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UNIVERSIDAD DE LA REPÚBLICA URUGUAY

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Adriana Peluffo
Alvaro Brunini

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Industrial Policy and Trade Promotion in Uruguay: Which are the Effects?

Adriana Peluffo(*)
Alvaro Brunini (**)

Resumen

La exportación desempeña un papel central en el crecimiento económico, especialmente en las economías pequeñas. Es por ello que en este trabajo analizamos una política industrial orientada a fomentar las exportaciones: el Régimen de Admisión Temporaria (AT). Para ello utilizamos un panel de empresas uruguayas para el período 2005-2016. Utilizamos dos técnicas de evaluación de impactos: análisis de efectos binarios del tratamiento sobre las empresas emparejadas y efectos continuos del tratamiento. Estas técnicas permiten controlar la selectividad en el tratamiento y el sesgo de selección. Encontramos efectos positivos de la Admisión Temporaria sobre el desempeño comercial, y en particular sobre el desempeño exportador, mientras que no hay efectos claros sobre la productividad total de los factores de la empresa y el empleo.

Palabras clave: política industrial, admisión temporaria, desempeño exportador, productividad, efectos causales

Código JEL: F13, F14, F16, O24

Abstract

Exporting plays a central role in economic growth, especially in small economies. In this work we analyze an industrial policy aimed at fostering exports: the Temporary Admission Regime (TA). To this aim we use a panel of Uruguayan firms for the period 2005-2016. We use two evaluation techniques: binary treatment effects on matched firms and continuous treatment effects. These techniques allow controlling for selectivity into the treatment and selection bias. We find positive effects of Temporary Admission on trade performance, and particularly on export performance, while there are no clear effects on the firm's total factor productivity and employment.

Keywords: industrial policy, temporary admission, export performance, productivity, causal effect.

JEL Classification: F13, F14, F16, O24

(*) Adriana Peluffo, IECON, Universidad de la República, Uruguay, correo electrónico: adriana.peluffo@fcea.edu.uy
(**) Alvaro Brunini, Uruguay XXI, Uruguay, correo electrónico:

1. Introduction

Exports may play a key role in economic growth and poverty reduction, in particular in small emerging economies. A number of countries have fostered exports with different programs.
There is a vast literature on the link between international market access and growth at the aggregate level and on export-led growth strategies. Nevertheless, there is little evidence at the micro-level and for Latin American economies. Especially, there are few studies on the effects of policies design at fostering exports using firm level data.

While subsidies to exports are considered against the rules of the World Trade Organization (WTO), the policies of Temporary Admission and Draw-Back are among those allowed by the WTO. Usually, the justification for these policies is that they correct the anti-trade bias due to high tariffs (Cadot et al., 2003).

The regime of temporary admission (TA) allows imports of intermediate to be used and re-exported over an 18-month period, but the value of imports should be lower than 80 % of the value of the final good to be exported. The goal is to promote exports that utilize imported inputs, avoiding double taxation (the double payment of tariffs), since final goods when exported would have to pay the tariff of the destination country including those of the intermediate inputs used in production.

In the case of Uruguay, it is important to differentiate between imports coming from the trade bloc to which the country belongs: MERCOSUR (Southern Common Market) and those coming from countries outside this trade bloc, since the former do not pay tariffs (with some exceptions such as in the sugar and automotive sectors and other sensitive sectors). Since 1995, MERCOSUR has had a Common External Tariff (CET), which currently varies between 0% and 35%. The highest tariffs are for non-food industry sectors such as footwear, textiles, and clothing.

MERCOSUR countries can apply exceptions to the CET, which means that the applied tariff varies from country to country. This is the case of national lists of exceptions, tariffs that in some cases are 0% on imports of capital goods, IT and communication, or other exceptions of a sectoral nature.

There is also the possibility that the member countries of the trade bloc apply special regimes that allow tariff reductions or exemptions, as is the case of the TA, which allows imports of inputs to be used in production with zero tariffs.

In addition to the CET, imports from Uruguay are subject to various levies such as the Value Added Tax (VAT), the Tax on the Sale of Agricultural Goods (IMEBA), the Internal Specific Tax (IMESI), fees and duties that apply to imports such as the consular fee.

Since 1994, MERCOSUR has applied several extensions of both the TA and the Draw-Back regime, given that it perforates the idea of Customs Union (CU) to which the trade bloc aspires but has not yet completed by the end of 2022. For Uruguay, the CET defined by MERCOSUR is above the appropriate level considering that it is a small country where imported inputs play a key role in improving its production capacities, mainly in export-oriented sectors. For this reason, the TA regime plays an important role for Uruguay by reducing the level of tariffs effectively paid.

Though tariff reduction has been a generalized phenomenon in last decades, there are still significant differences between developed and developing countries. While in the formers tariffs are low, in the latter they are high, which gives room to Temporary Admission and Draw-Back policies. Moreover, there are differences among Latin American and Caribbean countries, being the Southern countries of LACs (Mercosur countries) the closest economies of the LAC region.

In recent decades, the increase in global trade is largely explained by trade in intermediate inputs which, in turn, has been favored by the process of fragmentation of production, from the basic input, through intermediate goods and services and ending with the production of the final consumption good. Fragmentation of production is fostered by the comparative advantages of different countries and tends to translate into greater productive efficiency, higher quality, lower prices and greater variety of final goods. This in turn promotes the creation of global value chains that are encouraged by the reduction of trade costs led by a strong reduction of tariffs and other barriers to trade, as well as preferential opening processes.

Furthermore, exporting is considered an internationalization strategy, which can be used by small and medium enterprises (SMEs) to sell in the world market and obtain gains from scale economies. Though, SMEs' survival and growth may depend on several factors that affects exports, and of a careful evaluation of the policies aimed at fostering exports (Sousa et al. 2008).

Imported inputs can promote export performance, through gains in productivity due to lower costs, knowledge transfers from abroad, and higher quality and variety of intermediate inputs. Moreover, imported inputs can affect employment with an

ambiguous net effect, since they can compete with, and reduce domestic production (and employment), but they can also translate efficiency gains into higher employment.

Due to the low number of studies at the micro-level for emerging countries and Uruguay in particular, the objective of this work is to analyze the impact of using the Temporary Admission regime on firms' performance and employment. Regarding to firms' performance we evaluate firms' productivity and trade performance. To analyze trade performance, we measure export levels, export intensity, diversification of export products and countries of destination. Moreover, we examine the performance of import diversification in terms of number of imported products and source countries. As regards productivity we analyze the impact of TA on total factor productivity (TFP). Moreover, we analyze employment levels, and by skill category, since imports can destroy or contribute to job creation. Finally, we also study the effect of TA on the quality of exports and imports.

The main findings are positive impacts on trade performance, due to a higher level of exports, an increase in export share, and in export and import diversification, with not significant or mixed results of TA on productivity, employment and quality.

This work structures as follows, after this introduction we present a brief review of the literature, then the data used and the econometric methodology, and finally the results and the conclusions.

2. Literature review

Usually, it has been argued about the importance of trade to foster economic growth, and more recently on its micro-foundation: the improvement of firms' performance due to trade openness.

Through the implementation of industrial policies, policy-makers have tried to promote economic growth and development. These policies usually use monetary, fiscal incentives, investment in infrastructure or research and development, or various aspect of trade policy.

In turn, endogenous growth models have postulated the importance of R&D and knowledge transfer between countries as a key factor to explain growth. A channel of knowledge transfer is through imports of intermediates and capital goods and this would

happen mainly from knowledge embodied in goods from developed countries to developing ones (Coe et al., 1997).

Recently, the evidence points out that imports and exports are related through various channels. Firstly, reducing tariffs on imported inputs reduces input costs improving competitiveness, which can foster exports. Secondly, a part of sunk costs related to international trade are common for imports and exports, which may increase efficiency. Thirdly, imported inputs can be of higher quality and/or cheaper and use a higher variety of inputs. Moreover, there may be technology transfers embodied in imported goods. All these factors can promote exports.

Regarding employment, international trade has ambiguous effects. On one side, if trade increases productivity and improvements in productivity can be labor saving, this would impact negatively on employment. Also, imports may compete with domestic producers affecting in a negative way employment. Nevertheless, gains in efficiency can lead to an increase in production and employment if as a consequence of the increase in efficiency there is also an increase in demand. Moreover, imports by transferring advanced technologies can affect the demand of skilled labor (Blanchard et al., 2019; Barba Navarreti and Soloaga, 2002), since usually modern technologies are capital intensive and complements to skilled labor.

Lo Turco and Maggioni (2013) , and Feng et al. (2016), Aristei et al. (2013), and Laurin and Pierre (2022), find positive effects of imported inputs on exports and the number of destinations, with the origin of imports from high income countries easing exports to these countries.
Moreover, imported inputs is a way of achieving more diversified and higher quality exports (Castellani and Fasio, 2019; and Fan et al., 2015).

Elliot et al. (2019) show that decisions to export and import are determined simultaneously, and that sunk-entry costs play a significant role in a firm's decision to enter international markets.

Nowadays, the literature on the relationship between input imports and productivity is abundant and point out a positive relation between these two variables. More recently, there is also evidence on the positive effect of imports on productivity (Bass and Strauss-Kahn, 2014), while earlier works find mixed results (Sjoholm, 1999).

Some studies show that the impact of imported inputs on productivity is related to the absorptive capacity of the firm (Augier et al., 2013). Furthermore, a number of works find that both, exports and imports enhance firms' productivity (Ali et al., 2018, Camino-Mogro and López, 2021). The latter researchers find complementarity between imports and exports in affecting productivity.

Most of the research has been conducted for manufacturing firms while studies for trade in services is scarce (Morikawa, 2019). To study the TA regime, we have to focus on manufactured goods since the policy is aimed at these goods.

Lo Turco and Maggioni (2013) find positive impacts of trade (imports and exports) on employment growth at the firm level. Nevertheless, there are some works that find mixed impacts, for instance Fajnzylber and Fernandez (2009).

Some studies have found different results of imports from China on US (Caliendo et al., 2015; Autor et al., 2013; Méndez; 2015) and Japan (Taniguchi, 2019). These works find a negative effect of imports from China on USA employment, while imports from China have a positive effect on employment for Japan.

Regarding Uruguay we can find a number of studies: Terra (2006), and Lorenzo et al. (2005) show that most firms that use TA export to Mercosur's partners. Cadot et al. (2003) using a political economy framework show that a Custom Union would eliminate the need for TA (2015). Fernandez (2015) point out the importance of TA and that it is far more important for exports to Mercosur's' partners. Lalanne (2020) finds also the importance of imports using TA for exports to the Mercosur. Lavalleja and Scalesse (2020) show that TA is an important incentive to promote production and exports.

Peluffo and Zaclicever (2013), Blanchard et al. (2019) show that imported inputs increase firms' productivity and this effect is higher the higher the absorptive capacity measured by the share of skilled labor at the firm level.

The work of Allub et al. (2022) evaluates mechanisms that reduce tariffs and other taxes on imports in order to promote trade, for Argentina and Uruguay. For the Uruguayan case they focus on the Temporary Admission mechanism. This paper estimates the coverage and incidence in the use of temporary import regimes. In terms of coverage they find that in the case of Manufacturing of Industrial Origin [Manufacturas de Origen Industrial] 75% of exports used the regime in 2019, the last year of the analysis. The

incidence that measures the value of inputs imported under the regime over the value exported is 50% for Uruguay. This indicates that the use of the regime is more widespread than the percentage of firms. The coverage index is defined as the ratio of the value of exports covered by the regime to the value of total exports, while incidence is measured as the value of inputs imported through the regime relative to the value of exported products.

In what follows we present the empirical strategy used, the data and the econometric models.

3. Empirical Strategy

3.1 Data

We use two data sources to perform our analysis, administrative customs information and industrial firm-level data.

The customs data is collected by the National Customs Service (DNA, *Dirección Nacional de Aduanas*). This data is available from 2005 to 2016 at the transaction level from customs declarations. The level of detail of the database is quite comprehensive as products are coded at the 10-digit MERCOSUR Common Nomenclature (NCM, *Nomenclatura Común del MERCOSUR*). The NCM shares the same structure as the Harmonized System in its first six digits so our analysis is comparable to other studies in the literature. For each product, the database provides information on the CIF and FOB values traded in current US dollars, the country of origin or destination, as well as the measurement unit in which the product was traded, which allows us to calculate unit values and the methodology proposed by Khandelwal (2010, 2013) to estimate quality.

The second source of information used is the Annual Economic Activity Survey (EAAE, Encuesta Anual de Actividad Económica) from 2005 to 2016, carried out by the National Institute of Statistics (INE, Instituto Nacional de Estadística). The EAAE is based on a stratified sampling with probabilistic samples which are representative of the economic sectors as defined by the International Standard Industry Classification (ISIC). The exception is for the stratum of largest firms in terms of income or employment for which a census is performed. In the year 2006 only firms of compulsory inclusion were surveyed.[1] Since the AT regime is aimed at manufactured goods we retain in the sample only manufactures and disregard services.[2]

[1] The data is confidential but not exclusive and can be requested to the sources.
[2] We also analyze the results using manufacures and services and the results are qualitatively similar. Results are available upon request.

The survey covers firms that perform an economic activity related to industry, commerce or services in the Uruguayan territory, except for those establishments in Export Processing Zones (EPZ). It does not include industries related to agriculture and livestock, extractive industries, construction, or financial services controlled by the Central Bank, among others.

We expressed all the values in constant pesos with base year 2005.

3.2 Econometric Methodology

We use treatment impact analysis with binary and continuous treatment as we explain briefly below.

3.2.1. Treatment impact analysis with binary treatment

We analyze the causal effect of Temporary Admission, using a treatment effects with matching methodology. The treatment is undertaking TA, we measure the impact of the regime in relation to firms that do not use TA. We use matching in order to avoid biases between the treated and the control group.[3]

Thus, our aim is to evaluate the effect of TA on firms' total factor productivity, employment, and trade performance. We measure export performance by the level of exports, export intensity and diversification of products and markets. We also analyze the diversification of imported inputs and the quality of traded goods. Thus, $\boldsymbol{Y}$ is our outcome variable, i.e. firms' productivity, employment, export performance and diversification of imports.

We perform the analysis for the treatment and for various outcome variables as we commented above. The effect of TA is the estimated difference of the outcome variable considered between treated (firms that undertake TA) and the controls (firms that do not undertake TA) with similar covariates.

Let Y_{it} be the outcome – productivity, employment, export performance, diversification and quality of traded goods - for firm $\boldsymbol{i}$ in industry $\boldsymbol{j}$ at time $\boldsymbol{t}$. We consider total employment per firm, professionals and technicians and white collars (professionals and technicians plus employees in non-production activities), and the share of professionals and technicians and white collars over total employment. As we mention above, we analyze export performance measured by the level of exports, export intensity measured as exports over sales, and the diversification of markets and products exported and

[3] We also exploit our panel data running fixed effects regressions (FE) by firm. Fixed effects models, allow us to control for endogeneity into the extend that unobservable variables do not change over time. Results are available upon request.

imported. We also test whether TA has affected import diversification and quality of traded goods.

Let imports by temporary admission, $TA_{it} \in \{0,1\}$ denote an indicator (dummy variable) of whether firm i has received the treatment in moment t- and $Y^1_{i,t+s}$ is the outcome at t+s, after the treatment. Also denote by $Y^0_{i,t+s}$ the outcome of firm $\boldsymbol{i}$ had it not received the treatment.

The causal effect of the treatment for firm $\boldsymbol{i}$ at period (t+s) is defined as: $Y^1_{i,t+s}$ - $Y^0_{i,t+s}$.

The main problem of causal inference is that the quantity $Y^0_{i,t+s}$, referred as the counterfactual, is unobservable. Causal inference relies on the construction of the counterfactual, which is the outcome the firms would have experienced on average had they not undertaken TA. The counterfactual is estimated by the corresponding average value of firms that do not have undertaken TA. An important issue in the construction of the counterfactual is the selection of a valid control group and to this end we make use of matching techniques.

The basic idea of matching is to select from the group of firms belonging to the control group those firms in which the distribution of the variables $\mathbf{X_{it}}$ affecting the outcome is as similar as possible to the distribution to the firms belonging to the treated group. The matching procedure consists on linking each treated individual with the same values of the $\mathbf{X_{it}}$. We adopt the "propensity score matching" method. To this end, we first identify the probability of undertaking TA (the "propensity score") for all firms, irrespective if they belong to treated or control group by means of a logit model. A firm $\boldsymbol{k}$ belonging to the control industries, which is "closest" in terms of its "propensity score" to a firm belonging to the tradable industries, is then selected as a match for the former. There are several matching techniques, and in this work we use the "kernel" matching method which penalizes distant observations. A matching procedure is preferable to randomly or arbitrarily choosing the comparison group because it is less likely to suffer from selection bias by picking firms with markedly different characteristics. To estimate the propensity score (i.e. the probability of undertaking TA) we use as covariates lagged capital intensity (LnKL), lagged size of the firm measured as the total income from sales (LnSize), average wages (lnWages), and dummies for R&D (RD), training activities (Train) and a dummy equal 1 and zero otherwise for foreign firms (ET). Moreover, we introduce industry and time dummies. In all the cases we tested that the balancing properties were met. We analyze the balancing tests to see if the differences between the treated and the control group are not too big so the technique is adequate.

3.2.2. Treatment impact analysis with continuous treatment

Cerulli (2014) has developed a generalization of the propensity score of Rosenbaum and Rubin (1983) for continuous treatment effects. Similarly, to the binary case, the use of the generalized propensity score reduces the bias caused by non-random treatment assignment.

The generalized propensity score (gps) matching, evaluates the expected amount of treatment that a firm receives given the covariates. Thus, the estimation of the impact of the treatment is based on the comparison of firms with similar propensity scores. Furthermore, adjusting for the generalized propensity score (gps) removes the biases associated with differences in the covariates, as in the binary case. Hence, we can estimate the marginal treatment effect of a specific treatment level on the outcome variable of firms that have received that specific treatment level with respect to firms that have received another one (counterfactual), but both groups with similar characteristics. This methodology improves the intervention effect evaluation, for instance if there is an economic trend present at the same time as the treatment this technique avoids that positive or negative trends result in an overvaluation or undervaluation respectively, of the treatment effect.

Cerulli (2014) introduce a practical implementation of the generalized propensity score methodology. He assumes a flexible parametric approach to model the conditional distribution of the treatment given the covariates, which allows testing if the generalized propensity score balances the covariates.

For the sake of simplicity, we assume a linear model for the treatment -also quadratic, cubic and higher order response models are supported by the program- as follows:

$t\left|X_i \approx F(\beta_0 + \beta_1^{'} X_i, \sigma^2)\right.$, where *t* stands for the treatment and X_i are the covariates.

To estimate the causal effect for continuous treatment, firstly we have to estimate the conditional expectation of the outcome, $E\left[Y\left|T=t, R=r\right.\right] = E\left[Y(t)\left|r(t,X)\right.\right] = \beta(t,r)$; as a function of a specific level of treatment (t) and of a specific value of the generalized propensity score denoted by R=r.

It should be note that $\beta(t,r)$ does not have a causal interpretation. To have a causal interpretation it is needed to average the conditional expectation over the marginal distribution r(t, X): $\mu(t) = E\left[E(Y(t)\left|r(t,X)\right.\right]$, where $\mu(t)$ is the outcome at each level of the treatment in which we are interested.

In this way, we can obtain an estimate of the entire dose-response function as an average weighted by each different propensity score, i.e. $\hat{r}(t, X_i)$, estimated according to each specific level of treatment, *t*. After averaging the dose response function over the propensity score function for each level of treatment, we can also compute the derivatives of $\hat{\mu}(t)$, which can be defined as the marginal causal effect of a variation of the treatment Δt, on the outcome variable (Y), obtaining so the treatment effect function.

4. Results

4.1 Descriptive Features

In Table 1 we present some descriptive statistics. It can be observed that firms over the period have 87 workers in average, and 5 are professionals and technicians, and 21 white collar workers, 47 % are exporting firms. Export intensity measured as exports over sales is 11 %.

Nearly 14 % of the firms in the period use the TA regime. The number of imported products at 8-digit of the NCM is 32 and comes on average from 7 different countries, while the number of exported products is around 6, with 6 different countries as destination approximately. Moreover 12 % are firms with foreign ownership of capital, 54 % undertake R&D activities and 65 % training of workers.

Moreover, in Table 1 we can observe the behavior of the various variables according to sizes' categories of firms. For TFP, labor productivity, output, exports, imports employment R&D and training of workers, the bigger the firms the better performance. This feature also applies to export and import diversification of products and markets.

Table 1: Some descriptive statistics, average for the period 2005-2016

Variable	Small	Medium	Big	Total
Total Factor Productivity	11.63	11.97	12.37	11.86
(logarithms)	(0.99)	(0.88)	(1.01)	(1.02)
	3903	1551	1506	6960

Labor productivity (thousands of constant pesos)	0.5981	0.6005	0.9705	0.6763
	(3.3894)	(2.4706)	(3.6881)	(3.2829)
	0.0046	0.0017	0.0017	0.0080
Output (a) (millions of constant pesos)	31.30	102.00	643.00	221.00
	(67.10)	(311.00)	(5100.00)	(2750.00)
	4631	1744	2563	8938
Value added (a) (millions of constant pesos)	12.10	43.60	242.00	84.30
	(26.10)	(206.00)	(2920.00)	(1570.00)
	4631	1744	2563	8938
Exports (a) (millions of constant pesos)	12.30	31.40	346.00	84.30
	(263.00)	(221.00)	(1590.00)	(766.00)
	4192	1491	1457	7140
Imports (a) (millions of constant pesos)	0.06	0.18	1.57	0.64
	(0.15)	(0.64)	(21.00)	(12.70)
	1723	1083	1589	4395
Exporting firms	0.2857	0.4748	0.7920	0.4678
(share of firms)	(0.45)	(0.50)	(0.41)	(0.50)
	4631	1744	2563	8938
Total Employment	23.83	69.00	282.24	87.29
(number of workers)	(11.55)	(13.98)	(379.00)	(200.55)
	4631	1744	1671	8046
Professionals and	1.52	4.73	14.73	5.37
Technicians	(3.55)	(8.69)	(32.28)	(17.09)
(number of workers)	1823	912	812	3547
White Collars workers	6.84	19.31	55.50	21.19
(number of workers)	(6.94)	(15.96)	(62.67)	(36.95)
	1823	912	812	3547
Capital intensity	0.2901	0.4340	1.3914	0.5510
(capital over employment)	(2.3777)	(1.8268)	(13.7000)	(6.5788)
	4600	1744	1671	8015
Export intensity	0.073	0.109	0.241	0.114
(exports/sales)	(0.219)	(0.256)	(0.330)	(0.262)
	4181	1491	1455	7127
R&D (share of firms)	0.481	0.464	0.693	0.539
	(0.500)	(0.499)	(0.461)	(0.499)
	4631	1744	2563	8938

Table 1 (cont.)

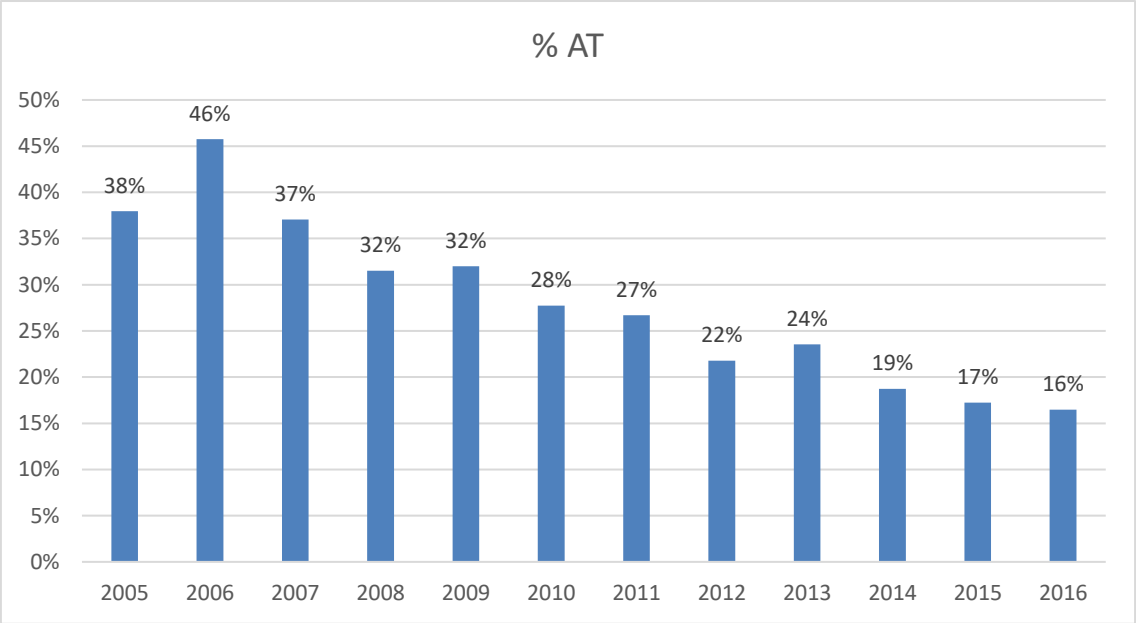
Size	Small	Medium	Big	Total
Training (share of firms	0.546	0.631	0.837	0.646
	(0.498)	(0.483)	(0.370)	(0.478)

	4631	1744	2563	8938
Foreign firms	0.0472	0.1185	0.2084	0.1164
(share of firms)	(0.212)	(0.323)	(0.406)	(0.321)
	2882	1477	2135	6494
Firms that use AT	0.067	0.138	0.224	0.141
(share of firms)	(0.250)	(0.345)	(0.417)	(0.348)
	1723	1083	1589	4395
Number of Imported	15.72	26.63	54.10	32.29
Products	(21.25)	(33.04)	(62.35)	(46.24)
	1723	1083	1589	4395
Number of source	4.33	6.65	9.73	6.85
Countries	(4.12)	(5.26)	(7.25)	(6.16)
	1723	1083	1589	4395
Number of exported	3.45	5.53	7.18	5.68
Products	(5.04)	(9.94)	(6.61)	(7.34)
	864	690	1354	2908
Number of destination	3.05	3.66	9.17	6.04
Countries	(3.49)	(3.78)	(10.48)	(8.17)
Quality of Exports	14.87	543.63	45760	10016
	(717.59)	(12759.11)	(613087.2)	(285738.6)
Quality of Imports	3.232	4.285	5.630	4.424
	(7.0595)	(15.753)	(19.0916)	(14.914)

Source: Own elaboration based on data from the INE y DNA.

In Chart 1 there is the percentage of firms that use the TA regime by year. The highest percentage is in 2006 due to the fact that in that year data was recorded only for the stratum of compulsory firms, which are the biggest ones and have a higher propensity to undertake TA. Moreover, we observe that the share of firms that use the regime present a declining trend over the sample period (Chart 1). This could be due to the reduction of the number of manufacturing firms sampled, and the increase in services firms over the period.

Chart 1: Percentage of firms that use the temporary admission (TA) regime



Source: Own elaboration based on data from the INE y DNA

We estimate total factor productivity (TFP) using different techniques. First, we use Olley and Pakes (1995) methodology, with (lnTFP1) and without (lnTFP3) the Davidon-Fletcher-Powell optimizer. Second, we used the Wooldridge (2009) technique (lnTFP2).

Observing the correlation matrix, we find that TFP obtained from using different techniques are highly correlated with each other. This is in line with the results obtained by Van Biesebroeck (2007) that finds that the use of various methodologies leads to similar results of TFP. We present the results of the impact evaluation techniques for TFP estimated using the Wooldrige methodology.

Table 2: Correlation matrix between different methodologies for TFP estimation

	lnTFP1	lnTFP2	lnTFP3
lnTFP1	1		
lnTFP2	0.9996	1	
lnTFP3	0.9437	0.9349	1

Note: number of observations 7,843; lnTFP1: TFP using Olley and Pakes, lnTFP2: TFP using Wooldridge technique; lnTFP3: Olley and Pakes with the Davidson-Fletcher-Powell optimizer.
Source: Own elaboration

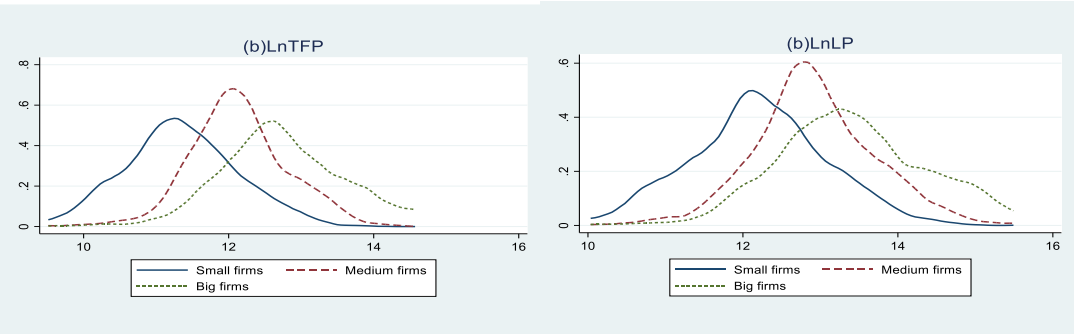
We define labor productivity as value added in constant pesos over total employment at the firm level. The correlation with TFP is quite high (0.96).

We estimate quality of exports and imports following the methodology proposed by Khandelwal et al. (2013), that builds on Khandelwal (2010) who combines information on prices and physical quantities using data from the Customs Direction.

In Chart 2a we present the kernel density function for TFP and labor productivity according to the size category of the firm. In the sample 52 % are small firms (with less

or equal to 50 workers, 20 % are medium sized firms (with 50 to 99 workers) and 28 % big firms (with 100 or more workers). We can observe that bigger firms have a higher TFP.

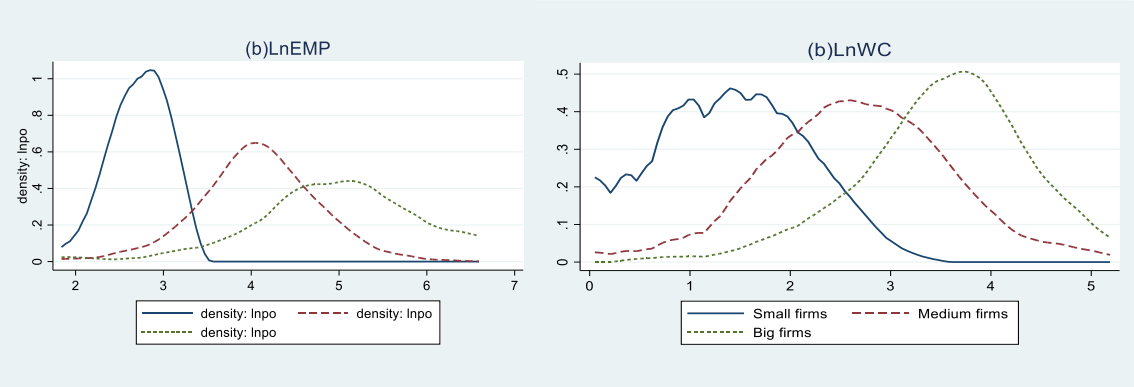
Chart 2a: Kernel Density function for Total Factor Productivity and Labor Productivity (in natural logarithm) and sizes' categories



Source: Own elaboration

A similar picture emerges when we estimate the kernel density function for labor productivity and white collar workers (Chart 2b respectively).

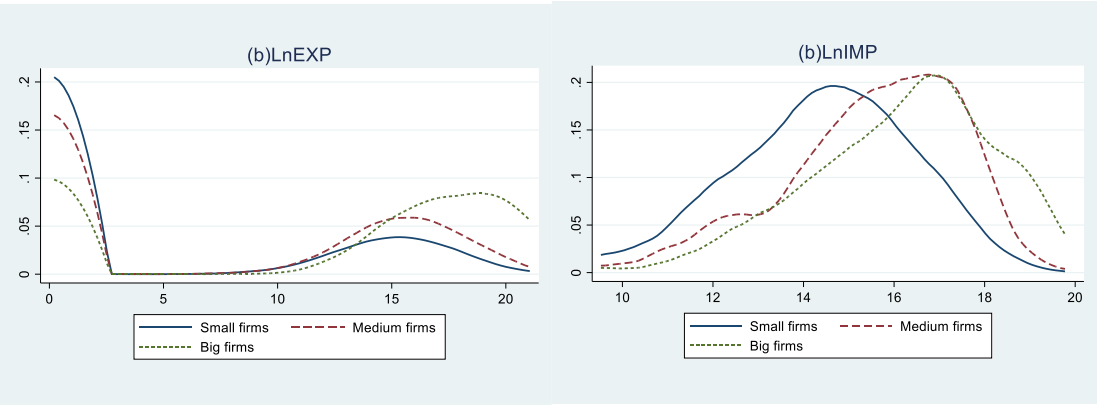
Chart 2b: Kernel density function for white collar workers and sizes' categories



Source: Own elaboration

In Chart 2c we present the behavior of export and imports in logarithms, by categories of firms' size. We observe that for small firms the distribution concentrates more around zero and for big firms more to the right. For imports the distributions is of medium and big firms is towards the right while for small firms towards the left.

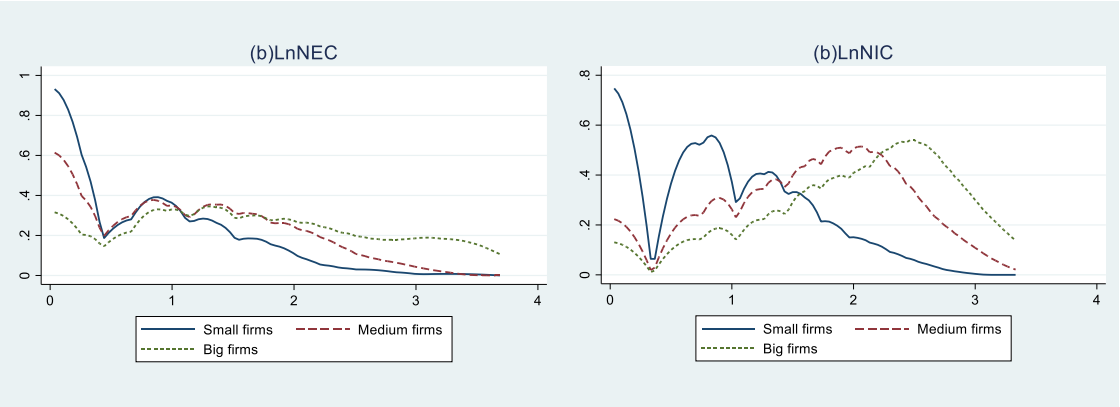
Chart 2c: Exports and Imports by sizes' categories



Source: Own elaboration

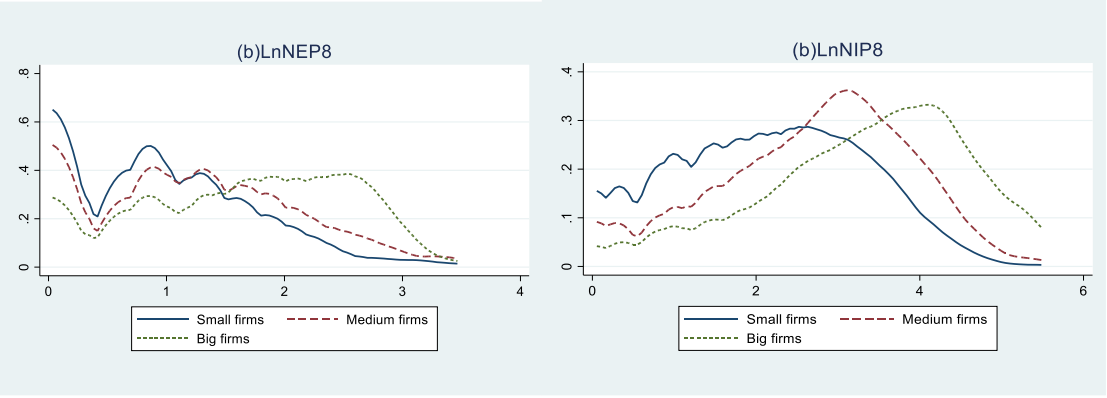
In Chart 2d we observe the diversification of exports and imports by country. Again we observe that small firms concentrates more to the left than medium and big firms. A similar picture emerges when we consider the number of exported and imported products (Chart 2e)

Chart 2d: Diversification of exports and imports by country

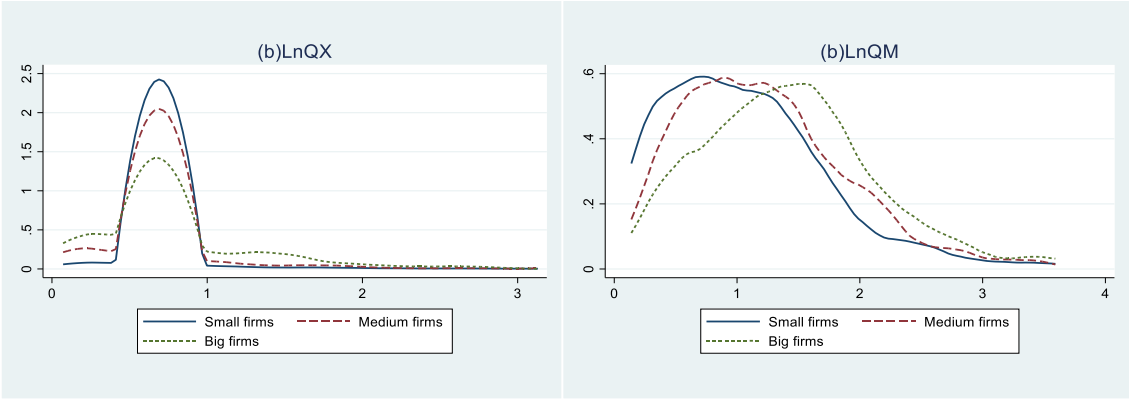


Source: Own elaboration

Chart 2e: Diversification in the number of exported and imported products at 8-digit level



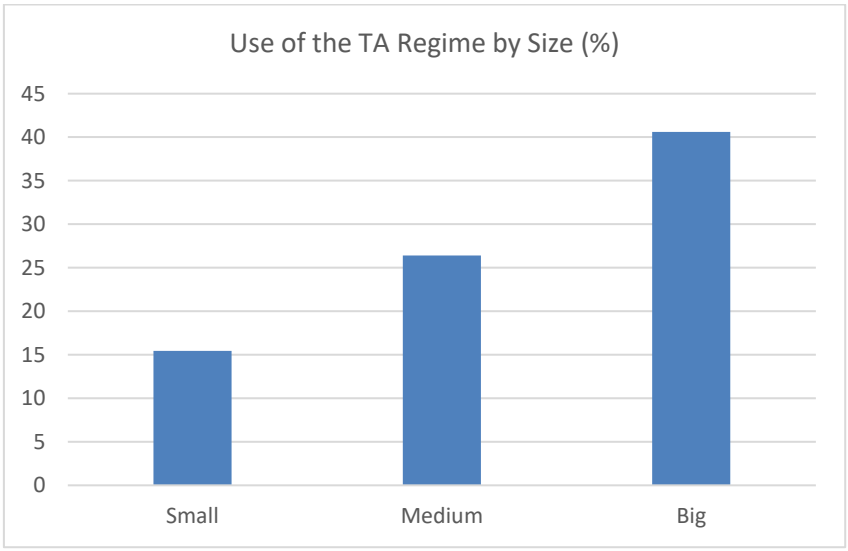
Source: Own elaboration
Chart 2f: Quality of Exported (QX) and Imported Products by size (in logs)



Quality of exported products by size seems to be concentrated to the left and relatively similar among firm size, while quality of imported product is slighter higher for bigger and medium firms compared to small ones.

In Chart 3 we can observe that bigger firms have a higher propensity to undertake TA as commented above. This can be since bigger firms have more skilled workers and social networks which provides information on policies that can be used to benefit themselves.[4]

Chart 3: Firms that use the TA regime according firms' size



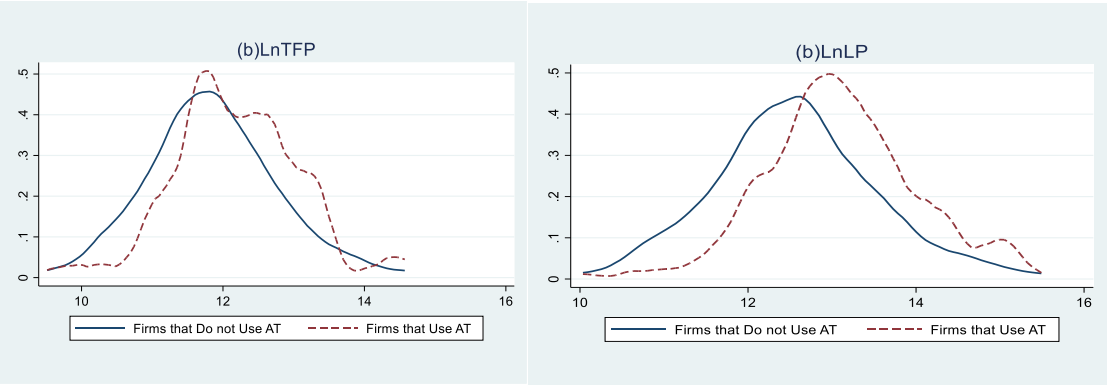
Source: Own elaboration based on data from the INE y DNA.

We also observe some firms' characteristics according to whether they use the TA regime or not.

We find that TFP, LP, employment, exports and diversification is higher for firms that use the TA regime.

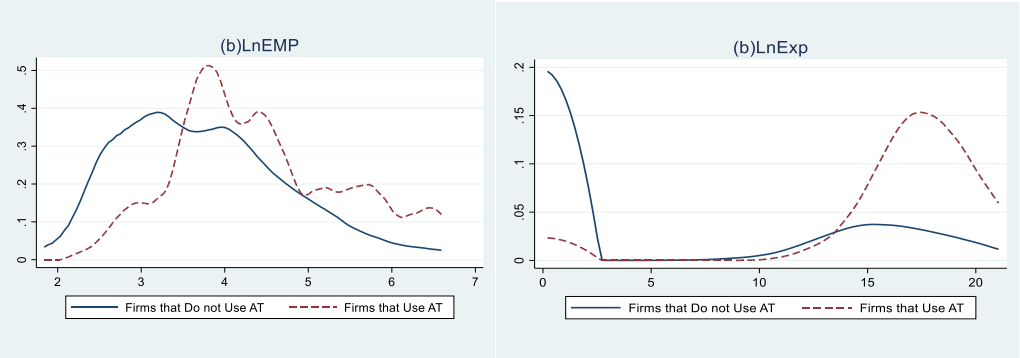
Chart 4a: Kernel density for TFP and labor productivity and use of the AT regime

[4] Small firms are defined as those with less than 50 workers, medium firms with 50-99 workers, and big firms those with more than 100 workers.



Source: Own elaboration based on data from the INE y DNA.

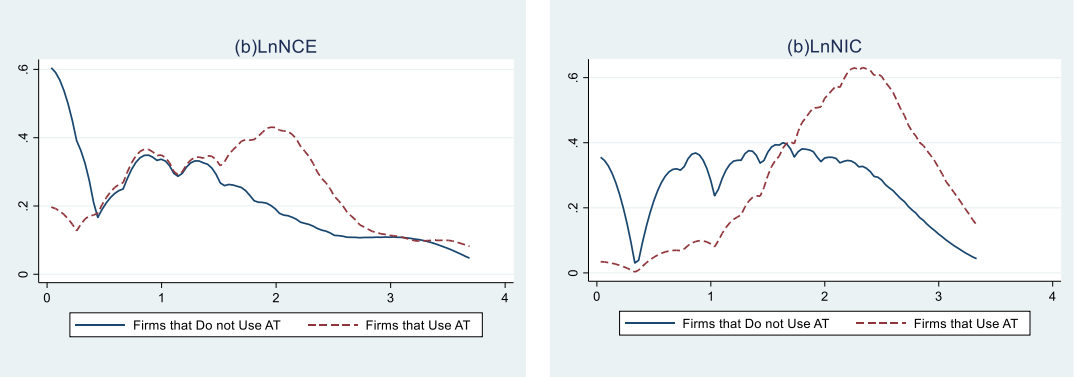
Chart 4b: Kernel density for employment and exports and use of the AT regime



Source: Own elaboration based on data from the INE y DNA.

Additionally, firms that do not use the AT regime concentrates around the level of zero exports.

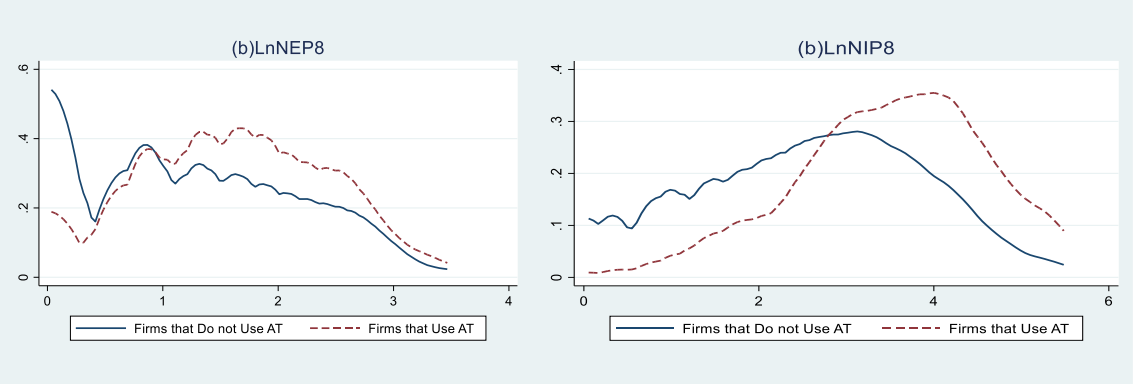
Chart 4c: Kernel density of export and import markets (NCE and NIC respectively) and use of AT regime



Source: Own elaboration based on data from the INE y DNA.

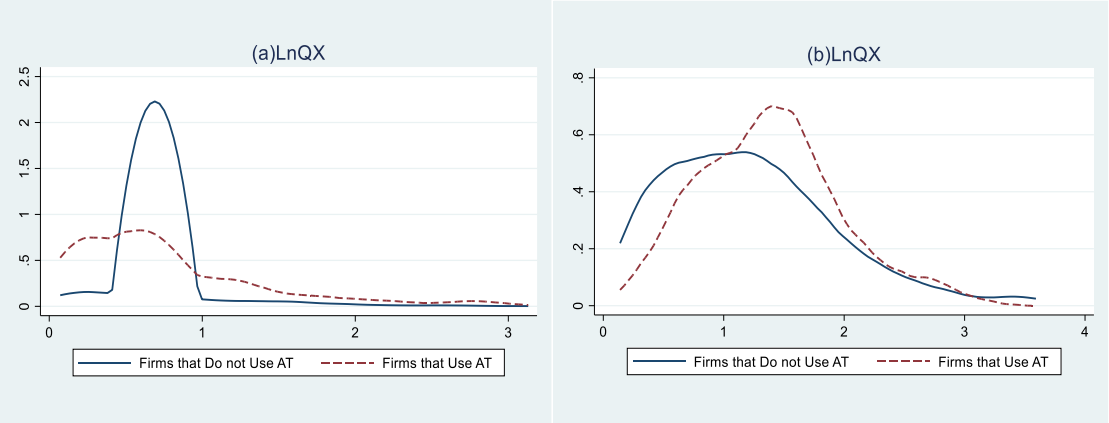
In Chart 4d we present diversification of exported and imported products at 8-digit NCM level.

Chart 4d: Diversification of exported and imported products (NEP and NIP respectively) according to use of TA regime



Source: Own elaboration based on data from the INE y DNA.

Chart 4e: Export (QX) and Import (QM) Product Quality according to the use of TA regime



Regarding quality of exported and exported products in Chart 4e we can observe very slight differences according to the use of TA regime.

Other characteristics of the TA regime has been analyzed using Customs data in the work by Allub et al. (2022). There is a significant heterogeneity between sectors in the use of the regime. Within manufactures of industrial origin, sectors such as land transport equipment, hides and skins, and base metals and their manufactures, make intensive use of this regime, with high coverage and incidence values, while the opposite is observed in the vast majority of the sectors that make up the Manufactures of Agricultural Origin category.

The incidence, which measures the value of inputs imported under the regime over the value exported, was 41% in Argentina and 50% in Uruguay in 2019. This points to the widespread use of this regime by exporting companies and the significant use of imported inputs for these exports.

The availability of information on the origin of inputs and destination of exports also makes it possible to construct measures that characterize the "geography" of the type of participation in chains by firms using these regimes. The most widespread use is by firms that import inputs from countries outside the region and then export goods within the region (Mixed Input-Output Chains), followed by firms that import inputs from the

region to transform and re-export them back to neighboring countries (Regional Value Chains).

Finally, using tariff data, it is possible to calculate the tax incentive provided by the regime. The evidence shows that in sectors such as textiles or land transport equipment, the tax incentive represents between 5% and 6% of the value exported, pointing to the significant barriers to trade faced by these sectors in general.

In the case of Uruguay, an intensive use of the instrument stands out. The transport equipment, plastic materials and hides and skins and leather sectors make almost universal use of the instrument. A high incidence of inputs in the export value of base metals, fats and oils, transport equipment and plastics stands out. In these four sectors, the value of imports exceeds 50% of the total.

Table 3 shows the share of each sector (manufactures of agricultural origin (MOA) and of industrial origin (MOI)) in total exports and the coverage and incidence indicators for exports using the regime. As can be seen, in the MOI the coverage is high and the incidence is also significant, both for the beginning of the period and for the end. In the MOA, both rates are lower, but especially the incidence rate, since the main input used is usually domestic. In Uruguay the use in other non-manufactured goods (e.g. mining and agricultural commodities) is lower but not negligible in magnitude. Uruguay make intensive use of the regime in their foreign trade, especially in manufactures. Nevertheless, the total share is decreasing and currently stands at around 30% of total exports and 75% of Manufactures of Industrial Origin.

Table 3: Sectoral composition of exports and use of the TA regime in 2005 and 2016

	2005			2016		
	Share in total Exports	Coverage	Incidence	Share in total Exports	Coverage	Incidence
Manufactures of Agricultural Origin (MOA)	48%	76%	11%	44%	34%	22%
Manufactures of Industrial Origin (MOI)	24%	87%	49%	17%	73%	43%
Other Goods	28%	45%	8%	39%	15%	15%
Total	100%	70%	22%	100%	33%	28%

Souce: Allub et al.(2022). The year 2016 was provided by A. Lalanne.

In Table 4.1 and 4.2 we show the participation of each origin-destination pair in the total amount of imported goods that are exported in 2005 and 2016 respectively.

Table 4.1: Share of each origin of imports by destination of exports in goods using TA regime. Years 2005. As % of total imports in each year (MOI only)

		Destination						
		Mercosur	Rest of LAC	USA & Canada	EU	Eastern Asia	ROW	Total
Origin	Mercosur	28%	4%	2%	0%	0%	0%	35%
	Resto LAC	1%	1%	1%	0%	0%	0%	14%
	USA & Canada	7%	2%	1%	0%	0%	0%	10%
	European Union	13%	3%	1%	2%	0%	0%	19%
	Eastern Asia	18%	2%	0%	0%	0%	0%	22%
	ROW	5%	3%	0%	1%	0%	1%	10%
	Total	72%	15%	6%	4%	0%	2%	100%

Source: Allub et al. (2022)

Table 4.2: Share of each origin of imports by destination of exports in goods using TA regime. Years 2016. As % of total imports in each year (MOI only)

		Destination						
		Mercosur	Rest of LAC	USA & Canada	EU	Eastern Asia	ROW	Total
Origin	Mercosur	19%	2%	0%	1%	0%	1%	23%
	Resto LAC	2%	0%	0%	0%	0%	0%	3%
	USA & Canada	9%	2%	4%	0%	0%	1%	16%
	European Union	9%	1%	0%	1%	0%	1%	12%
	Eastern Asia	28%	2%	0%	0%	0%	1%	32%
	ROW	10%	1%	0%	1%	0%	1%	14%
	Total	78%	9%	5%	3%	0%	4%	100%

Source: Allub et al. (2022)

In Uruguay, as in Argentina, imported inputs destined for MERCOSUR increased their relative importance, increasing their share from 72% to 83%, in this case at the expense of shipments to the rest of LAC and Europe, which went from 21% to 12%. The importance of Asian inputs has also increased, with their share rising from 22% to 83%, mainly in detriment of Mercosur inputs, which were 35% in 2005 and decrease to 23% in 2016.

4.2 Binary treatment analysis

When considering the treatment as a binary variable, we find that using the regime has a slight negative effect on total factor productivity, and the number of white collars per firm (Table 3). This negative effect on TFP is at odds with the literature on imports and productivity. Nevertheless, there are no significant effects for labor productivity. While for employment, we find no effects on total employment and professionals and

technicians and the share of professionals and technicians and white collars over total employment.

Regarding trade performance, we find that there is a causal effect through which firms that make use of the TA regime outperform those that do not, in terms of the level of exports, export intensity, and number of destinations, and products exported. Moreover, there is a significant positive effect on the number of origins, and number of products imported. Therefore, the policy has a significant impact on the export and import performance of firms. Nevertheless, we did not find any significant effect on the quality of exported and imported products. This may be due to the fact that firms may look for cheaper inputs and not higher quality ones, and that exports are mainly of products with low scope for vertical differentiation.

In Table 1A of the Appendix we present some balancing tests. As we mention above, balancing tests verify the correct performance of the propensity score matching procedure, i.e. after matching the distribution of observable characteristics is not statistically different between the treated and the control group.

Table 5: Average Treatment Effect for the binary treatment (AT) after matching

Outcome	Difference	Observations		
		Treated	Untreated	Total
Total Factor Productivity (in logarithms)	-0,1647***	761	1796	2557
	(0,05)			
Labor Productivity (in logarithms)	-.08013	313	1797	2110
	(0.0605)			
Total Employment (in logarithms)	-0,0288	768	1812	2580
	(0,06)			
Professionals and Technicians (in logarithms)	-0,0118	465	373	838
	(0,12)			
White Collars (in logarithms)	-0,2046**	470	715	1185
	(0,08)			
Share of Professionals and Technicians	0,0074	475	735	1210
	(0,01)			
Share of White Collars	-0,0171	475	735	1210
	(0,02)			
Exports (in logarithms)	7.373***	718	1814	2532
	-0.41			

Export Intensity (Exports/Sales)	0.3674***	768	1812	2580
	(1,80)			
Number of Source Countries	0,3204***	768	1812	2580
	(0,05)			
Number of Destination Countries	0,6686***	686	849	1535
	(0,09)			
Number of Products Imported (8-digit, in logarithms)	0,2303***	768	1812	2580
	(0,08)			
Number of Products Exported (8-digit, in logarithms)	0,4382***	686	849	1535
	(0,08)			
Quality of Exported Products	-0.164	221	1622	1843
	(0,1845)			
Quality of Imported Products	-0.081	227	1425	1653
	(0,0846)			

Notes: Standard deviation in parenthesis.

If we take into account the matching and Difference-in-Differences (MDID) specification (Table 2A of the Appendix), the only significant result is the positive effect the treatment has on the number of countries of destination. Thus, it supports our previous findings on the effect of the policy to improve export diversification.

4.3 Continuous Treatment Effect

Finally, the continuous treatment effect does support our main results regarding the impact of TA on trade performance.

We present a synthesis of the regression results in Table 4 and the corresponding charts for the various outcome variables. In all the models we include as covariates capital intensity in natural logarithms and lagged one period, size measured as total sales of the firms in natural logarithm and lagged one period, average wages in natural logarithms, a dummy equal one if the firm undertakes R&D activities and zero otherwise, a dummy equal one if the firm has more than 10 % of foreign capital, time and industry dummies. Values in pesos were taken to constant values in 2005.

We find not significant effects on TFP, professional and technicians, and white collars. Nevertheless, we observe a negative and significant impact on total employment. Regarding to the share of skilled labor on total employment it is not significant for

professionals and technicians which it shows a slightly positive effect for the share of white collars.

As regards trade performance, we observe that there is an almost linear positive relation between the use of AT and the level of exports and export intensity of the firm, i.e., a more intense use of the regime has a positive effect on the level and the share of sales that are exported, as was to be expected.

Moreover, we find that both the origin and the destination diversification increase at a marginally decreasing rate as a result of importing through the TA regime. This result is consistent with the fact that using this regime reduces the cost of imports, which could broaden the number of countries from where Uruguayan firms import their inputs. Thus, import diversification in terms of countries and products increases up to 30 % of imports by TA but afterwards show a decreasing rate to the use of the regime, i.e. shows a quadratic causal relationship for origin countries and the number of imported products.

Finally, export and import quality shows a different behavior. While increasing the use of TA shows a negative effect on export quality it turns to be positive in the case of imports. This unexpected results could be due to the sectorial heterogeneity, markets of origin of inputs and products. The sectors that use intensively the regime are: plastic, chemical, pharmaceutical and automobile sectors. The plastic sector imports mainly all the inputs without much differentiation and value added, and the value added in the domestically is quite low too. On the contrary the pharmaceutical and automobile industries imports from more diversified sources and add more value added locally (Lanzilotta et al. (2022). Thus, a qualitative and sectoral analysis would help to enlighten this issue.

Table 6: Continuous treatment effect

Outcome	Coef.	SE	t	P>|t|	Obs.
LnTFP	-0.0124	0.0361	-0.34	0.73	2572
LnPO	-0.0754**	0.0390	-1.93	0.05	2596
LnP&T	-0.0734	0.1153	-0.64	0.52	839
LnWC	-0.0741	0.0693	-1.07	0.29	1185
P&T share	0.0126	0.0117	1.08	0.28	1210
WC share	0.0281*	0.0158	1,78	0.08	1210
Ln Exports	8.5708***	0.44310	19.34	0.00	2598
Exports/Sales	0.2591***	0.0158	16.45	0.00	2598
NCI	0.3833***	0.0437	8.77	0.00	2596
NCE	0.3624***	0.0631	5.74	0.00	1539
NPI8	0.3790***	0.0666	5.69	0,00	2596
NPE8	0.2804***	0.0620	4.52	0.00	1539
Ln Export Quality	-0.581***	0.1111	-5.22	0.00	3104
Ln Import Quality	0.163***	0.0548	2.98	0.00	3111

Notes: LnTFP: total factor productivity in natural logarithm, LnPO: Size of the firm measured by the number of total workers, LnP&T: number of skilled workers measured by professional and technicians in log;
LnWC: log of the number of white collars measured by professionals and technicians and employees in non-production activities; P&T share: share of professional and technicians in total employment; WC/L: share of white collar in total employment; LnExp: value of levels in logs; Exports/Sales: export intensity; NCI: number of source/import countries in logs; NCE: number of destination/export countries in logs; NPI8: number of imported products at 8-digit level of NCM in logs; NPE8: Number of exported products at 8-digit level of NCM in logs.

Chart 5: Dose-response function of Total Factor Productivity

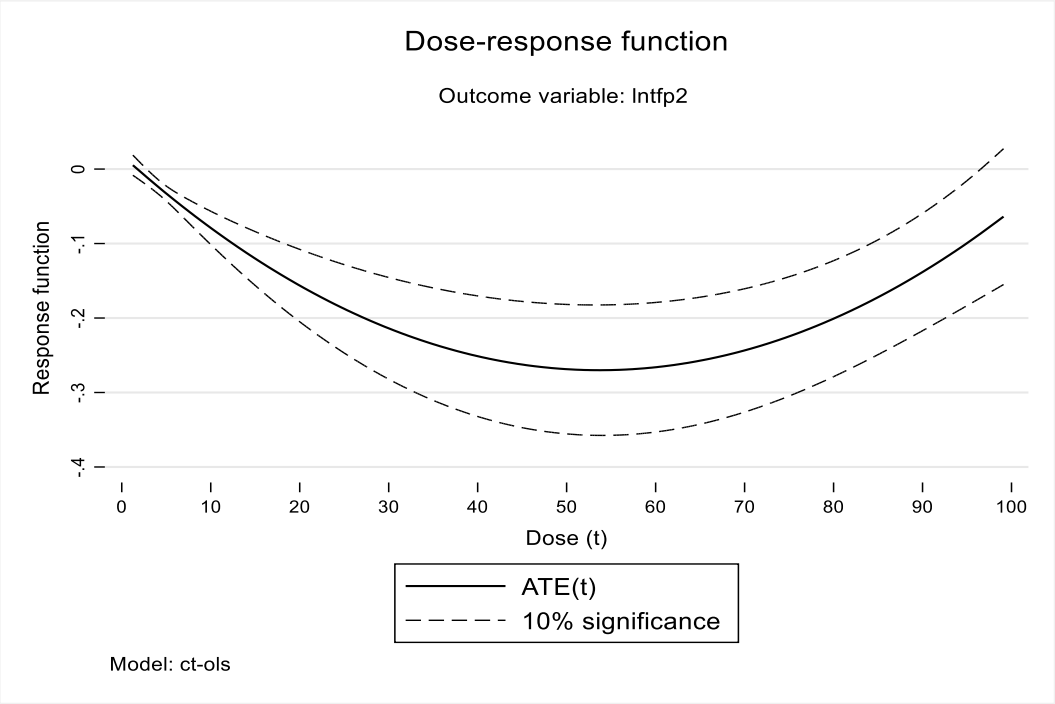


Chart 6: Dose Response Function of Total Workers per Firm

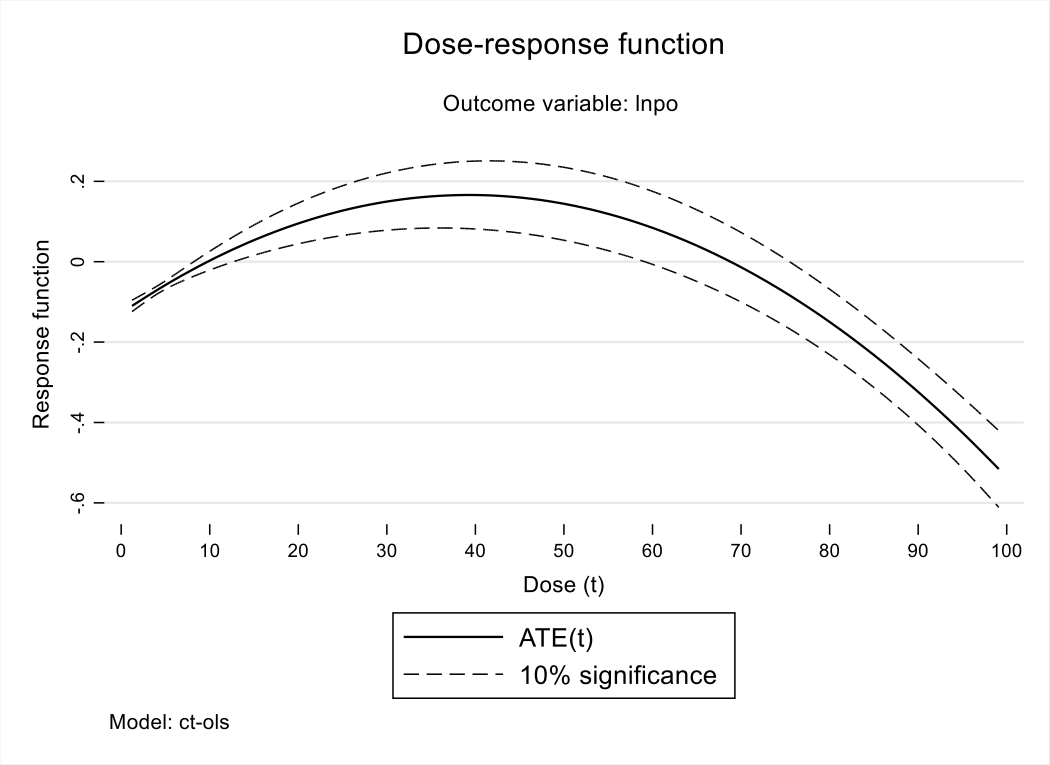


Chart 7: Dose Response Function of the share of white collar in total employment

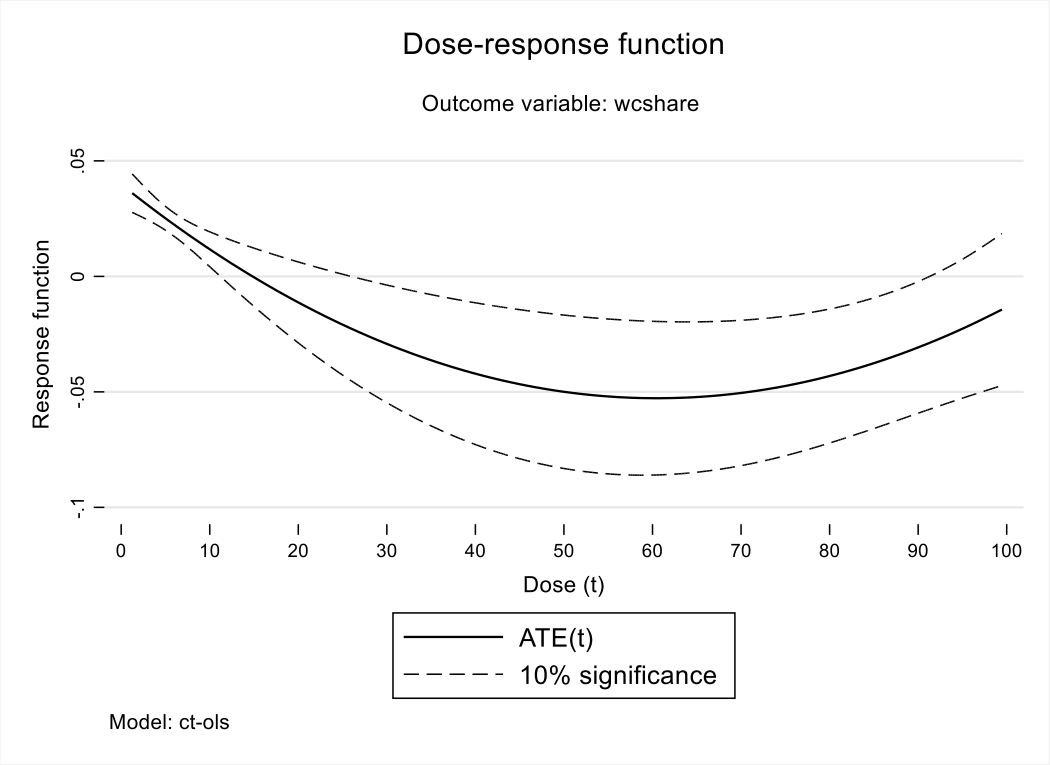


Chart 8: Dose Response Function of the level of exports

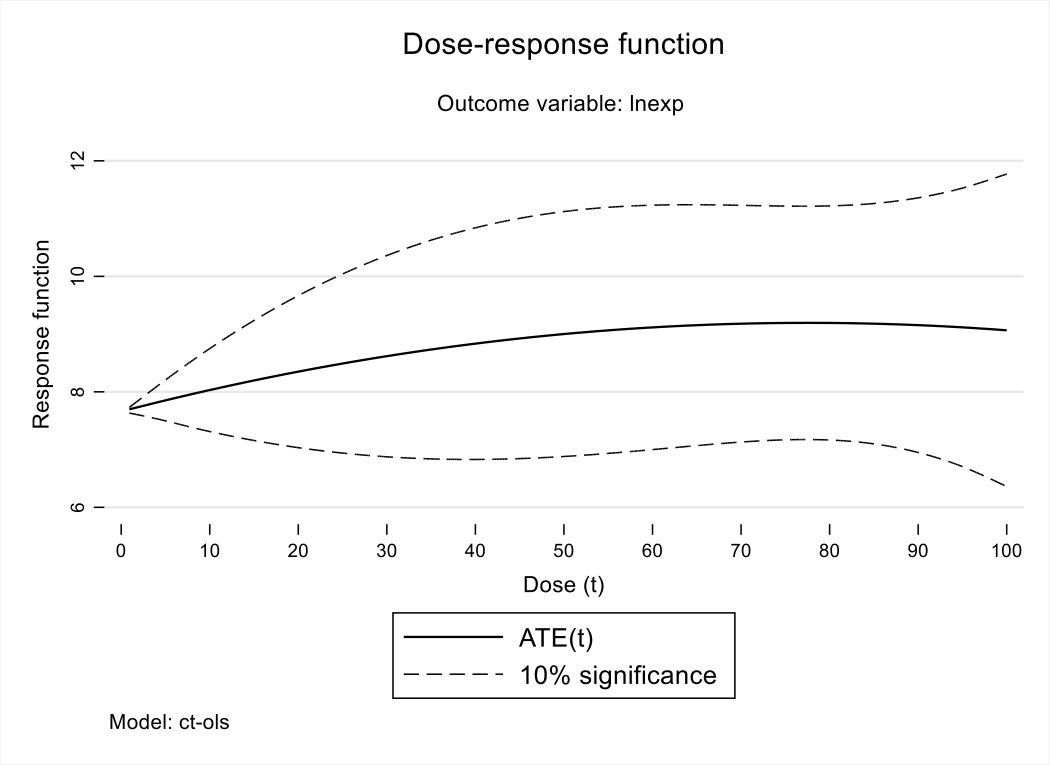


Chart 9: Dose Response Function of Export Intensity

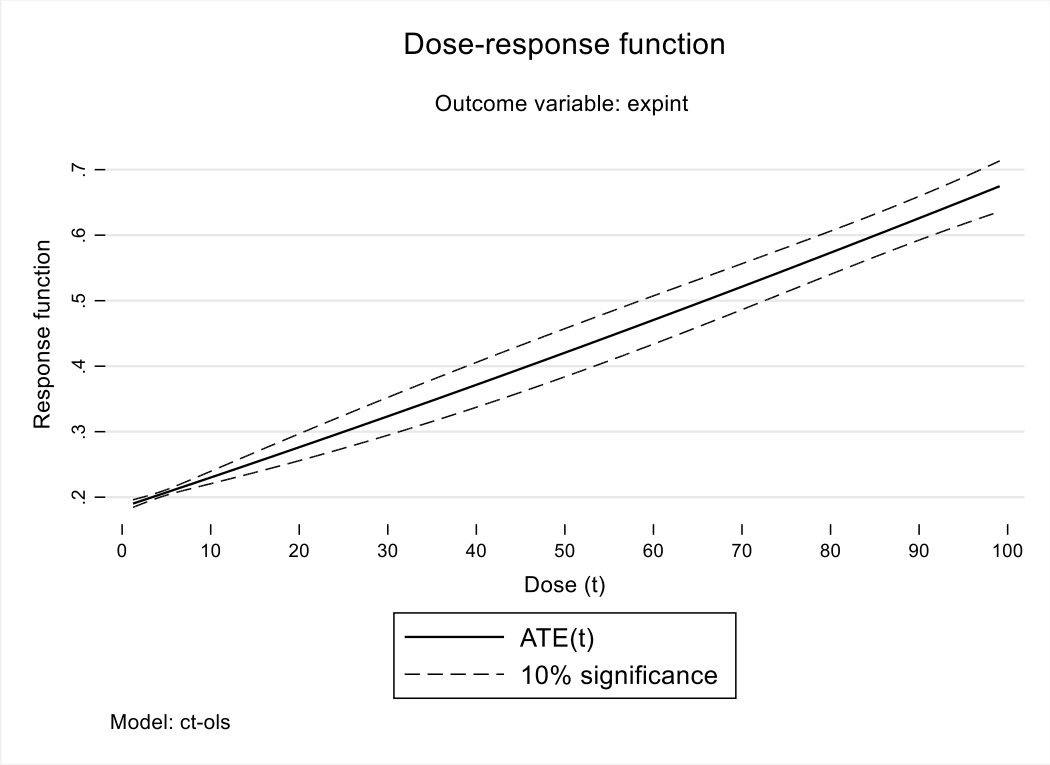


Chart 10: Response Function of the Number of Source Countries

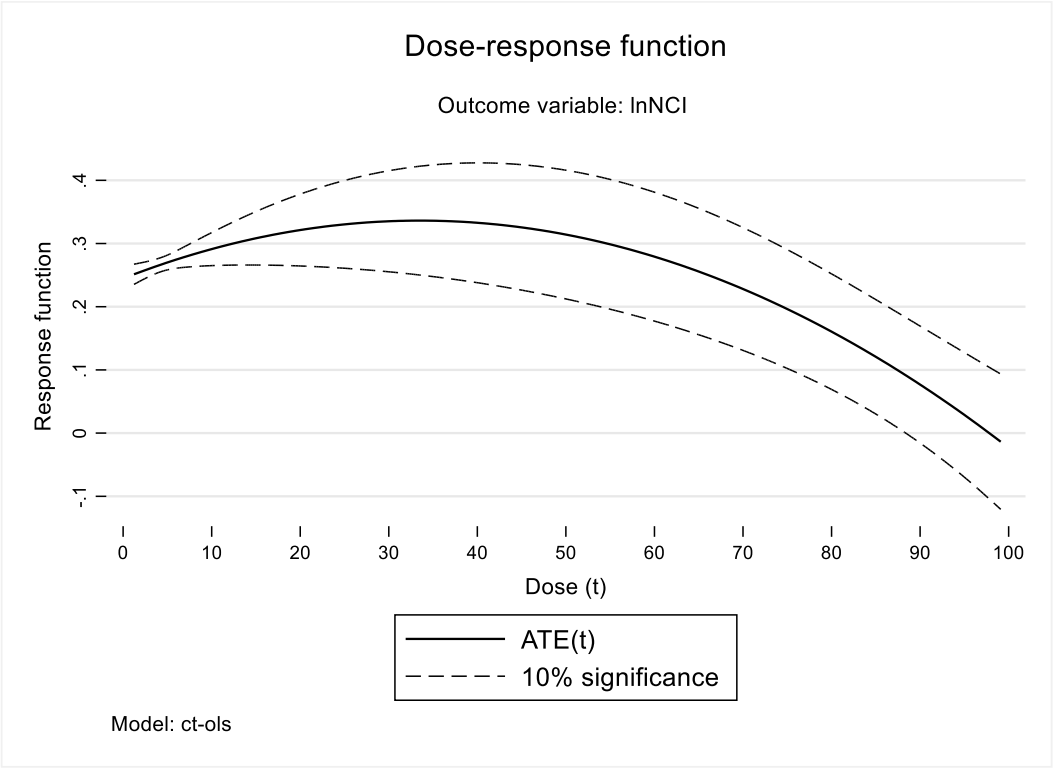


Chart 11: Dose Response Function Number of Destination Countries

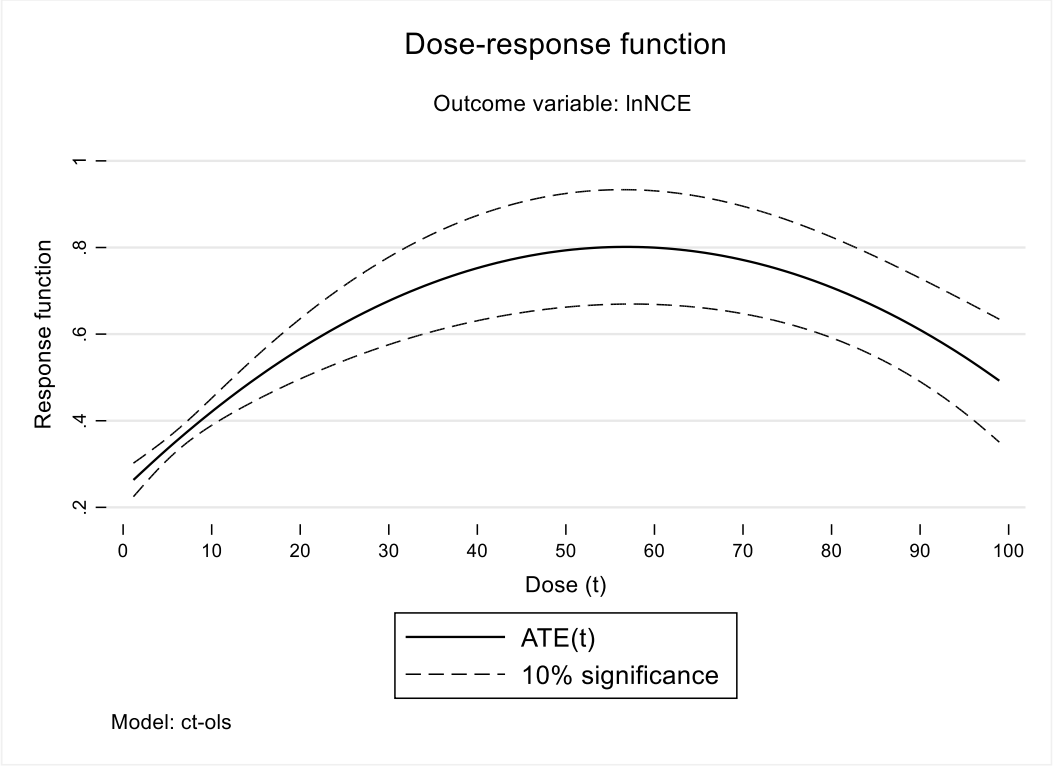


Chart 12: Dose Response Function of the Number of Imported Products (at 8-digit NCM level)

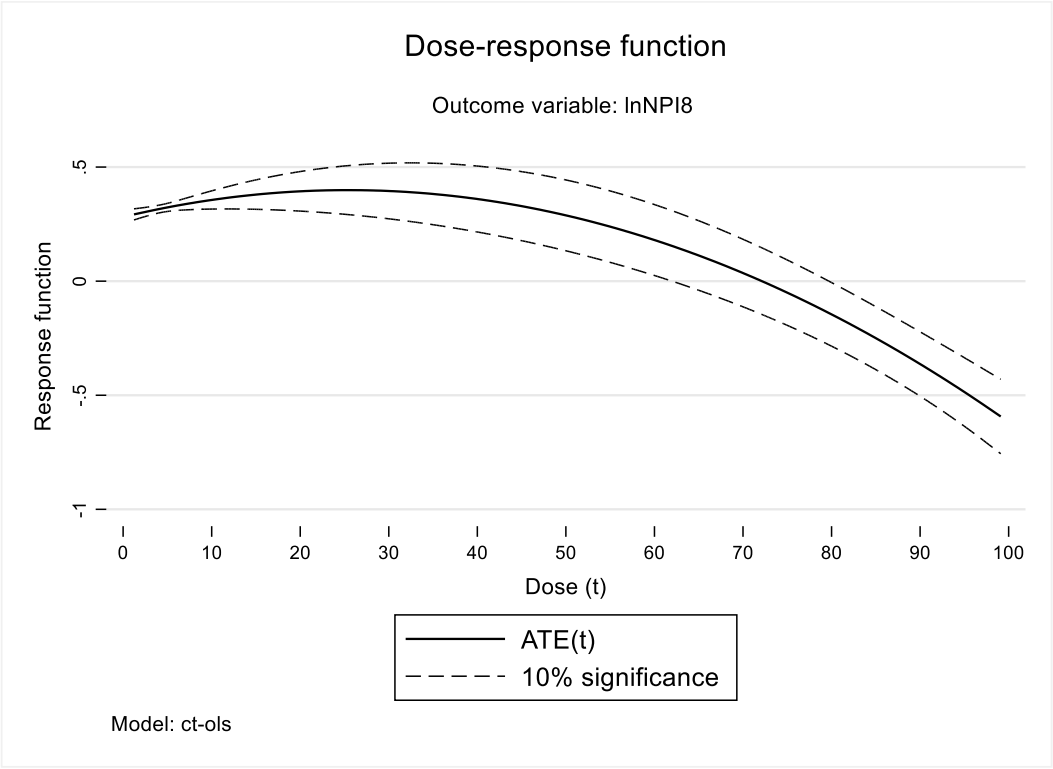


Chart 13. Dose Response Function of Number of Products Exported (at the 8-digit NCM level)

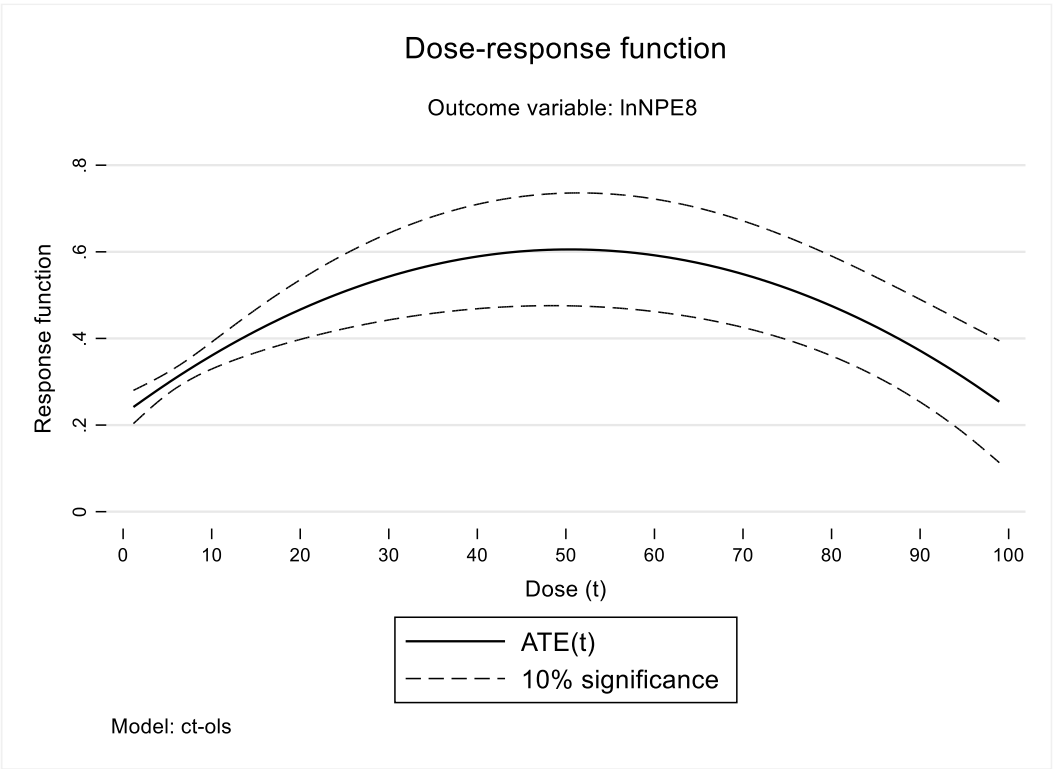


Chart 14: Dose Response Function of quality of exported products

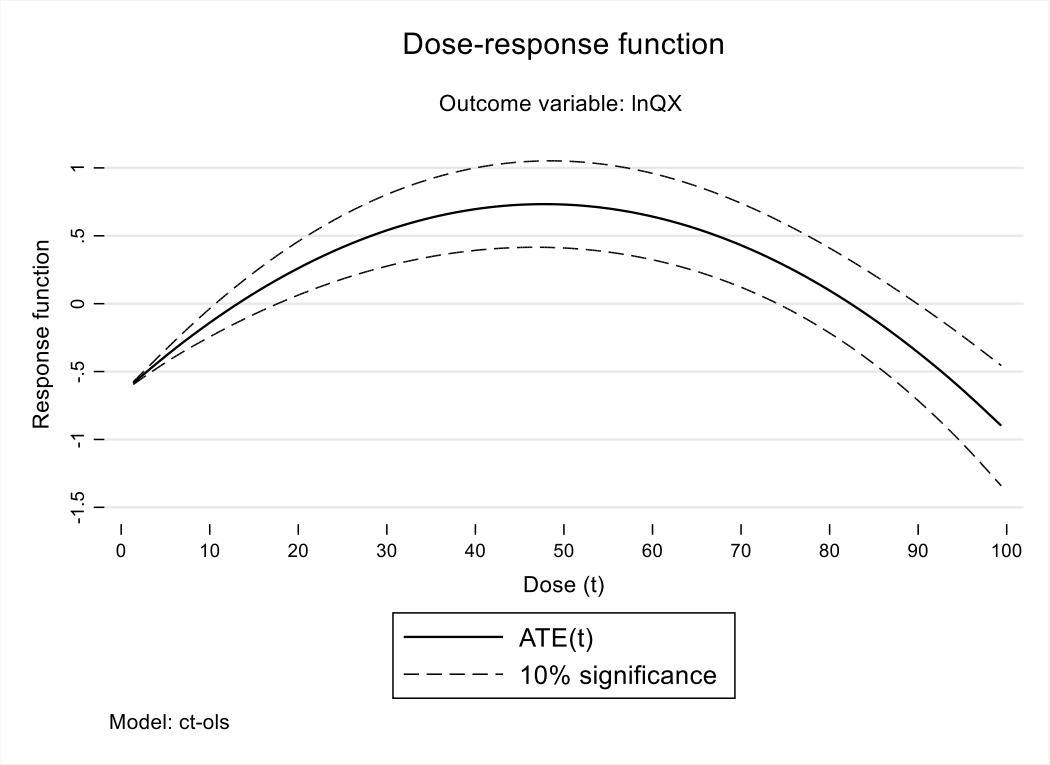
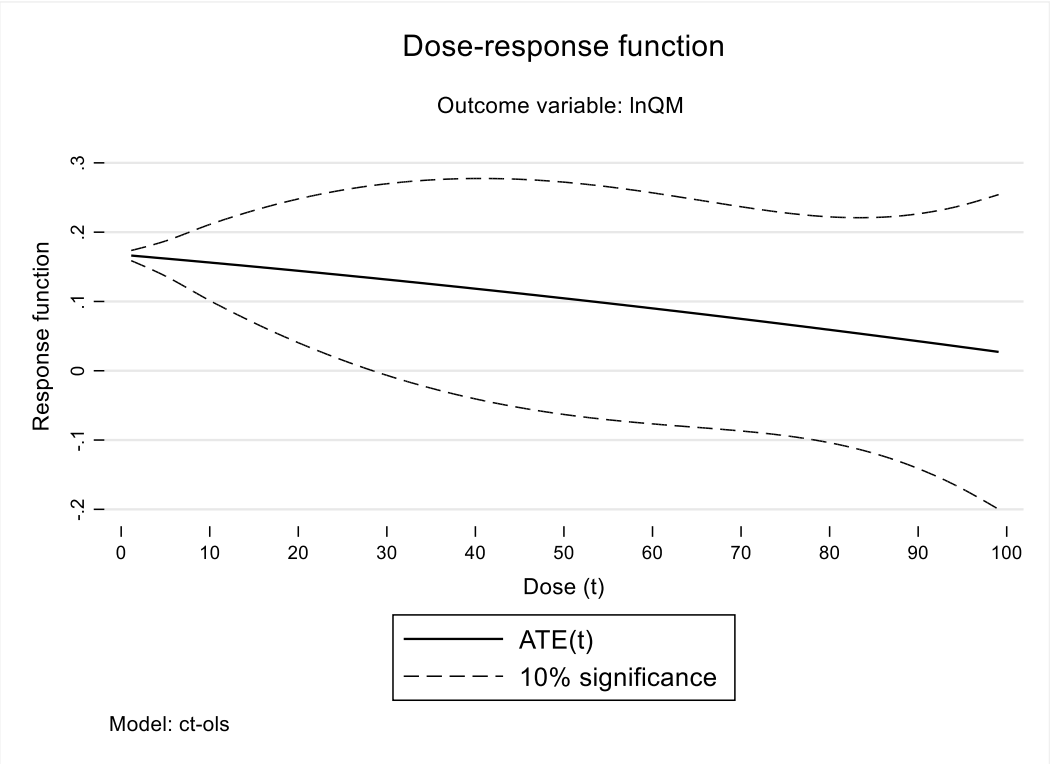


Chart 15: Dose Response Function of quality of imported products



5. Concluding remarks

Our findings show that the TA regime is a successful policy in terms of trade performance. It shows positive effects on the level of exports, export intensity and diversification. Moreover, it impacts also positively imports diversification in terms of the number of products and source countries. Nevertheless, we find mixed results for total factor productivity and for the employment variables considered. As regards total factor productivity further research is in order, since this result is at odds with previous findings for the country in the sense that imports showed a positive impact on firms' TFP. Results for quality are not conclusive.

Summing up, the TA policy can be considered an effective one according to the objectives it aimed at when created, but eventually could reach smaller firms to benefit from it.

Finally, related to previous descriptive findings such as the higher intensity of the TA in bigger firms, the policy recommendation that emerges is design further instrument to ease access to the information of the regime and the procedures to benefit from it to small and micro firms.

In the agenda we propose to dig deeper in the issue of the discrepancy between the results of imports and TA on TFP and on the quality of exports and imports when firms increase the use of the TA regime.

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Appendix

Table A1. Balancing tests for the binary treatment effects.

1) Total Factor Productivity (lnTFP2)

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
LnKL lagged	12.963	12.999	-2.9	-0.58	0.562
LnSize lagged	19.318	19.361	-3.2	-0.59	0.555
lnAvgwage	2596.5	2625.3	-2	-0.31	0.753
RD	0.54318	0.51902	4.8	0.92	0.36
Training	0.79248	0.7726	4.3	0.91	0.361
ET	0.27716	0.28717	-2.6	-0.42	0.674

2) Total Employment per firm

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
LnKL lagged	12.963	12.999	-2.9	-0.58	0.562
LnSize lagged	19.318	19.361	-3.2	-0.59	0.555
LnAvgWage	2596.5	2625.3	-2	-0.31	0.753
R&D	0.54318	0.51902	4.8	0.92	0.36
Training	0.79248	0.7726	4.3	0.91	0.361
ET	0.27716	0.28717	-2.6	-0.42	0.674

3) Professionals and Technicians

	Mean			t-test	
Variable	Treated	Control	% bias	t	p>t
LnKL lagged	12.825	12.841	-1.3	-0.19	0.85
LnSize lagged	19.096	19.154	-4.3	-0.66	0.511
LnAvgWage	2155.7	2097.8	3.9	0.67	0.503
R&D	0.24586	0.20523	8.1	1.41	0.158
Training	0.65012	0.62534	5.3	0.75	0.454
ET	0.28132	0.2718	2.4	0.31	0.757

4) Level of Exports in constant value (in logarithms)

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
LnKL lagged	12.963	12.999	-2.9	-0.58	0.562
LnSize lagged	19.318	19.361	-3.2	-0.59	0.555
LnAvgWage	2596.5	2625.3	-2	-0.31	0.753
R&D	0.54318	0.51902	4.8	0.92	0.36
Training	0.79248	0.7726	4.3	0.91	0.361
ET	0.27716	0.28717	-2.6	-0.42	0.674

5) Export Intensity (exports/sales)

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
LnKL lagged	12.963	12.999	-2.9	-0.58	0.562
LnSize lagged	19.318	19.361	-3.2	-0.59	0.555
LnAvgWage	2596.5	2625.3	-2	-0.31	0.753
R&D	0.54318	0.51902	4.8	0.92	0.36
Training	0.79248	0.7726	4.3	0.91	0.361
ET	0.27716	0.28717	-2.6	-0.42	0.674

6) Number of source/importing countries

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
LnKL lagged	12.963	12.999	-2.9	-0.58	0.562
LnSize lagged	19.318	19.361	-3.2	-0.59	0.555
LnAvgWage	2596.5	2625.3	-2	-0.31	0.753
R&D	0.54318	0.51902	4.8	0.92	0.36
Training	0.79248	0.7726	4.3	0.91	0.361
ET	0.27716	0.28717	-2.6	-0.42	0.674

7) Number of exporting countries

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
LnKL lagged	13.005	13.043	-3.1	-0.59	0.556
LnSize lagged	19.4	19.396	0.2	0.04	0.965
LnAvgWage	2619.3	2722.1	-7	-1	0.319
R&D	0.52656	0.50529	4.3	0.76	0.447
Training	0.77969	0.7538	5.6	1.09	0.274
ET	0.29219	0.25709	9	1.41	0.16

8) Number of imported products at 8-digit NCM level (in logarithms)

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
LnKL(-1)	12.963	12.999	-2.9	-0.58	0.562
LnSize(-1)	19.318	19.361	-3.2	-0.59	0.555
LnAvgWage	2596.5	2625.3	-2	-0.31	0.753
R&D	0.54318	0.51902	4.8	0.92	0.36
Training	0.79248	0.7726	4.3	0.91	0.361
ET	0.27716	0.28717	-2.6	-0.42	0.674

9) Number of imported products at 8-digit NCM level (in logarithms)

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
LnKL(-1)	13.005	13.043	-3.1	-0.59	0.556
LnSize(-1)	19.4	19.396	0.2	0.04	0.965
LnAvgWage	2619.3	2722.1	-7	-1	0.319
R&D	0.52656	0.50529	4.3	0.76	0.447
Training	0.77969	0.7538	5.6	1.09	0.274
ET	0.29219	0.25709	9	1.41	0.16

Notes: LnKL lagged is the lagged value of the log of the capital intensity, LnSize lagged is the log-lagged value of the size of the firm, LnAvgWage is the log of the average wages, R&D is a dummy that indicates whether the firm performs research and development activities, Training is a dummy that indicates whether the firm performs training activities and ET indicates whether the firm is foreign owned i.e. the ownership of foreign capital in total capital is 10 % or higher.