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The Role of Investments in Export Growth: Evidence of a Middle-Income Country

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The Role of Investments in Export Growth: Evidence of a Middle-Income Country

Adriana Peluffo*

Resumen

En este trabajo se sigue la línea reciente de trabajos que vincula innovación, productividad y exportaciones. Se testea la hipótesis de que un aumento en las inversiones favorece la entrada en los mercados de exportación e incrementa el nivel de exportaciones de las firmas que ya están exportando. Los vínculos causales se analizan con técnicas de evaluación de impacto, analizando el caso binario y el continuo para inversiones como variable de tratamiento. El análisis se realiza para un panel de empresas manufactureras uruguayas para el periodo 1997-2008. En la medida de nuestro conocimiento, este es el primer estudio con este enfoque para una economía de América Latina, y en un lapso de tiempo relativamente largo permite identificar a los nuevos entrantes en los mercados exportadores y a las empresas que cambian su comportamiento exportador. Adicionalmente, nuestros datos incluyen información para estimar la productividad total de los factores, incluyen datos sobre I+D y capacitación del personal, lo que permite su inclusión en el modelo. Se encuentra evidencia de que las inversiones tienen una relación causal en la entrada a los mercados de exportación, lo que brinda elementos para el diseño de políticas de promoción de la inversión en lugar de otras políticas de promoción de las exportaciones.

Palabras clave: comercio internacional, inversiones, desempeño exportador

Código JEL: F14, O33, D22

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Abstract

In this work we follow the recent strand of work linking innovation, productivity and exports. We test the hypothesis that a rise in investment favors entrance in export markets and increases exports among previously exporting firms. We address causal links through impact evaluation techniques for observational data. We examine the binary case as well as continuous treatment analysis for investment as treatment. The analysis is conducted for a panel of Uruguayan manufacturing firms for the period 1997-2008. To the best of our knowledge, this is the first study of our approach for a Latin American economy, and the relatively long time span of our data makes it possible a better characterization of new entrants and firms with changing export behavior. Also, our data appears to be richer, including information to estimate total factor productivity, and R&D and training investments, which provide better controls for confounding factors. We find evidence that investments "cause" exports and export orientation, which provides a rationale for carefully designing investment promotion policies rather than focusing on other export support policies.

Palabras clave: international trade, investments, export behavior

Código JEL: F14, O33, D22

1. Introducción

Nowadays, there is a growing literature on export behavior with heterogeneous firms.[1] This large empirical literature using firm and plant-level data, documents that, on average, exporting producers are more productive than non-exporters. A general finding is that this reflects the self-selection of more productive firms into the export market but, in some cases, it may also reflect a direct effect of exporting on future productivity gains. A further possibility is that there is a spurious component to the correlation reflecting the fact that some firms undertake investments that lead to both higher productivity and a higher propensity to export.

Recently, several authors have begun to measure the potential role of the firms' own investments in R&D or technology adoption as a potentially important component of the productivity-export link. Bernard and Jensen (1997), Hallward-Driemeier et al. (2002),. Baldwin and Gu (2004), Aw et al. (2008,), Bustos (2011), Lileeva and Trefler (2010), find evidence from micro data sets that exporting is also correlated with firm investment in R&D or adoption of new technology that can also affect productivity.

Similarly, Atkeson and Burstein (2007), Ederington and McCalman (2008), Costantini & Melitz, (2008), Lileeva and Trefler (2010), and, Aw et al. , (s. f.) [Field] study the impact of firm-level innovation on productivity evolution and exporting over time. Moreover, the works by Yeaple (2005) and Bustos (2011) highlight the link between firm-level exports and hiring Nowadays, there is a growing literature on export behavior with heterogeneous firms.1 This large empirical literature using firm and plant-level data, documents that, on average, exporting producers are more productive than non-exporters. A general finding is that this reflects the self-selection of more productive firms into the export market but, in some cases, it may also reflect a direct effect of exporting on future productivity gains. A further possibility is that there is a spurious component to the correlation reflecting the fact that some firms undertake investments that lead to both higher productivity and a higher propensity to export.

Nevertheless, total physical firm level investments and changes in export behavior have been less studied. Investments in physical assets may help firms to expand capacity and obtain scale economies. Rho and Rodrigue (2012) present and estimate a dynamic model of investment and export decisions with heterogeneous firms for Indonesian manufacturing plants. They study the impact of investments in physical capital on firm-level entry, growth and duration in export markets. These authors find that new exporters invest at higher rates that non-exporters and incumbent firms. New investments allow young exporters to survive longer in export markets while reducing their vulnerability to productivity or demand shocks across markets. They argue that differences in export behavior can account for differences in performance in both domestic and export markets across heterogeneous producers and over time. The policy implication is that costly investment may deter firms from entering and maintaining their presence in export markets.

Thus, the objective of our work is to test the hypothesis that a rise in investment favors entrance in export markets and increases exports among previously exporting firms. We describe the behavior of different types of firms (new entrants into export markets, permanent exporters, switchers, and non-exporting firms). Additionally to the policy relevance of our investigation,

1 For a review see Wagner (2012).

we contribute methodologically to the literature by addressing endogeneity issues arising when we attempt to estimate the impact of asset growth on firm exports.

It is nowadays well established that exporters are larger and more productive than non-exporters (e.g. Bernard et al., 1995; Wagner, 2007), and that most of this difference may be attributed to self-selection of best performers into foreign markets (e.g. Bernard and Jensen, 1999). While the ex-post impact of export entry on firms' growth has been extensively investigated (e.g. Clerides et al., 1998; Wagner, 2002; Girma et al., 2004), less attentions has been paid to the effect of ex-ante firms' growth on the probability of becoming exporters. Since firm's growth is affected by unobservable factors such as managerial choices and profit opportunities, it is difficult to identify its causal effect on export entry. Additionally, firms' investments and employment policies are likely to reflect their strategy with regard to future expansion in foreign markets; hence reverse causality impedes the correct identification of the impact of ex-ante firms' growth on export (Lileeva and Trefler, 2010).

To address the identification issue, we analyze causal links through impact evaluation techniques for observational data. We examine the binary case as well as continuous treatment analysis for investment as treatment. The analysis is conducted for a panel of Uruguayan manufacturing firms for the period 1997-2008.

To the best of our knowledge, this is the first study for a Latin American middle-income economy, and the relatively long time span of our data makes it possible a better characterization of new entrants and export performance. Also, our data appears to be richer, including information to estimate total factor productivity, data on R&D and training of workers, which provide better controls for confounding factors. We find evidence that investments "cause" exports and a rise in exports, which provides a rationale for carefully designing investment promotion policies rather than focusing on other export support policies. The results are of interest to development and trade economists in general, and to policymakers and stakeholders in Uruguay and other countries experimenting with stimuli for investment, innovations and exports.

2. Empirical Strategy

2.1. Methodology

2.1.1. Binary Treatment Effects

We use a matching and difference-in-differences methodology[2] which allows studying the causal effect of investments (the treatment) on firms that enters into export markets and export performance relative to firms that serve exclusively the domestic market. Thus, our aim is to evaluate the causal effect of investment on entry in export markets and export performance-**Y**, where **Y** represents the outcome (starting to export and export performance).

Thus our treatment is firms' investments and we consider different treatment definitions: a) growth in investments, and we generate a dummy equal to one for those firms that increase its investments and zero otherwise; b) defined as a variable equal to one if the firm undertakes investments and zero otherwise (dinv);[3] c) due to the high dispersion in investment across sectors we define a variable that takes the value of one if the firms undertakes investments higher than the industry average and zero otherwise (di). Finally, we define different cut-points

2 Blundell and Costa Dias (2000) present a review of the microeconomic evaluation literature.
3 We note that 40 percent of the observations are firms that do not undertake investments.

for the increase in investments and for the ratio of investments of the firm in relation to average investments in the sector as we explain below.
We perform the analysis for these definitions of the treatment and for various outcome variables: entry in export markets and export performance (export propensity and the value of exports).

The effect of investments is the estimated difference-in-difference of the outcome variable (export behavior) between the treated (firms that invest) and the control groups (firms that do not invest).

Let be the outcome –entry in export, export propensity or the value of exports- for firm *i* in industry *j* at time *t*.

Let investments (DI) where $DI_{it} \in \{0,1\}$ denotes an indicator (dummy variable) of whether firm *i* has received the treatment- and $Y_{i,t+s}^{1}$ is the outcome at t+s, after the treatment. Also denote by $Y_{i,t+s}^{0}$ the outcome of firm *i* had it not received the treatment. The causal effect of the treatment for firm *i* at period (t+s) is defined as: $Y_{i,t+s}^{1} - Y_{i,t+s}^{0}$.

The fundamental problem of causal inference is that the quantity $Y_{i,t+s}^{0}$, 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 investments. The counterfactual is estimated by the corresponding average value of firms that do not have invested. An important issue in the construction of the counterfactual is the selection of a valid control group and to this end me 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 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 X_{it}. We adopt the "propensity score matching" method. To this end, we first identify the probability of undertaking investments (the "propensity score") for all firms, irrespective if they belong to treated or control group by means of a logit model. A firm *k* belonging to the control industries, which is "closest" in terms of its "propensity score" to a firm belonging to the treated group, 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. As Blundell and Costa Dias (2004) point out, a combination of matching and difference-in-difference is likely to improve the quality of non-experimental evaluation studies. The difference-in-difference approach is a two-step procedure. Firstly, the difference between the average output variable before and after the treatment is estimated for firms belonging to the treated group, conditional on a set of covariates **($\mathbf{X}_{it}$)**. However, this difference cannot be attributed only to the treatment since after the firm has received it, the outcome variable might be affected by other macroeconomic factors, such as policies aimed to stabilization of the economy, the real exchange rate and so on. To deal with this, the difference obtained at the first stage is further differenced with respect to the before and after difference for the control group. The difference-in-difference estimator should therefore remove the effects of common shocks and provides a more accurate description of the impact of the investment on export activities.

To estimate the propensity score (i.e. the probability of investing) we use as covariates lagged total factor productivity, lagged capital intensity, lagged size of the firm measure as the number of workers, lagged mark-ups and average wages, a dummy for R&D and a dummy for training activities. In all the cases we tested that the balancing properties were met. Also we note that to analyze entry into export markets we retain for the analysis switchers into export markets and non-exporting firms and dropped permanent exporters. On the other hand to analyze export propensity and the value of exports we consider the full sample (domestic firms, switchers and permanent exporters).

2.1.2. Continuous Treatment Effects

We apply a generalization of the propensity score of Rosenbaum and Rubin (1983) implemented by Bia and Mattei (2008), and Cerulli (2014) for continuous treatment effects. The advantage of using the generalized propensity score is that it reduces the bias caused by non-random treatment assignment as in the binary treatment case. While Joffe and Rosenbaum (1999) and Imbens (2000) have proposed two possible extensions to standard propensity score for ordinal and categorical treatments respectively, propensity score techniques for continuous treatment effect were proposed by Hirano and Imbens (2004).

Similarly to the binary propensity score matching, the generalized propensity score (gps) matching, evaluates the expected amount of treatment that a firm receives given the covariates. Therefore, the estimation of the impact of the treatment is based on the comparison of firms with similar propensity scores. Further, as in the binary treatment, adjusting for the generalized propensity score (gps) removes the biases associated with differences in the covariates. Thus, 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.

Bia and Mattei (2008) and Cerulli (2014) introduce a practical implementation of the generalized propensity score methodology, assuming a flexible parametric approach to model the conditional distribution of the treatment given the covariates, and 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:

$$t \left| X_i \approx F(\ _0 + \ \acute{} _1 X_i , \pm^2) \right.,$$

Where t stands for the treatment and X_i are the covariates.

In order to estimate the causal effect for continuous treatment, firstly we have to estimate the conditional expectation of the outcome, $E\left[Y \left| T = t, R = r \right. \right] = E\left[Y(t) \left| r(t, X) \right. \right] = \quad (t, r)$; estimated 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 (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): $\text{«}(t) = E\left[E(Y(t) \left| r(t, X) \right. \right]$, where $\text{«}(t)$ is the outcome at each level of the treatment in which we are interested.

Thus, 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 $\hat{\alpha}(t)$, which can be defined as the marginal causal effect of a variation of the treatment, on the outcome variable (Y), obtaining so the treatment effect function.

2.2. Data

The analysis is based on an unbalanced panel of Uruguayan manufacturing firms covering the period 1997-2008. The panel data was constructed using data from the IV Economic Census (1997) and the annual Economic Activity Surveys from 1998 up to 2008, carried out by the National Institute of Statistics of Uruguay (INE). The annual surveys include all firms in the formal sector with 50 or more employees and a random sample of those with 5 to 49 employees which introduces a bias towards big firms.

The panel contains annual data on sales (domestic and exports), value added, capital, intermediate inputs, energy, and other expenditures, which were deflated using detailed price indices (base year 1997).[4] It also includes data on employment, R&D activities and training of workers, among other variables. Additionally, we use data from the "product sheets" (available from the same surveys), which contain the value of each firm's sales in domestic and foreign markets.

We have 1,444 different firms present at least in one period, with an average of 672 firms per year and a total of 8,063 firm-year observations.[5]Firms are classified into three categories, according to their export status over the period of analysis: i) non-exporter: firms that never export during all the sample period (830 firms which represents 57.60 percent of total firms and 45 percent of observations), ii) permanent exporters: firms that exports all the years of our TFP observations), and iii) switchers: firms that switched into export markets once or more over the sample period (296 firms representing 20.54 percent of total firms and 29 percent of observations). From the first group of firms –non-exporting firms- a subset is selected as control group by means of propensity score matching.

In Table 1 we present descriptive statistics for the firms in our panel, averaged over the sample period. We observe that exporting firms are larger in terms of output, capital, and labor than non-exporting firms, particularly permanent exporters. They are also more capital intensive, invest more, have a larger share of skilled workers, have a higher propensity to use imported intermediates and undertake R&D and training of workers activities. Permanent exporters are the best performing firms. They show the highest total factor productivity (TFP),[6]gross output, value added, investments, and share of skilled workers.
Furthermore, permanent exporters and switchers use a higher share of imported inputs, are older, have a higher share of firms that perform R&D activities and training of workers.

In Chart 1 we present the kernel densities for TFP, employment, capital/employment ratio and labor productivity. We can observe that that permanent and firms entering foreign markets have a higher TFP, employment, capital intensity and labor productivity than for non-exporting firms.

4 For sales and materials we computed firm-specific deflators as the weighted average of the four-digit ISIC revision 3 price indices corresponding to all items produced/used as inputs each year by the firm.
5 We discarded firms that were only present in the Economic Census, as well as those with no data available from the product sheets.
6 TFP was estimated using various techniques: Olley and Pakes (1996), Levinshon and Petrin (2002), and Ackerberg et al (2006). We find correlations higher than 0.97 for the various measures of TFP.

We also split the sub-sample and analyze the features of switchers that change more than once their export status, and once- time switchers, this is those firms that break into foreign markets and keep exporting. We name this group of firms as "once-time switchers". From Table 1 we can compare some characteristics of all the switchers and once-time switchers. Once-time switchers exhibit similar features than general switchers, but have a slighter small number of workers, while have a higher investment in machinery and equipment, and share of firms undertaking R&D.
It is worth noting that 39.75 percent of the observations do not register investments over the whole sample period while 60.25 percent do invest.

3. Results

3.1. Binary treatment effects

As we commented above to estimate the propensity score (i.e. the probability of receiving the treatment) as covariates lagged total factor productivity, lagged capital intensity, lagged size of the firm measure as the number of workers, lagged mark- and average wages, a dummy for R&D, a dummy for training activities and time dummies. As outcome variables we analyze switching into export markets and export performance. To analyze switching into export markets we consider only non-exporting firms and switching firms, while to analyze export propensity we take the whole sample (permanent exporters, switchers and non-exporting firms).

As treatment variable we try investments as a binary variable defined in various ways as we comment above: firms that increase investments (ginv),[7] firms that undertake investments (dinv=1) and those that do not (dinv=0), and also we define the average level of investment for the various sector at the three level digit and calculate the ratio between the level of investment of the firm in relation to the average of the sector. If this ratio was higher than one we compute the value of one for the firm (di=1) and if the value was below the average of the sector we compute a zero (di=0).

From the logit model we observe that lagged productivity, lagged employment, undertaking R&D activities and training of workers have a positive effect on the probability of investing (dinv), of increasing investments (ginv) and investing more than the average of the industry (di). Capital intensity has a positive impact on investing (dinv) and investing more than the average of the industry (di) but not on the increase of investments (ginv). On the other hand, lagged mark-ups are negatively significant for growth in investments (ginv) only, and lagged average wages is negatively significant only for investing more than the average of the industry (di). Results are presented in Table 2.1.

Firstly, we perform matching and double-difference estimation without using the panel structure, i.e. we estimate the propensity score and run a regression in double differences on the common support. We report the results in Table 2.2 for the treatments *ginv, dinv,* and *di***,** and switching into the export market as our outcome variable. We find that for all the treatment variables investments do cause switching into exports markets with a higher effect for *di*, i.e. for those firms that invest more than the average of the sector in which the firm has its main activity. The effect of firms' investments on entry in foreign markets could be pointing out to active and deliberate efforts to enter into export markets (Fernandes and Isgut, 2009). These

[7] For permanent exporters ginv is of 0.44 (44 percent), for switchers into exporting of 0.39 (39 percent), and for non-exporting firms the figure falls to 0.28 (28 percent).

results are also in line with the idea of "build-in capacity" to enter into foreign markets (Rho and Rodrigue, 2014).

We also try alternative definitions for the ratio of investments of the firm in relation to the average investment of the industry[8] using various cut-off points: i) firms with an investment ratio in relation to the industry equal or greater than 0.05 (di1); b) firms with an investment ratio equal or greater than 0.10 (di2); c) firms with an investment ratio equal or greater than 0.15 (di3); d) firms with an investment ratio equal or greater than 0.20 (di4). We present the results in Table 2.2.1. We find positive and significant effects of the various cut-off points on entry into export markets while there are not significant effects on export propensity. Nevertheless, when we analyze the value of exports as outcome variable, we find positive and significant effects of the ratio of investments on this variable.

Also we try as treatment the rate of growth of investments taking different cut off points: an indicator variable equal to one if growth in investments is non-zero (gri1), a dummy equal to one if growth in investments is greater than 0.10 (gri2), a dummy equal one if growth in investments is greater than 0.15 (gri3), and a dummy equal one if growth in investments is greater than 0.20 (gri4). In Table 2.2.2 we present the results. We find increasing effects on starting to exports the higher the cut-off point for the rate of growth in investments, but not significant effects for export share. Furthermore, we report the balancing tests in Tables 2.3.1 to 2.3.3. The balancing tests verify the correct performance of the propensity score matching procedure (after matching, the distribution of observable characteristics is not statistically different between the treated and control groups). For brevity reasons we do not report the results for the sector and time dummies.

When we consider export propensity, i.e. the share of exports in total sales, as outcome variable (Table 2.2, column 2), we find also positive and significant effects of the treatment variables considered –non-zero growth in investments, undertaking investments and investing more than the average of the sector-.

Thus, the big picture that emerges is that investments do cause entry into export markets and a rise in exports.

3.2. Continuous treatment effects

For the continuous treatment effects we focus on the analysis of continuous outcome variables (export propensity and the value of exports). Firstly, we use the Stata program developed by Bia and Mattei (2008). Since our previous treatment variables are non-normal we use the level of investment over capital as treatment and we applied a zero skewness Box-Cox transformation (bcskew0) and a quadratic regression type. Results are reported in Table 3 and Chart 1. Observing the dose response we find increases in export propensity up to 0.6 and a fall after that figure. The treatment effect chart shows the negative effect of investments/capital on export share beyond 0.60.

Then we apply the new Stata program developed by Cerulli (2014) which has the advantage of addressing non-normal distribution of variables. We analyze the effect of investments levels on export share and the value of exports. As covariates we use lagged total factor productivity, lagged capital intensity, lagged size of the firm measure as the number of workers, lagged mark-ups, and a dummy for R&D and for training activities.

[8] Firms that invest more than the average of the industry to which they belong are in the upper 90th percentile.

We find a significant positive effect of investments on export share (Table 4). Nevertheless, observing the Dose Response Function (DRF) we find a non-linear behavior, with a maximum around 10 per cent, declining afterwards, and again raising at 60 per cent (See Chart 2).
Regarding the effect of investments on the value of exports we find also a positive significant effect (Table 5), with an increasing effect over the whole range of the treatment (Chart 3) with a small spike at 20 per cent, and an important raise after 50 per cent approximately.

4. Concluding Remarks

We find that investments had a positive effect on entry in exports markets, export propensity and the level of exports. Thus, there is some evidence that investments precede exports indicating a deliberate an active effort of the firm to break into foreign markets and to build-in capacity.
For the continuous treatment effect we find a positive effect of investments on export propensity and also on the value of exports. While for export propensity the results show a non-linear effect, the value of exports tend to be increasing on investments.

Thus, we find evidence that investments "cause" exports and export orientation, which provides a rationale for carefully designing investment promotion policies rather than focusing on other export promotion policies such as subsidies. The results are of interest to development and trade economists in general, and to policymakers and stakeholders in Uruguay and other countries experimenting with stimuli for investment, innovations and exports.

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Annex

Table 1: Descriptive Statistics, averages 1997-2008[a]

	All	Permanent Exporters	Switchers into Exports	Once-time switchers	Non-Exporters
Total Factor Productivity	9.965	10.236	10.097	10.170	9.702
	(0.989)	(1.09)	(0.903)	(110.569)	(120.808)
Output	74.049	188.026	50.411	50.994	21.608
	(244.942)	(416.643)	(96.382)	(77.094)	(84.072)
Value Added	32.786	76.463	25.174	25.393	11.748
	(144.718)	(245.166)	(63.195)	(23.207)	(23.441)
Capital (Bmaq2)	12.865	33.89	8.755	8.249	3.029
	(103.532)	(196.177)	(19.975)	(71.097)	(65.298)
Investment in machinery	1.661	4.356	1.184	1.352	0.368
and equipment	(10.454)	(18.413)	(6.824)	(9.069)	(2.709)
No. of workers	81.668	164.943	72.396	67.578	38.147
	(151.849)	(251.577)	(76.376)	(0.077)	(0.042)
Share of P&T (skill)	0.024	0.041	0.03	0.036	0.011
	(0.061)	(0.079)	(0.063)	(0.876)	(1.766)
Capital intensity	10.303	11.06	10.689	10.519	9.56
	(1.735)	(1.45)	(1.49)	(0.196)	(0.911)
Export propensity	0.16	0.505	0.084	0.079	0
	(0.296)	(0.344)	(0.196)	(0.355)	0
Share of imported inputs	0.261	0.419	0.353	0.305	0.103
in total inputs	(0.355)	(0.382)	(0.37)	(0.807)	(0.247)
Price-cost margin	-0.071	-0.237	0.098	0.213	-0.083
	(10.687)	(19.161)	(2.484)	(17.077)	(5.761)
Age	27.289	30.484	30.594	29.267	23.228
	(17.16)	(18.173)	(17.277)	(0.262)	(15.525)
Expenditures in R&D	0.052	0.117	0.041	0.052	0.019
	(0.329)	(0.417)	(0.351)	(1.508)	(0.22)
R&D	0.124	0.224	0.144	0.185	0.051
	(1.498)	(2.041)	(1.604)	(0.126)	(0.853)
Expenditures in training	0.389	0.773	0.443	0.043	0.125
of workers	(0.471)	(0.496)	(0.494)	(0.499)	(0.341)
Training	0.331	0.564	0.42	0.332	0.135
	(0.317)	(0.455)	(0.22)	(0.329)	(0.26)

Notes:
[a] Standard deviations in parentheses
[b] Millions of constant Uruguayan pesos
[c] Total employment (number of employees)
[d] Professionals and technicians over total employment

Chart 1: Kernel densities by firm export status

Chart 1.1: Total Factor Productivity by firm export status

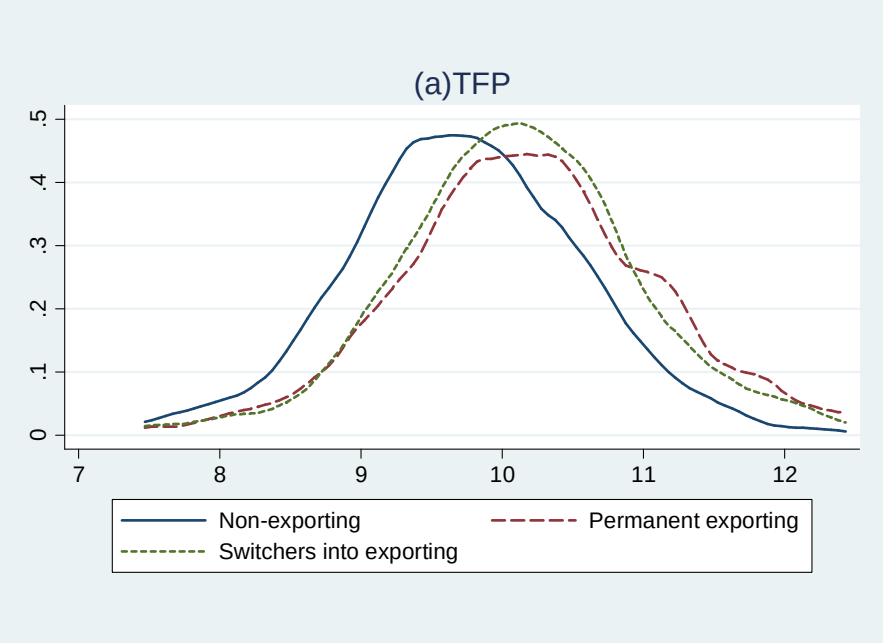


Chart 1.2: Employment by firm export status

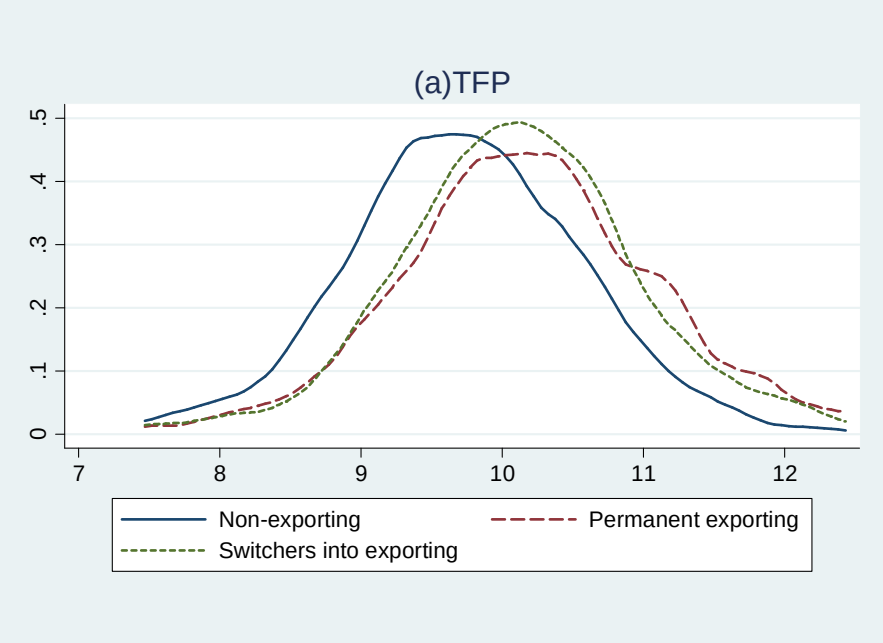


Chart 1.3: Capital/Labor ratio by firm export status

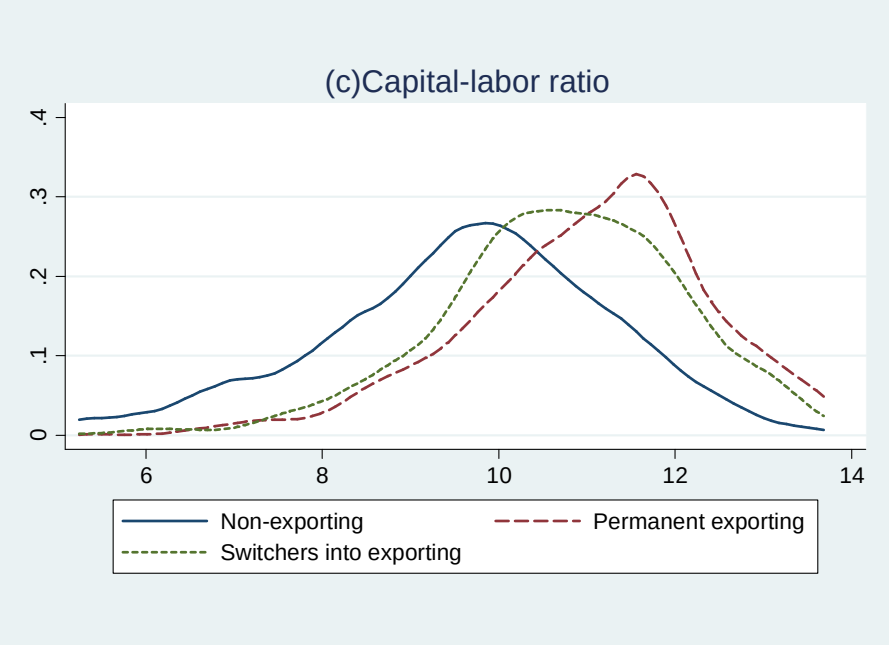


Chart 1.4: Labor productivity by firm export status

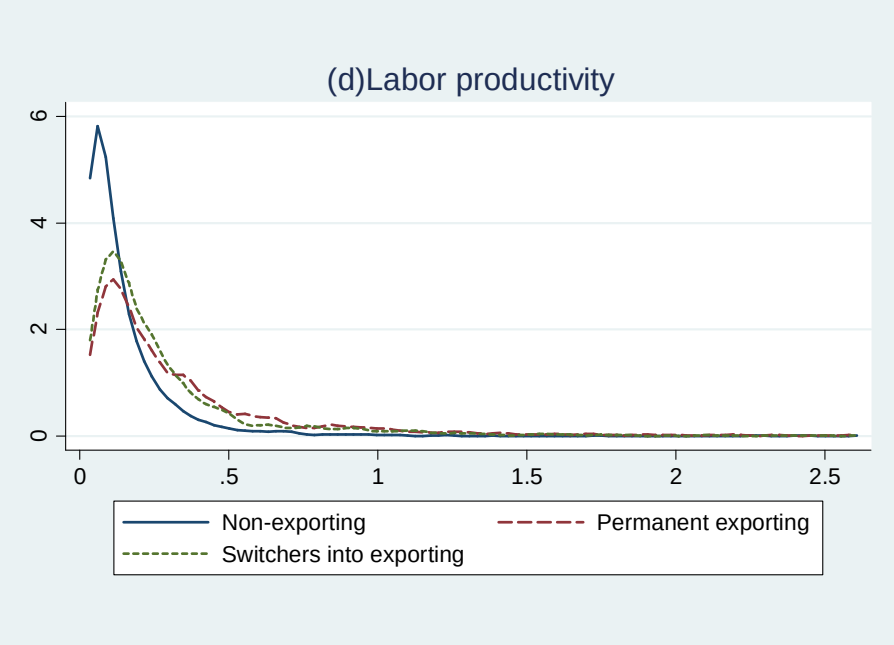


Table 2.1: Results of the logit model

	ginv	dinv	di
Lagged mark-ups	-0.034	-0.031	0.004
	(0.020)*	(0.020)	(0.082)
Lagged TFP	0.167	0.136	0.354
	(0.064)***	(0.066)**	(0.121)***
Lagged Employment	0.139	0.469	0.900
	(0.046)***	(0.049)***	(0.075)***
Lagged capital intensity	-0.030	0.226	0.577
	(0.024)	(0.025)***	(0.050)***
Lagged average wages	0.068	-0.083	-0.336
	(0.078)	(0.079)	(0.141)**
Dummy R&D	0.280	0.345	0.412
	(0.117)**	(0.141)**	(0.159)**
Dummy Training	0.417	0.733	0.399
	0.088	(0.096)***	(0.130)***
Industry dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes

*** p<0.01, ** p<0.05, * p<0.10; ginv: dummy equal one for firms that increase their investments; dinv: dummy equal one for firms that undertake investments; di: dummy equal one for firms with a level of investment higher than the average at the 3-digit level.

Table 2.2: Binary treatment (ginv, dinv and di) on entry into export markets and export propensity

	Outcome	
Treatment	Entry into exports	Export propensity
Growth in investments (ginv)	0.023	0.029
	(0.015)*	(0.008)***
Undertake investments(dinv)	0.026	0.071
	(0.016)*	(0.007)***
Investments higher than the industry (di)	0.055	0.148
	(0.027)***	(0.010)***

*** p<0.01, ** p<0.05, * p<0.10; ginv: dummy equal one for firms that increase their investments; dinv: dummy equal one for firms that undertake investments; di: dummy equal one for firms with a level of investment higher than the average at the 3-digit level.

Table 2.2.1: Binary treatment (rate of investments/average investment in the industry)

	Outcome		
Treatment	Entry into exports	Export propensity	Exports (a)
di1	0.0459	0.019	36.24
	(0.017)***	(0.011)	(4.66)***
di2	0.057	0.017	40.61
	(0.018)***	(0.011)	(5.22)***
di3	0.060	0.02	45.69
	(0.019)***	(0.011)	(5.74)***
di4	0.051	0.015	48.42
	(0.020)***	(0.012)	(6.18)***

(a) In millions of constant pesos; di1: firms with an investment ratio in relation to the industry equal or greater than 0.05; di2: ratio equal or greater than 0.10 ; di3: ratio equal or greater than 0.15; di4: ratio equal or greater than 0.20. *** p<0.01, ** p<0.05, * p<0.10

Table 2.2.2: Binary treatment (rate of growth of investments) on entry into export markets and export propensity

	Outcome	
Treatment	Entry into exports	Export propensity
gri1	0.02	0.005
	(0.015)**	(0.009)
gri2	0.025	0.004
	(0.015)**	(0.009)
gri3	0.025	0.0078
	(0.015)**	(0.009)
gri4	0.031	0.008
	(0.015)**	(0.009)

Gri: dummy equal one if the rate of growth in investments is greater than zero; gri2: dummy equal one if the rate of growth in investments greater than 0.10; gri3: dummy equal one if the rate of growth in investments greater than 0.15; gri4: dummy equal one if the rate of growth in investments greater than 0.20. *** p<0.01, ** p<0.05, * p<0.1

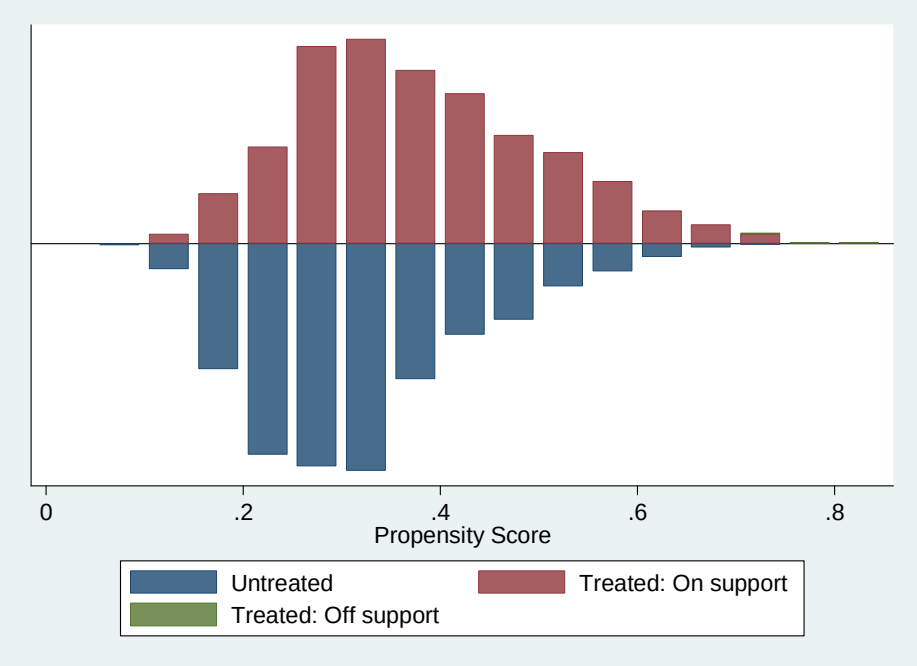
2.3: Balancing tests

2.3.1: Balancing tests for growth in investments (ginv)

	Mean		t-test		
Variable	Treated	Control	%bias	t	p>t
leeva	0.11411	0.14525	-1	-0.37	0.713
ltfp	10.026	10.016	1.1	0.32	0.751
lpo	3.8015	3.8057	-0.4	-0.12	0.907
lkint	10.271	10.302	-1.8	-0.48	0.629
law	11.172	11.163	1.2	0.35	0.73
rd	0.14674	0.14021	1.8	0.49	0.622
training	0.40014	0.39135	1.8	0.47	0.635

Leeva: lagged markups; Ltfp: lagged total factor productivity; lkint: lagged capital intensity; lpo: lagged size of the firm measure as the number of workers; law: average wages, rd: dummy equal one for firms that undertake R&D activities; training: dummy equal one for firms that undertake training activities for their workers. Time and industry dummies not reported. N treated: 1397; N control: 2723 (on support).

Histogram of the propensity score by treatment status

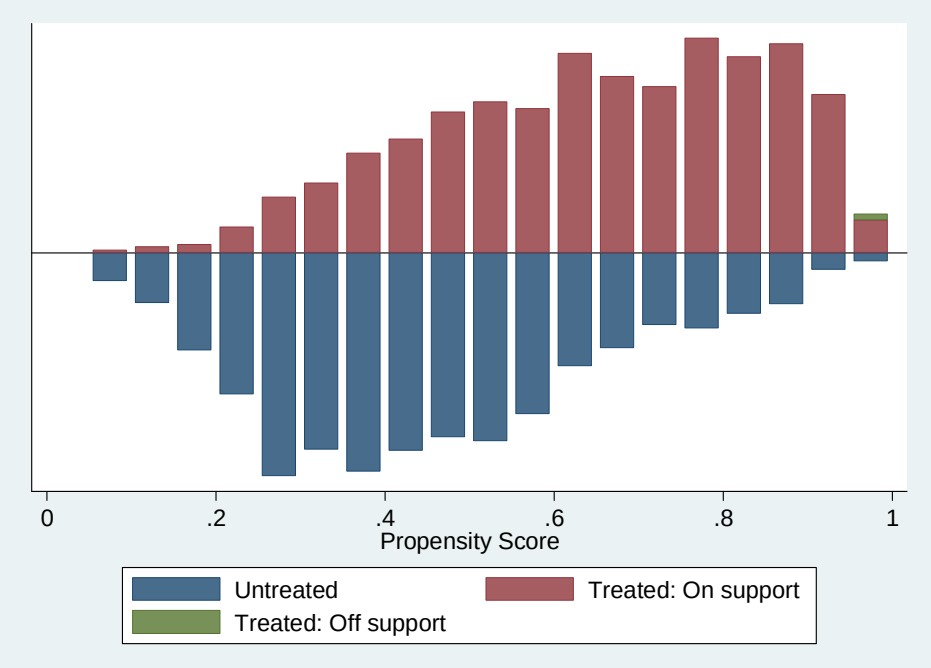


2.3.2: Balancing tests for dinv

	Mean		t-test		
Variable	Treated	Control	%bias	t	p>t
leeva	0.13949	0.16082	-0.8	-0.38	0.703
ltfp	10.001	9.9988	0.2	0.07	0.944
lpo	3.8701	3.8685	0.1	0.06	0.955
lkint	10.522	10.562	-2.4	-0.89	0.376
law	11.192	11.176	2.1	0.8	0.426
rd	0.14427	0.12697	5.6	1.72	0.085
training	0.41219	0.41508	-0.7	-0.2	0.842

Leeva: lagged markups; Ltfp: lagged total factor productivity; lkint: lagged capital intensity; lpo: lagged size of the firm measure as the number of workers; law: average wages, rd: dummy equal one for firms that undertake R&D activities; training: dummy equal one for firms that undertake training activities for their workers. Time and industry dummies not reported. N treated: 2329; N control: 1787 (on support).

Histogram of the propensity score by treatment status



2.3.3: Balancing tests for di

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>t
leeva	0.31964	0.31283	0.2	0.13	0.898
ltfp	10.24	10.244	-0.4	-0.08	0.935
lpo	4.3916	4.3269	6.2	1.06	0.287
lkint	11.165	11.106	3.9	0.68	0.5
law	11.436	11.406	4	0.68	0.494
rd	0.20432	0.19299	3.1	0.45	0.651
training	0.58743	0.56482	4.9	0.73	0.466

Leeva: lagged markups; Ltfp: lagged total factor productivity; lkint: lagged capital intensity; lpo: lagged size of the firm measure as the number of workers; law: average wages; rd: dummy equal one for firms that undertake R&D activities; training: dummy equal one for firms that undertake training activities for their workers. Time and industry dummies not reported. N treated: 509; N control: 3608 (on support).

Histogram of the propensity score by treatment status

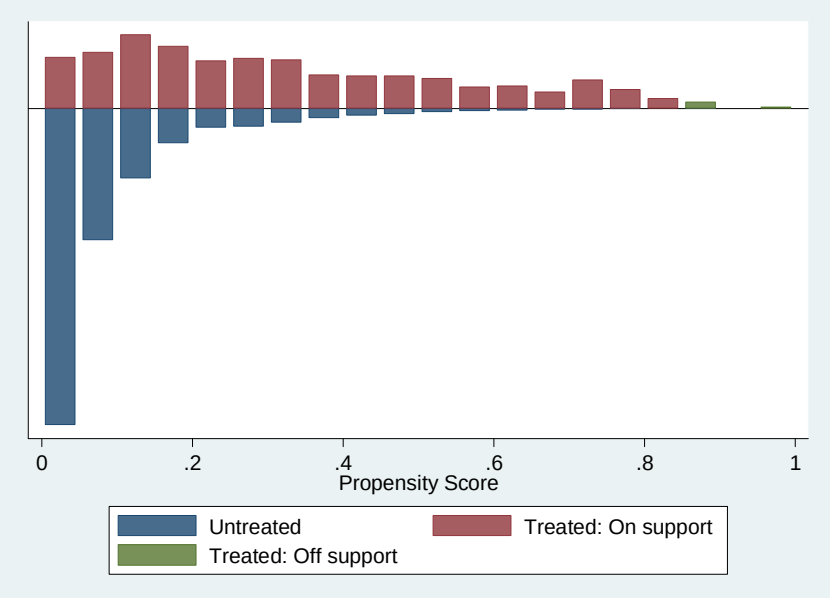


Table 3: Continuous treatment effect for the treatment ratio of investment to capital and export propensity as outcome variable

xshare	Coef.	Std.Err.	t	P>|t|	[95% Conf. Interval]	
inv_k	0.241807	0.1265195	1.91	0.056	-0.0062396	0.4898537
inv_k_sq	-0.2202299	0.1009333	-2.18	0.029	-0.4181138	-0.022346
gps	0.1797039	0.064727	2.78	0.006	0.0528039	0.3066039
inv_k_gps	-0.748935	0.3107649	-2.41	0.016	-1.358202	-0.1396676
_cons	0.1603986	0.0189353	8.47	0	0.1232752	0.1975221

xshare: exports/total sales, inv_k: investments/capital, inv_k_sq: squared investments/capital, gps: generalized propensity score, inv_k_gps: investments/capital interacted by the propensity score.

Chart 1: Continuous treatment effect of investment/capital on export share

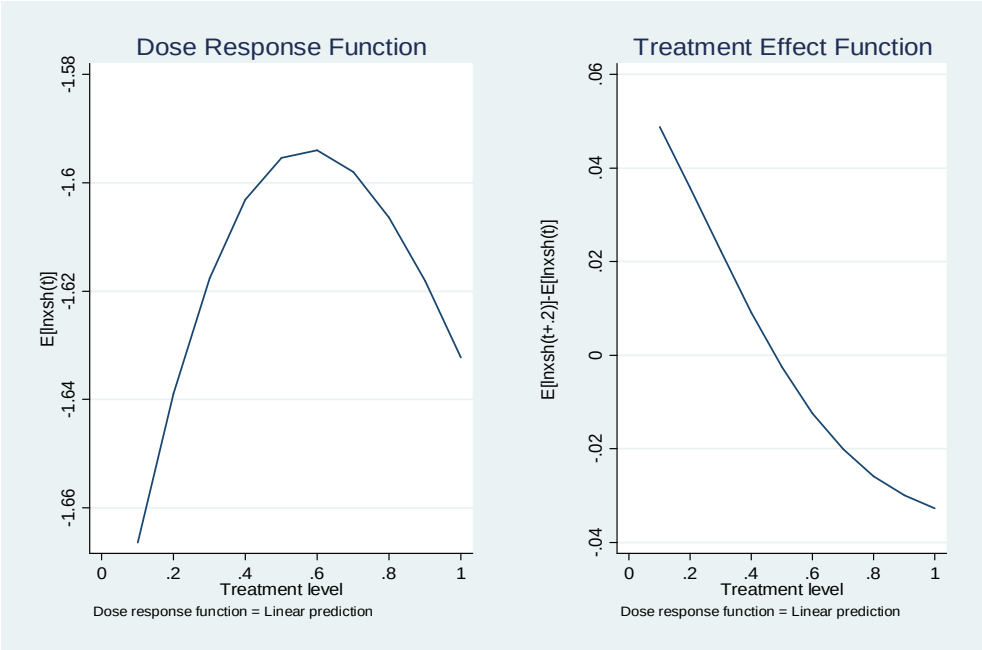
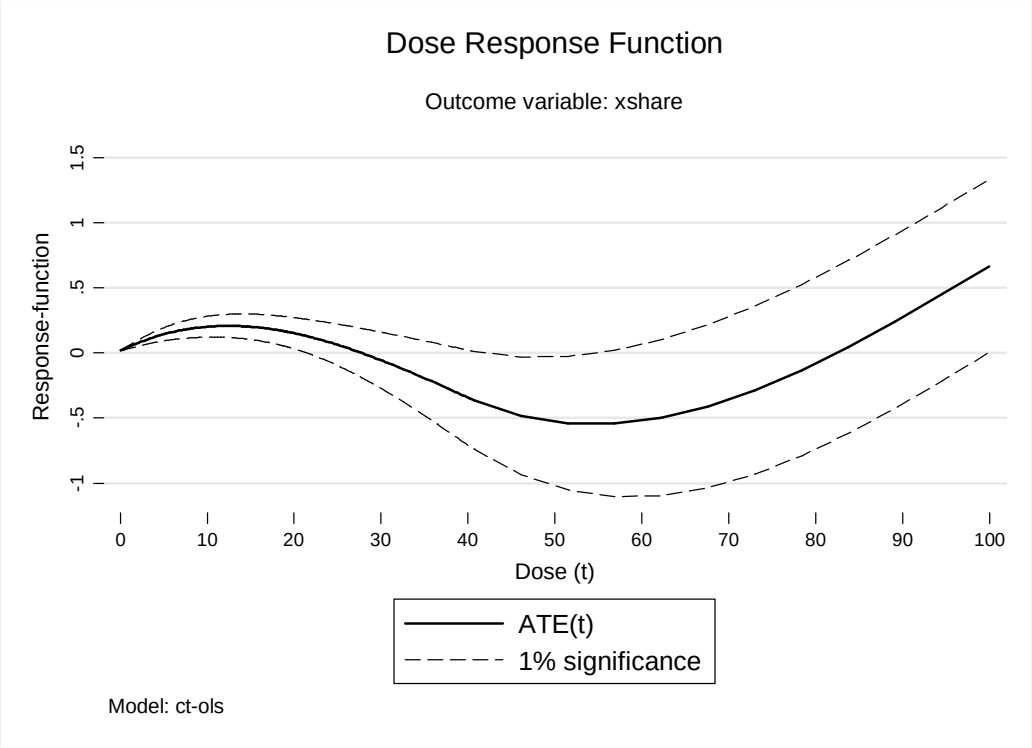


Table 4. Continuous treatment effect for investment on export propensity as outcome variable (ctreatreg, Cerulli 2014)

xshare	Coef.	Std. Err.	t	P>t [95%	Conf.	Interval]
treatment	0.01673	0.00872	1.92	0.055	-0.00036	0.03381
leeva	-0.00197	0.00135	-1.45	0.147	-0.00463	0.00069
ltfp	0.03492	0.00717	4.87	0.000	0.02086	0.04898
lpo	0.03611	0.00638	5.79	0.000	0.02441	0.04941
lkint	0.02748	0.00243	11.32	0.000	0.02273	0.03224
_Ird_1	-0.01928	0.01081	-1.78	0.075	-0.04048	0.00192
_Itraining_1	-0.00263	0.00880	-0.3	0.766	-0.01989	0.01464
Industry dummies	Yes					
Time dummies	Yes					
_ws_ltfp	0.00233	0.00832	0.28	0.779	-0.01398	0.01864
_ws_lpo	0.02545	0.00760	3.35	0.001	0.01054	0.04035
Tw	0.03293	0.00534	6.16	0.000	0.02246	0.04340
T2w	-0.00157	0.00029	-5.5	0.000	-0.00213	-0.00101
T3w	0.00001	0.00000	5.37	0.000	0.00001	0.00002
_cons	-0.51035	0.07521	-6.79	0.000	-0.65778	-0.36291

xshare: export propensity; leeva: lagged markups; Ltfp: lagged total factor productivity; lkint: lagged capital intensity; lpo: lagged size of the firm measure as the number of workers; rd: dummy equal one for firms that undertake R&D activities; training: dummy equal one for firms that undertake training activities for their workers.

Chart 2: Dose Response Function for export propensity and investment as treatment variable



Dose: level of investment defined as (investment-0)/(max_investment-0)*100;
i.e.(fbkf3_d - 0)/(526000000 -0)*100

Chart 2.1: Dose Response Function for the impact of investment on export propensity (xshare)

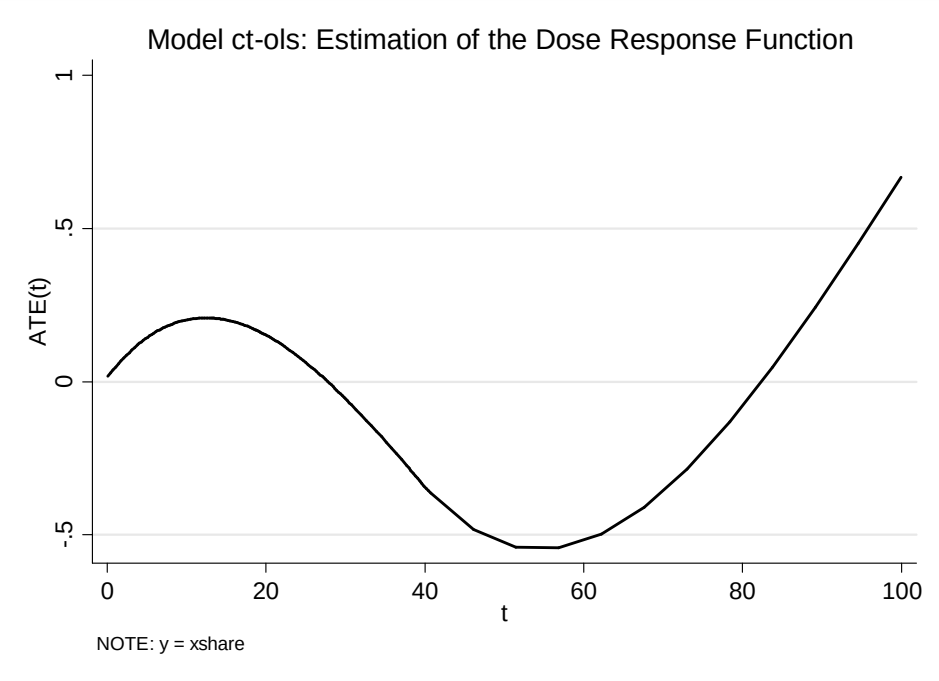


Chart 2.2: Average treatment effect of investments on export share

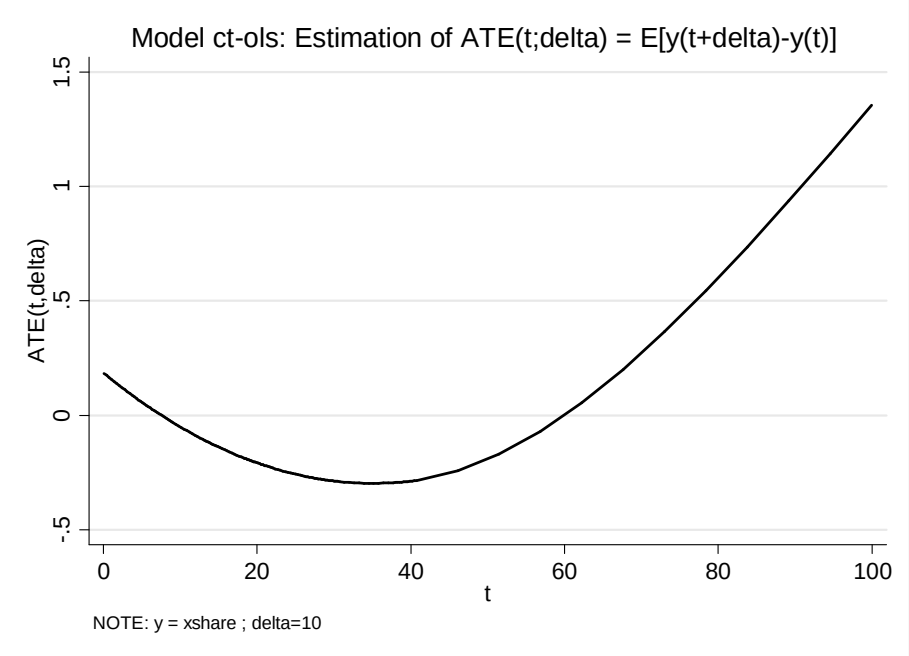
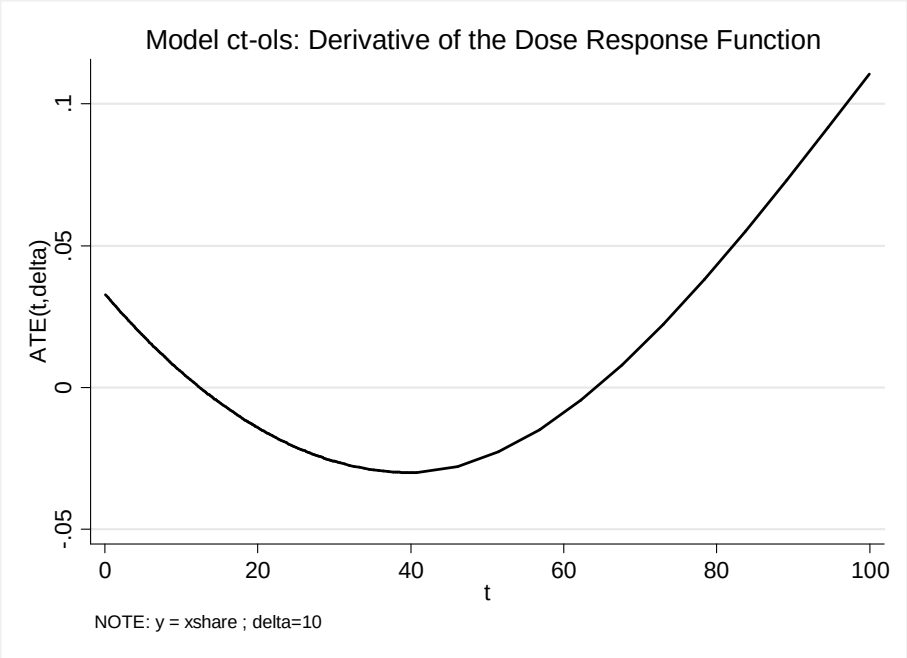


Chart 2.3: Derivative of the Dose Response Function



2.4: Dose Response Function and its Derivative for investments as treatment and export share as outcome variable

DRF4

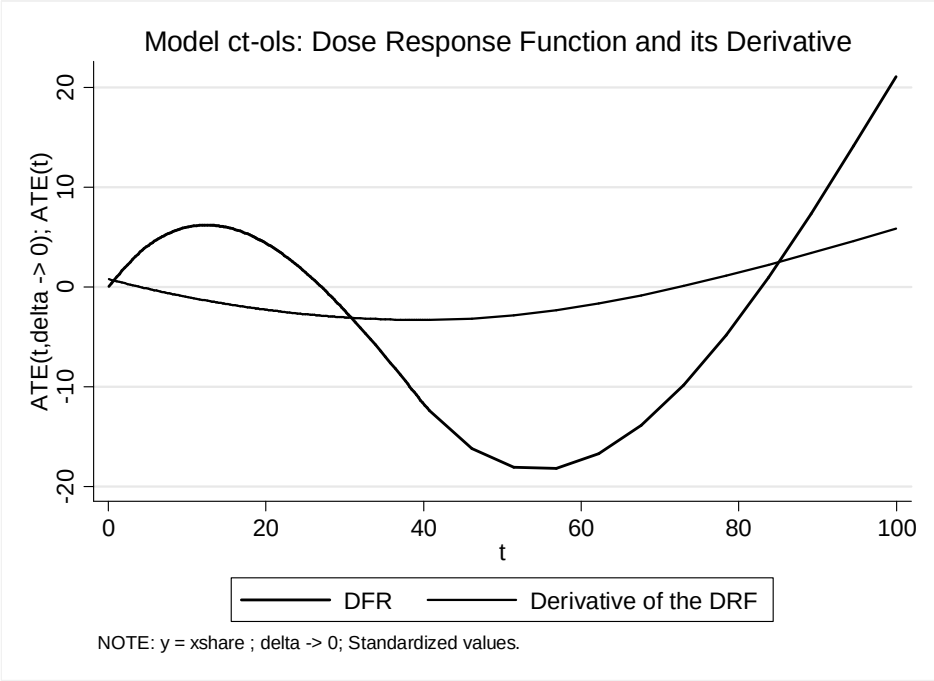


Table 7: Continuous treatment effect for investment on the value of exports (millions of constant pesos) as outcome variable (ctreatreg, Cerulli 2014)

Vexp_d2	Coef.	Std. Err.	t	P>t [95%	Conf.	Interval]
treatment	18.09231	4.690511	3.86	0	8.897074	27.28754
leeva	-3.164742	0.7305329	-4.33	0	-4.596872	-1.732612
ltfp	19.16251	3.85909	4.97	0	11.59718	26.72783
lpo	7.863511	3.43192	2.29	0.022	1.135606	14.59142
lkint	5.822118	1.306557	4.46	0	3.260756	8.38348
_Ird_1	-19.77691	5.819222	-3.4	0.001	-31.18487	-8.368964
_Itraining_1	-12.47533	4.73847	-2.63	0.008	-21.76458	-3.18607
Industry dummies	Yes					
Year dummies	Yes					
_ws_ltfp	43.83328	4.478318	9.79	0	35.05402	52.61253
_ws_lpo	26.72431	4.091312	6.53	0	18.70374	34.74488
Tw	56.95164	2.87499	19.81	0	51.31554	62.58775
T2w	-1.800104	0.1536714	-11.71	0	-2.10136	-1.498848
T3w	0.017201	0.0013102	13.13	0	0.0146325	0.0197695
_cons	-188.2269	40.4736	-4.65	0	-267.571	-108.8828

Vexp_d2: value of exports in millions of constant pesos; leeva: lagged markups; Ltfp: lagged total factor productivity; lkint: lagged capital intensity; lpo: lagged size of the firm measure as the number of workers; rd: dummy equal one for firms that undertake R&D activities; training: dummy equal one for firms that undertake training activities for their workers.

Chart 3.1: Dose Response Function for investment as treatment and the value of exports (in millions of constant pesos) as outcome variable

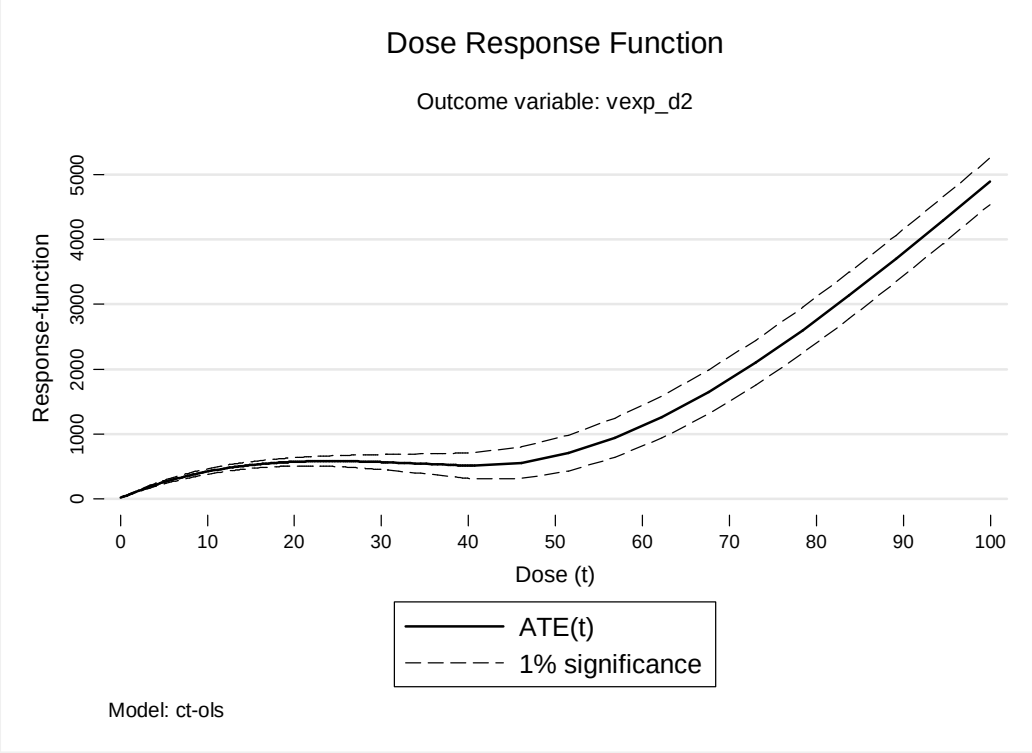


Chart 3.2: Estimation of the Dose Response Function for investment as treatment and the value of exports as outcome variable

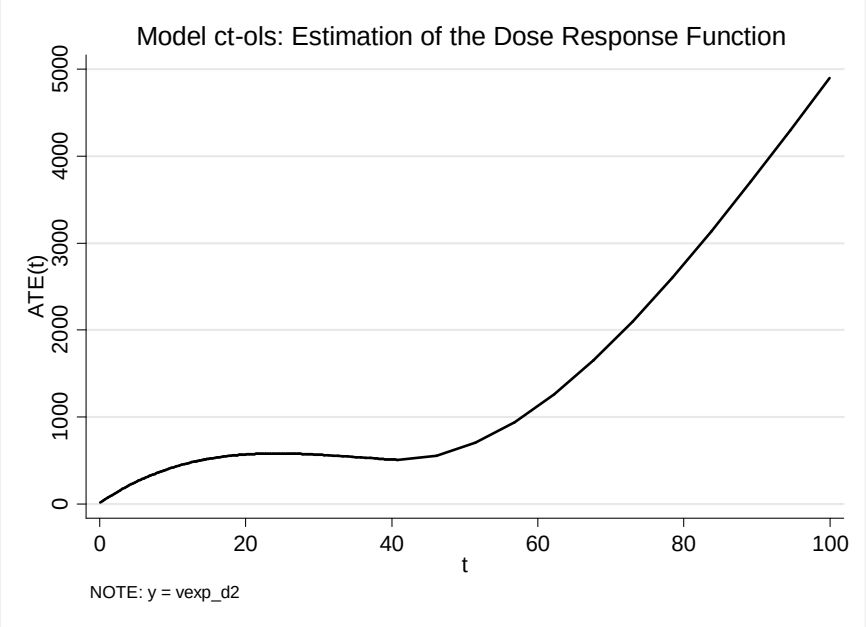


Chart 3.3: Estimation of Average Treatment Effect for investment as treatment and the value of exports as outcome variable

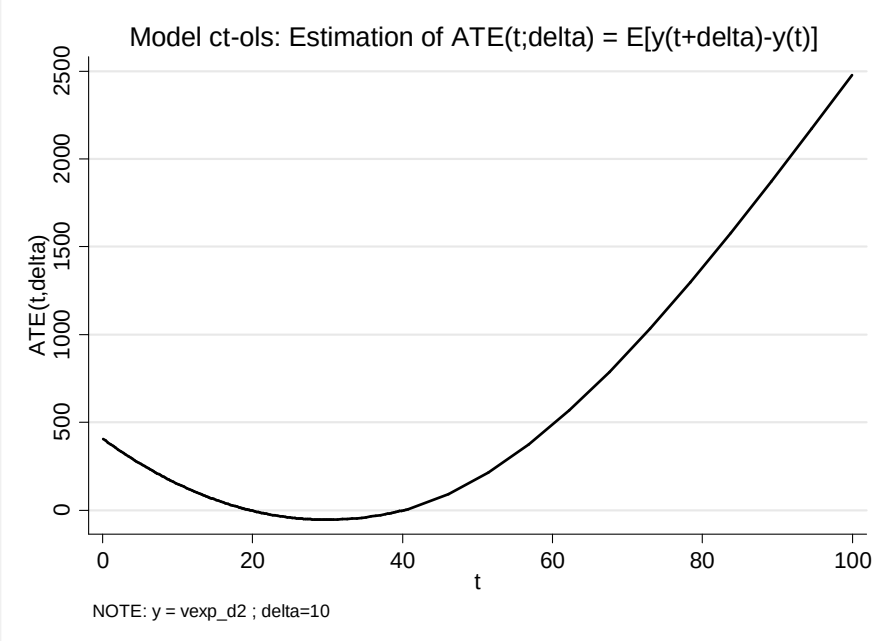


Chart 3.4: Derivative of the Dose Response Function

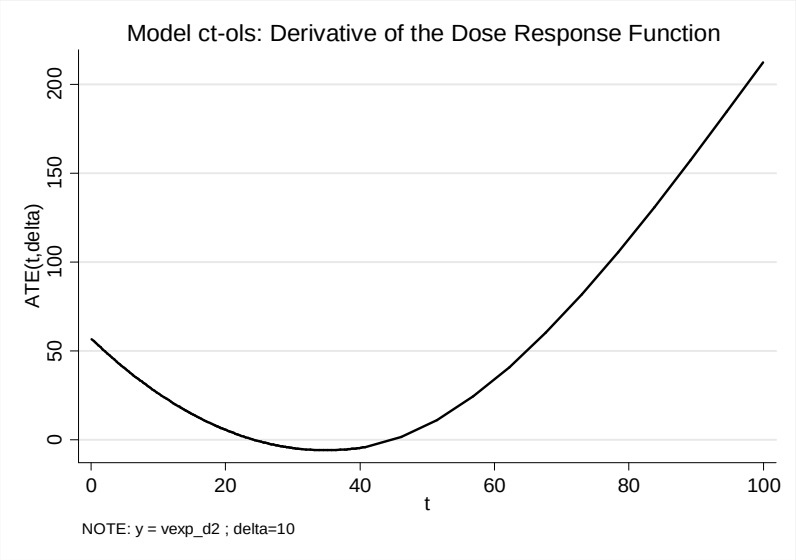
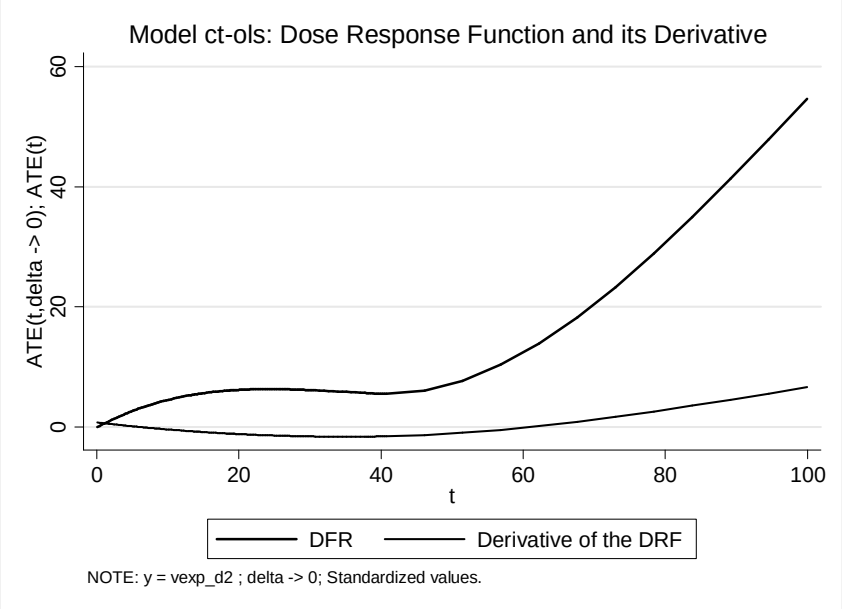


Chart 3.5: Dose Response Function and its Derivative



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