 was not plotted but it does not differ significantly from the one for 2007, with a p-value of 0.95 for the null hypothesis of equality 2004 - 2010 in the Kruskal-Wallis test. For 2004 there were 97 products, while for 2007 there were 102. Values are in nominal US Dollars. If any, correction for inflation would bias us towards not finding a difference.

Figure 8. Empirical cumulative density of fixed cost of utilization (only list A with immediate staging)

More formally, we run quantile regressions for the evolution of the median and the 75-th percentile of costs overtime. These regressions confirm the pattern in Table 7, with a clear reduction after

the first year of the treaty. The third quartile decreases of utilization costs decreased by around 70%, from circa 3,000 USD to below 1,000; with an additional decrease in the second year that is borderline significant at 90%. But then it remains in the neighborhood between zero and a throusand dollars for the rest of our sample, even years 4 and 5 which coincide with the financial crisis. The quantile regression for the median shows a very similar picture, with a large drop in the first year, although at much lower levels.



Plotted marginal effects using delta method for a quantile regression of utilization costs f_{it} over various years t; estimated for the 75-th and 50-th percentiles. The 25-th percentile is not estimated because it precisely is zero for all years. Plotted standard errors at 95% confidence.

Figure 9. Quantile regressions of the evolution of fixed cost by year

In the appendix we show additional robustness checks for our stylized fact of an important decrease in utilization costs, using standard regressions with product fixed effects and also taking into account the churning of products. All show a reduction in fixed costs

Overall, the estimates in this section are evidence consistent with some "learning" during the first years of the treaty, because the cutoff level needed for using the treaty went down both economically and statistically. We cannot distinguish, though, whether this process of reduction in the cutoff

size to use the treaty is due to learning within firms, market dynamics or externalities. [20]

7 Concluding remarks.

This paper offers a model to explain why free trade agreements are not fully used, and then provide a novel empirical technique to back out the fixed costs from data readily available to governments.

Our model is composed of exporters with heterogeneous productivity from a small open economy, who are price takers. When there are fixed costs of using the tariff benefits of a treaty, firms would weigh the benefits of doing it, which grows with the volume exported and the magnitude of the tariff advantage, against the fixed utilization costs. As usual in these models, larger exporters would prefer to use the treaty - increasing even more their shipments - while the smallest would rationally restraint from using the tariff benefit. In extreme cases, when the factor prices are not perfectly elastic, the small exporters could even lose from the mere existence of the free trade agreement, since larger firms would use it, increasing exports and therefore pushing up factor prices. This differential utilization of the treaty is, at the best of our knowledge, a novel channel that creates heterogeneous impacts of free trade agreements *within* an industry.

We also offer a novel method to structurally estimate fixed utilization costs. Assuming that larger exporters in an industry use the treaty first, then we can back out which is the marginal exporter that might be indifferent between using and not using the treaty. Since we observe its export volume and know the tariff savings from using the treaty, then we can back out the money that this marginal user is apparently leaving on the table if it does not use it. This provides our estimates for the fixed cost.

Empirically, we estimate our model using data from Chilean firms exporting to the US, following the first years of the Free Trade Agreements between these two countries, starting in 2004. We find that there is substantial heterogeneity across products. While for almost half of the products the cost was estimated to be zero or non binding for any firm, for the 75-th percentile the utilization cost was around 3 thousand dollars. Given a tariff benefit of 4%, which is close to the mean in our sample, it means that treaty users would have to ship at least 70,000 dollars to the US to use the treaty. We also find that the utilization cost is decreasing over time, especially in the first years, in which we observe a drop of around 70% for both the second and third quartiles of the distribution. These results are consistent with learning about the treaty.

[20] As a robustness check, in an analysis not shown here, we did not see any obvious differences in the above mentioned pattern of "learning" when we split the sample between sectors with stronger and weaker rules of origin. This may be partially explained by the concerns about endogenous rules of origin, biased towards more competitive products and already discussed previously.

8 Appendix on the estimation of fixed utilization costs f_i

Having access to individual level data (product-firm) combinations about utilization is ideal, although very unlikely, As mentioned, Thailand seems one of the few exceptions in this respect[21].

Analyzing various cases:

- **Ranges**. Of course with a finite number of firms and some noise in the record keeping we cannot make a one to one mapping between firm level exports; so we can replicate this method and give a range estimate for $F_i \in \left[\underline{F_i}, \bar{F_i}\right]$ instead of a point estimate; but it is essentially the same calculation.

- **Corners**. Also, when $u = 0$ or $u = 1$ we only know a broad range for the cost. With $u = 0$ we know that $F_i > x_{i,1} \cdot \Delta\tau_i$; where $x_{i,1}$ is the export value of the largest exporter ($j = 1$) in product i. In contrast,when everybody uses it ($u = 1$) we know that $F_i < x_{i,J} \cdot \Delta\tau_i$; where $x_{i,J}$ is the export value of the smallest exporter ($j = J$) in product i.

- **Assumption of full information**. We may wonder how reasonable is the idea that firms are aware of the utilization costs and make the formal decisions as stated in Eq 5. In our view it might probably be somehow in adequate for firms during the first years of the treaty; but probably a much better fit when people (and intermediary services for exports) are more aware of the benefits.

- **Upward bias when forgetting about variable costs of utilization**.One may want to think about what would happen if there is in fact a variable cost c of using the treaty. The equivalent of Eq 5 would be $x_{i,j}\left[1-\tau_i^{FTA}\right][1-c] - F_i \geq x_{i,j}\left[1-\tau_i^{MFA}\right]$; which implies that the true fixed cost is now given by $F_i = \hat{x}_i \cdot \Delta\tau_i - \hat{x}_i \cdot c$; note that $\hat{x}_i \cdot \Delta\tau_i \equiv \tilde{F_i}$ is the number we get if we omit that there is a cost. This argument implies that if we assume away the variable cost c despite the true model contains it, then our estimate $\tilde{F_i} = F_i + \hat{x}_i \cdot c$, would be an over-estimation of the true fixed cost; where F_i is the true fixed cost. And the bias is proportional to the size of this variable costs. Our strategy would be to assume a c (for example of 0 or 1 percentage point). Note that if $F = 0$; then the strategy of a cutoff unravels, because any time $\Delta\tau > c$ everybody would use it, and otherwise nobody would use it;never a partial use according to the model.

- **Downward bias when forgetting about dynamic sunk costs of utilization**. Imagine that the true utilization costs are dynamics and sunk. The real cost would be given by the expectation of future savings where the overall net present value of exports $X_{i,j}$ is what matters; where $X_{i,j} \equiv \mathbb{E}\left[\sum_{t=0}^{\infty} \beta^t x_{i,j,t}\right]$. The true cutoff for firms would be $F_i = \hat{X}_i \cdot \Delta\tau_i$;because they are thinking about all the future inter-temporal benefits that justify the current entry

[21]Maybe having some concerns about mis-measurement of the true utilization costs due to corruption in the application

cost. In contrast, if we think the fixed cost is yearly, we measure $\tilde{F}_i = \hat{x}_i \cdot \Delta\tau_i$. Since the present value of future exports is (usually) higher than the current exports, so $\hat{x}_i < \hat{X}_i$; then the estimated cost that forgets about dynamic optimization is an under estimation of the true costs $\tilde{F}_i < F_i$

9 Appendix on how we built our sample

9.1 Explanation

Our analysis requires the use of a few datasets. The original data, prepared by the IADB, contains six variables: "HTSProductCode", "HTSNumberExplanation", "MFN", "FTA", "TotalTrade", and "year". "HTSProductCode" is the 8-digit code which identifies each product. "HTSNumberExplanation" contains a brief description of each product. "MFN" is the amount of trade that enters the US through most favored nation status while "FTA" is the amount of trade that enters the US through the use of the FTA. "TotalTrade" is the sum of "MFN" and "FTA." We also used information from Annex 3.3 of the FTA compiled into an Excel spreadsheet. This spreadsheet contains the following variables: HTS2003, an identifying code for each product; description, which gives a brief description of each product; base rate, which contains the pre-FTA tariff rate; and staging, which identifies which tariff decrease schedule for each product. In order to account for the Rules of Origin, we used a database which contained HSProductCode, an identifier at the 6 digit level of each product, and the Rules of Origin description. For tariff rates, we used two sources: the USITC and TRAINS tariffs datasets. The USITC dataset is identified on the HTS level whlie the TRAINS dataset is identified on the HS level.

Since there was not a common identifier across all datasets, the best merging strategy was not completely obvious. Through trial and error, we were able to come up with a workable method. In an ideal world, we would have had databases which all had the HTS 8-digit format as provided for in the original database compiled by IADB. Since the databases do not all share a common identification code, we had to build in some translations so that the merge would work properly. After removing 75 duplicates from the original data, we merged the original database using the Annex 3.3 database of stagings. Initially, it is not a perfect merge. We recover the nonmatches through the use of the HS translator and the USITC tariffs data. When we apply the translator, we lose some uniqueness. To resolve any problems with inconsistent stagings on the HS level, we use the mode of the staging by each HS product code. These recovered observations are then appended to the original database. This merge produces a loss of 11 observations. Next, we merge the Rules of Origin database. 70 observations are lost as a result of this merge. Last, we merge the TRAINS tariffs database which turns out to be a perfect merge. Altogether, we lose 234 observations through this merging process which yields a final total of 8,956 observations.

9.2 Detail of variable definition

$$use_{it} = \begin{cases} 0 & \text{if } u_{it} = 0 \\ 1 & \text{if } u_{it} > 0 \end{cases}$$

$$fulluse_{it} = \begin{cases} 0 & \text{if } 0 < u_{it} < .90 \\ 1 & \text{if } u_{it} > .90 \end{cases}$$

$$logValue_{it} = ln(TotalTrade_{it})$$

$$ratediff_{it} = MFN_{it} - FTA_{it}$$

$$ROOnest_{it} = \begin{cases} 1 & if\, Cambio\, de\, Subpartida \\ 2 & if\, Cambio\, de\, Partida \\ 3 & if\, Cambio\, de\, Item \\ 4 & if\, Cambio\, de\, Capítulo \end{cases}$$

$$requisito_{it} = \begin{cases} 1 & if\, product\, has\, requisito\, de\, procesamiento \\ 0 & otherwise \end{cases}$$

$$VCR_{it} = \begin{cases} 1 & if\, product\, has\, regional\, value\, content\, requirement \\ 0 & otherwise \end{cases}$$

$$quota_{it} = \begin{cases} 1 & if\, product\, has\, import\, quota \\ 0 & otherwise \end{cases}$$

Persistence: "1" if a product enters in year t and is consistently exported for all subsequent years; "0" otherwise.

10 Robustness checks on the decrease of utilization costs

This subsection makes additional analysis to confirm the robustness of the decrease in utilization costs over time. Regression show that f decreased between 10 and 20% per year during the period

2004-2010, as shown in Table 8, but much more in the early years. First in specifications (1) and (2) we estimated a regression of $\ln(f+1)$to include observations with $f=0$, showing a rate of decline per year of around 7 to 13 percentage points, depending on the type of fixed effects used. When looking only among those products with non-zero the point estimates are even stronger, around 20% reduction in utilization costs per year (3 and 4). Finally, specification (5) shows that most of the effect was concentrated in the first years , with a decline in utilization costs of around 40% per year. This is closer to our results of quantile regressions in Section 6.

	Dependent variable: fixed cost f				
	$\ln[f+1]$		$\ln f$		
	(1)	(2)	(3)	(4)	(5)
Years since treaty started (2004)	-0.0765**	-0.136***	-0.190**	-0.236***	-0.414***
	(0.04)	(0.04)	(0.07)	(0.06)	(0.12)
Time Frame	2004-2010	2004-2010	2004-2010	2004-2010	2004-2007
FE by Staging Group	YES		YES		
FE by Product		YES		YES	YES
Observations	682	682	470	470	285
R-squared	0.041	0.039	0.034	0.062	0.076
Number of FE	5	243	5	185	149

Panel regressions with clustered standard errors at the same level of the fixed effects. Standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1 . Specifications (1) and (2) include all observations with $f=0$; while specifications (3) to (5) exclude them. Specification (5) uses only the sub-sample before 2004-2007, before the financial crisis. Since there are fixed effects involved, the constant of the regression is not reported because it is not directly interpretable.

Table 8. Panel Regressions showing reduction of fixed utilization costs f over time.

11 Appendix: Parameters of the Free Trade Agreements between Chile and the US

Table 9. Staging list for the Chile-US FTA, indicating the reduction in tariff over the MFN tariff rate, so percentages are $\left(1-\tau_t^{FTA}\right)/\tau_t^{MFN}$.

	Year													
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	N^{Theo}	$\%^{Theo}$
Product List														
List A	100%												5,935	55.83
List B	25%	50%	75%	100%									200	1.88
List C	13%	25%	38%	50%	63%	75%	88%	100%					139	1.31
List D	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%			51	0.48
List E	8%	17%	25%	33%	42%	50%	58%	67%	75%	83%	92%	100%	38	0.36
List F	"Free" , meaning that MFN tariff was already zero before the treaty												3,991	37.54
List G	0%	0%	0%	0%	8%	17%	25%	33%	50%	67%	83%	100%	16	0.15
List H	0%	0%	13%	25%	38%	50%	63%	75%	88%	100%			0	0
List J	0%	0%	0%	0%	0%	0%	0%	20%	40%	60%	80%	100%	0	0
List K	50%	50%											0	0
List L	5%	10%	15%	20%	25%	30%	40%	50%	60%	100%			17	0.16
List M	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%			4	0.04
List N	100%												23	0.22
Annex 1	Special but usually "slow"												217	2.08
Total													10,631	100

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