WP-01-2018.E

ITC WORKING PAPER SERIES

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TRADE IMPACT FOR GOOD

 WP-01-2018.E

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THE IMPACT OF QUALITY-RELATED BUSINESS TRAININGS IN LATIN AMERICA

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Abstract

This paper assesses the impact of quality-related business trainings on firm certification and export status, using panel data on 14 Latin American countries for 2006 and 2010. Using a rich set of firm level controls, we apply a difference-in-difference regression specification and propensity score matching to check the robustness of the results. Findings indicate that quality-related trainings help firms gain and retain internationally recognised quality certificates (IRQC). Furthermore, our results show that these trainings help firms transition from non-exporter to exporter status as well as to retain their exporter status in case they already export. Trainings also resulted in annual sales and employment growth, although no rise in exports, productivity or capacity utilization was detected. Interestingly, the magnitude of these benefits increases with the size of the firm. This may be related to absorptive capacities, which may hinder SMEs ability to apply the knowledge they have gained through the trainings. The last finding points to the need of complementary policies to ensure SMEs reap the full benefits of quality-related trainings.

JEL Classification: F13; F14; L25 ; C31

Keywords: Export Promotion, Quality Certification, Impact Evaluation, Training, Difference-in-difference.

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[4] The authors thank Marion Jansen, Olga Solleder, Michele Pellizzari, Loe Franssen, Eleonora De Falcis and the participants of the Economics of Global Interactions Conference in Bari and the 2018 ETSG Conference in Warsaw for useful comments and discussions.

Introduction

Standards are a set of agreed-upon specifications related to a product's features or a firm's production processes. They are essential to international trade and value chains, because they determine not only whether inputs are compatible with the next stage of production, but also if final products are safe for consumption.

Nevertheless, navigating the maze of standards is no easy job, especially for small and medium-sized enterprises (SMEs). Enterprises must first learn which standards are relevant to their business, select one or more which add value to its offering, implement the necessary changes to become compliant, and then demonstrate compliance (ITC, 2016). To be compliant with any given standard, enterprises must acquire that standard's certificate, which can be costly. Furthermore, these costs usually come in the form of fixed costs. This places SMEs at a disadvantage, as certification costs make up a larger share of their unit costs compared to larger firms.

This issue is particularly relevant in developing countries, where firms tend to be smaller, less productive, and have lower capacities to comply with standards and regulations than in developed countries. In addition, firms in developing countries may also face a more challenging business ecosystem, due to poor governance or lack of testing facilities and logistics infrastructure (ITC, 2016).

As a result, an industry has developed around helping firms acquire quality certificates for their products or their procedures. According to a survey of Spanish firms, 30% reported spending less than €6,000 annually on quality management, while 15% spent over €60,000 (Viadiu & Fransi, 2005). Attending total quality management (TQM) trainings, paying consultants, and paying for the procedural costs of certification all add up. The global ISO certification market was valued at $11.8 billion in 2017 (PMR, 2017).

However, are quality management trainings effective in helping firms acquire certification and eventually exporting? If they are, which types of firms are most likely to benefit? This paper tries to provide an answer to these questions using World Bank Enterprise Surveys panel data on 14 Latin American countries for 2006 and 2010. We assess the impact of attending quality-related trainings on firms' likelihood to acquire or maintain an internationally recognised quality certificate (IRQC) as well as to become or remain exporters.

Using a rich set of firm level controls, we apply a difference-in-difference regression specification and propensity score matching to check the robustness of the results. Our identification strategy takes advantage of the fact that not all firms in the sample received these trainings, so that we have a treatment and control group. Also, we have a wide range of firm level information before and after the treatment, in both 2006 and 2010. Finally, we account for various sources of unobservable heterogeneity by including sector and country fixed effects.

The results from this difference-in-differences approach indicate that quality-related trainings help firms gain and retain internationally recognised quality certificates (IRQC). These trainings also help firms transition from non-exporter to exporter status as well as to retain their exporter status. Interestingly, the magnitude of the benefit increases with the size of the firm. The lower absorptive capacities of smaller firms may explain why treatment on smaller firms is less effective.

Our paper is related to several strands of the economic literature. First, our focus on the impact of quality-related business trainings on firm certification and export status builds on the assumption that quality certifications have positive effects on firms' performance and export status. As such our paper builds on the literature that shows how certification raises not only firms' growth (Terlaak & King, 2006), but also their likelihood of exporting and export values (Martincus, Carballo & Gallo, 2010; Otsuki, 2011; Goedhuys & Sleuwaegen, 2016).

Second, to become certified, firms need to make considerable investments in personnel and equipment, both in terms of time and resources. Governments and national trade associations have a role to play in supporting firms efforts to become certified, and provide specific trainings (Kotler & Gertner, 2002). As such, our paper builds on the literature that assess the impact of governmental export promotion initiatives on firm's export competitiveness (Ahmed, Julian & Majar, 2006; Gençtürk & Kotabe, 2001; Lederman, Olarreaga & Payton, 2009; Martincus, Carballo & Gallo, 2010). Some evidence shows the positive impact of export promotion programmes on firms export values (Görg, Henry & Strobl, 2008; Martincus & Carballo, 2010; Freixanet, 2012; Geldres-Weiss & Carrasco-Roa, 2016), as well as on firm's ability to enter and survive in exports markets (Lederman, Olarreaga, and Zavala 2016), and export-related resources and capabilities of small exporters (Leonidou, 2011).[5]

Finally, by focusing on trainings, our paper also contributes to the broad literature that investigates on the impact of different types of trainings on firms' performance. Several papers confirm that training significantly boosts productivity, at the firm level (Zwick, 2006), or at the sector level (Besides, (Dearden, L., Reed, H. & Reenen, J. V., 2000). This effect is reflected in the reduction of the cost of production (Dearden, L., Reed, H. & Reenen, J. V., 2005; Moretti, 2004; Zwick, 2006; Bilanakos *et al.*, 2014).

To our knowledge there is no empirical evidence showing that quality-related trainings effectively increase firms' probability to become certified or to start exporting. This is partly due to the lack of enterprise surveys capturing the relevant information. As such, our paper fills a gap in this strand of the literature by confirming that this form of support to firms is effective in the sample of Latin American firms analysed.

Our findings have two policy implications. The first is that, in general, investments in quality control and quality-related trainings in Latin American led to a variety of beneficial outcomes for these firms. However, to help small firms reap the same outcomes as larger firms, additional support may be needed. The second relates to an additional finding from the paper showing that the source of funding (public versus private) is not an important factor determining the effectiveness of investments in quality control or quality trainings. This confirms that deploying public resources in Latin America is no less effective than using private sector funds, and can be promoted.

[5] However, these positive results are counterbalanced by further evidence suggesting that export promotion programmes have no impact on the intensive margins (Lederman, Olarreaga & Zavala, 2016), or the probability to export (Bernard & Jensen, J. B., 2004; Görg, Henry & Strobl, 2008)

The remainder of the paper is organised as follows. In Section II we present the dataset and describe some of its main features. Section III presents the statistical framework for the difference-in-difference estimation, while Section IV reports the main findings. Section V shows the robustness checks that confirm the results. Section VI discusses the policy implications of the results and Section VII concludes.

1. Data and descriptive statistics

This paper uses firm-level data collected by the World Bank's Enterprise Surveys to determine whether firms which received quality-related trainings were more likely to (a) subsequently acquire an IRQC or (b) become exporters. The question asked in the 2010 World Bank Enterprise Surveys, which determines whether a firm was treated or not is, '*Over the last three years, did this establishment use any services or programs to improve quality control or training to obtain quality certification?*' This means that the treatments were implemented sometime between 2007 and 2009. The discerning reader will have noticed that the question stated above is actually two questions in one. This muddies the interpretation of our results somewhat, but depending on the construction of different specifications one interpretation may be more appropriate over another.

The dataset contains no information on why some firms received (or indeed paid for) 'services or programmes' (hereafter simply referred to as 'treatments' or 'quality trainings'). However, we do know that the surveys conducted in these countries attempted to construct representative samples of the firm population using industry, establishment size, and region strata (World Bank, 2014). Thus, there is little reason to believe an explicit sampling bias related to treatment status was introduced as a result of the sampling process.

We also have no information on the content of the training, nor its duration (i.e. its quality). Given this lack of information, combined with the relatively large numbers of firms surveyed, we must assume that the treatment received by firms represents the average quality of such service in Latin America. Therefore, in this paper, we assess the impact of quality-related trainings *in general*.

The panel comprises firm level surveys conducted in 2006 and 2010 in 14 Latin American countries. These were: Argentina, Bolivia, Chile, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, and Uruguay. In total, the initial dataset contains 19,646 observations, with 10,430 from the 2006 surveys, and 9,216 from the 2010 surveys.

In order to retain only relevant observations for the analysis, we drop firms that were not surveyed in both years. This condition reduces the sample to 6,226 observations, evenly split between both survey years. Table 1 describes all the variables used in this paper. Table 2 contains a range of summary statistics on the properties of the sample.

The right-most columns of Table 2 show the difference between the treated and non-treated groups for each indicator. With respect both to the export status[6] and the certification status of firms, it is clear from these two columns that the difference between the treated and non-

[6] A firm is considered an exporter in our sample if 1% or more of its sales come from direct export.

treated groups increased over the time period under investigation. This is an early indication that quality-related trainings may have a positive effect on treated firms.

Table 2 also gives summaries of several firm characteristics, namely the number of employees, the age of the firm, and the sales. Treated firms were systematically bigger than non-treated firms (by number of employees) and this difference grew over time. There are also significant differences between the age of the firms and the sales for both groups.

2. Statistical framework

This study aims at assessing the impact of quality-related business trainings on firm's certification and export status. For this, we apply statistical methods from the program evaluation literature, where we define quality-related business trainings as the "treatment", $Treat_i$. $Treat_i = 1$ denotes the treatment state, that is, the firm participated in quality-related business training, and $Treat_i = 0$ denotes the non-treatment state, that is, the firm did not participate in a quality-related business training. Y_{it} is the outcome associated with each state, for example being certified and being an exporter.

Our identification strategy takes advantage of the fact that not all firms in the sample received these trainings, so that we have a treatment and control group. Also, we have a wide range of firm level information on firm characteristics before and after the treatment, in both 2006 and 2010, and we know that the treatment happened between 2007 and 2009.

2.1 Regression Model

To estimate whether quality-related trainings had an impact on firm performance, we adopt a difference-in-difference (DiD) OLS regression model.[7] The specification chosen empirically determines the effect of a treatment on an outcome, and can be written as follows:

Equation (1) $$Y_{it} = \alpha + \beta_1 Treat_i + \beta_2 Time_t + \beta_3 (Treat_i * Time_t)_{it} + \beta_4 X_{it} + \gamma_j + \gamma_s + \varepsilon_{it}$$

Here, subscript *i* represents individual firms and subscript *t* the year of the survey. The outcome variable, $Y_{it,}$ is a binary variable which determines whether a firm holds an IRQC or is an exporter. $Treat_i$ is a treatment dummy which controls for time-invariant differences between the treated and non-treated groups. $Time_t$ is a time dummy which controls for time-variant differences between 2006 and 2010, and the interaction between $Treat_i$ and $Time_t$ isolates the effect of being treated over time on outcome variable Y_{it}. The coefficient of this interaction term is the main statistic of interest in this paper.

Finally, X_{it} is a vector of firm level controls, the composition of which varies according to the specific regression, while γ_j and γ_s are country and sector fixed effects, controlling for country and sector characteristics that remain constant over time and that apply to all firms in each

[7] We prefer to rely on simple linear probability model rather than a non-linear probit (or logit) model for two reasons. The first is that non-linear models suffer from the incidental parameter problem when fixed effects are included in the regressions, like ours. The second is that, both the outcome and independent variables of interest are a dummy variables, and thus our coefficients of interest encounter no bounded probability problems, making the use of a probit (or logit) model unnecessary.

country or sector. All control variables are set to their 2006 values, and not allowed to evolve. A brief description of the construction of the control variables is provided next.

Firm size is defined by the number of full-time employees. Firm age is a two-step categorical variable defined by the median value, 23 years of age.[8] Manager's experience is a 6 step categorical variable, with each interval equivalent to 10 years of management experience (i.e. manger's experience = 0 for mangers with less than 10 years' experience, = 1 for between 10 and 20 years, and so on). We also add the size of the locality the firm is situated in, as a control. If the firm is situated in the capital city, or a city of 1 million people or more, locality is set to 1; for all other localities it is set to 0.

Traditional standard errors are calculated on the assumption that all observations are independent of one another. While this assumption is mostly valid for our dataset, we might expect the error terms to cluster based on country, the surveys were run on a country-by-country basis. We cluster our errors according to a country dummy, and find that on the whole, clustering lowers the error term.

The DiD approach (developed by Marie L. Obenauer & Bertha von der Nienburg, 1915), has been greatly used in economics to assess changes in state laws and regulations (Lechner, 2010), the effect of training and other labour market programmes on several labour market outcomes (Ashenfelter, 1978; Ashenfelter & Card, 1985; Heckman, J. J. & Robb, R., 1986; Heckman & Hotz, 1989; Heckman, J. *et al.*, 1998; Blundell *et al.*, 2004), as well as the impact immigration on the local labour market (Card, 1990), to name just a few. Over the last decade the DiD method has been significantly improved by Hansen, (2007b), (2007a) on issues of inference, focusing on what can be learned with various group, time period dimensions and serial independence in group-level shocks, by Athey & Imbens, (2006) on nonparametric approaches to difference-in-differences, and by Alberto Abadie, Alexis Diamond & Jens Hainmueller, (2007) on constructing synthetic control groups.

The DiD method relies on the parallel paths assumption, which posits that the average change in the comparison group represents the counterfactual change in the treatment group if there were no treatment (Mora & Reggio, 2012). This parallelism is assumed to apply to both the outcome variable and key firm characteristics such as employee count. If the parallel paths assumption can be shown to be true, then the addition of control variables into the DiD regression are not needed. However, if selection into treatment selects for certain firm characteristics, then controls must be added to put the treated and non-treated firms back onto parallel paths.

The data at our disposal for the 14 Latin American countries does not allow us to know the specifics of the trainings firms were subjected to. As a result, we also have little information on the selection method. The significant differences between the treated and non-treated groups before treatment, as per Table 2, seem to suggest that the selection process was not entirely random. Indeed, the firm characteristics of the treated group outperform those of the non-treated group according to every metric, suggesting that the parallel paths assumption may not hold in the absence of controls. Hence, the use of controls in Equation 1.

[8] Firm age can be specified as a continuous variable, but if specified as such, the coefficient is exceptionally small.

3. Results

3.1 The impact of treatment on certification status

Results from the difference-in-difference specification (Equation 1) using certification status as the outcome variable are reported in Table 3 (see Annex). Before executing the regression, firms which held an IRQC in 2006 were dropped. This is done to facilitate the interpretation of the DiD coefficient, which now exclusively represents how effective treatment was for firms transitioning from uncertified to certified status. Furthermore, this filtering makes it likely, so far as the outcome variable is concerned, that both the treated and control groups were on parallel path before treatment.

The difference in difference term is the interaction of treatment and time, and the coefficient for this variable is positive and significant. The result is robust to the iterative inclusion of fixed effects and controls (Models 2-7). The value of the DiD coefficient remains stable at around 0.303(±0.019)[9]. In other words, 30.3% of treated firms received an IRQC due to treatment. But how does this compare to the untreated firms? The coefficient on the time term, 0.046(±0.008), indicates that 4.6% of untreated firms gained an IRQC between 2006 and 2010. To calculate the fraction of treated firms which had an IRQC in 2010, one simply adds the time and DiD coefficients, which gives 0.349. Calculating the ratio of treated to non-treated, we find that treated firms were 7.6 times more likely to gain an IRQC compared to untreated firms.

It is also possible to test whether treatment increases the probability that firms retain their IRQC. One can do this by dropping all firms which did not hold an IRQC in 2006. The result is shown in Table 4. The time term, -0.631(±0.061), indicates that only 37% of untreated firms retained their IRQC over the period of investigation. On the other hand, the DiD coefficient is 0.431(±0.045), meaning that 80% of treated firms retained their IRQC. Calculating the ratio of treated to untreated retention rates, we find that treated firms were 2.1 times more likely to retain their IRQC compared to untreated firms, or 43.1% of treated firms retained their IRQC due to treatment.

We recall that the definition of treatment is *any services or programs to improve quality control or training to obtain quality certification.* It seems reasonable to assume that in the case where firms are uncertified in 2006, treatment refers to *training to obtain quality certification*, whereas, in the case where firms are already certified in 2006, treatment refers to *any services or programs to improve quality control.* This may help explain why treatment seems to be beneficial in both specifications.

3.2 The impact of treatment on exporter status

Firms with competent quality management systems and the necessary IRQCs have a higher chance of exporting their goods and services (e.g. Goedhuys & Sleuwaegen, 2016). Thus, we investigate whether treatment increases the chances of firms becoming exporters. Before executing the difference-in-difference regression, firms which were exporters in 2006 were

[9] For the reader's convenience, we include statistical error on the coefficient derived from the linear regressions. Note, however, that this error does not capture all potential sources of error, such survey sampling bias, and as such, is likely to be an underestimate.

dropped. This facilitates the interpretation of the DiD coefficient, which now represents how effective treatment was for firms transitioning from non-exporter to exporter status.

The time term in Table 5 shows that 4.8%(±0.9%) of untreated firms became exporters over the period of investigation. The DiD coefficient is 0.095(±0.018), indicating that 14.3% of treated firms became exporters over the same period. This means that treated firms were 3.0 times more likely to become exporters compared to untreated firms, or 9.5% of treated firms became exporters due to treatment.

Similarly to what was done for certification, if one drops all the firms which were non-exporters in 2006, one can calculate the probability that treatment results in current exporters retaining their exporter status. From the time term in Table 6, -0.295(±0.040), one can deduce that 70.5% of untreated firms retained their export status. This compared to 87.6% for the treated sample. Calculating the ratio, one finds that treated firms were 24% more likely to retain their exporter status as a result of treatment compared to untreated firms. This suggests that treatment does indeed help current exporters maintain their exporter status. Put another way, 17.1%(±3.3%) of treated firms retained their export status due to treatment.

3.3 Does the effectiveness of treatment depend on firm size?

The richness of the dataset allows us to test additional hypotheses, such as whether DiD coefficient associated with gaining an IRQC for the first time varies according to firm-size.[10] To test this, we split the sample by the number of full-time employees into 10 bins of equal size. The results are shown in Figure 1, where the DiD coefficients from the regressions are plotted against firm size.

From Figure 1 it is clear that as firm size increases, the average effect of the treatment on the treated, in this case the fraction of treated firms which gain an IRQC due to treatment, rises from about 15% to 40%. In other words, an extra 15% to 40% of the treated sample gained an IRQC as a result of treatment. Fitting a trendline to the data, we see a fit with an R^2 value of 0.92, providing further evidence for the existence of a strong firm-size dependence of the DiD coefficient. The p-value of the regressions are also shown; except for the regressions with a median size of 5 and 7, all the p-values are below 0.01. The coefficient on the time term (i.e. the control group) for each of these regressions rises steadily from about 1% for the smaller firms to 8% for the largest.

A similar relationship is observed when splitting the sample by firm sales. The average effect of the treatment on the treated was more effective for firms with higher sales: the DiD coefficient was 18% for firms with sales of about $35,000, but rises to 60% for firms with sales of about $25,000,000 (see Figure 2). Repeating the analysis using export status as the outcome variable yielded no evidence of a dependence on firm size, although the larger errors (due to the smaller samples) make it more challenging to tease out a relationship. In summary, smaller firms do seem to find it harder to translate treatment into gaining a quality certificate. The reasons for this are discussed in Section VI.

[10] Testing on retaining certification (e.g. dropping firms with did not hold an IRQC in 2006) yielded no results of significance.

3.4 Which is more effective: public or privately funded treatment?

The dataset used also includes a question on the source of the financing for the quality-related investment. Three options are available: entirely financed by the establishment (2,350 firms), partially financed by public resources (372 firms), and entirely financed by public sector resources (30 firms).

With this data it is possible to test whether publically funded treatments were more effective than self-funded treatments. To improve the statistical robustness in the analysis, we merge the latter two categories. Even so, self-funded trainings are over 6 times more prevalent than public or partially publicly funded trainings.

One might expect that firms which opted for publically or partially publically funded trainings may be systematically different from firms which could afford self-financing (e.g. publically funded trainings may have targeted SMEs or start-ups). Table 7 shows the properties of both subsamples. The results are somewhat heterogeneous: self-funded treated firms were less likely to be certified in 2010; self-funded firms were less likely to be exporters in both survey years; and self-funded firms had higher average sales in both survey years.

Since all the firms which state their funding source are, by definition, firms which have received treatment, one must design a new DiD specification. Thankfully, this is simple to do, as a funding term can replace the role of the treatment term. The equation which results can be written as follows:

Equation (3) $Y_{it} = \alpha + \beta_1 Funding_i + \beta_2 Time_i + \beta_3 Funding_i * Time_i + \beta_4 X_{it} + \gamma_j + \gamma_S + \varepsilon_i$

Where $Funding_i$ is a dummy variable. When equal to 1, it selects for self-funded treatments and when equal to 0, for publically or partially-publically funded treatments. To aid with the interpretation of the coefficients, firms which held an IRQC in 2006 were dropped, meaning that the DiD coefficient now exclusively represents how effective treatment was for firms transitioning from uncertified to certified status.[11]

The regression results are shown in Table 8. According to the time term, 44.6%(±5.0%) of ‘untreated’ firms gained an IRQC. In this case, ‘untreated’ refers to firms which had publically or partially-publically funded treatments. The DiD term is -0.111(±0.052), and suggests that 33.5% of self-funded firms gained an IRQC. However, because the error on both coefficients are of the order of 5%, the difference between both coefficients is not statistically robust, and thus the result does not hold. In summary, the source of the funding does not seems to matter greatly to the outcome of the treatment.

3.5 The impact of treatment on sales and exports

In the previous subsections, we investigated the impact of treatment on two outcomes; whether firms were more likely to gain/retain an IRQC or become/stay an exporter. However, we can also test the impact of treatment on a host of performance variables. The World Bank Enterprise Surveys recorded the annual sales for enterprises surveyed in 2006 and 2010.

[11] Testing on retaining certification (e.g. dropping firms with did not hold an IRQC in 2006) or becoming or remaining an exporter yielded no results of significance.

Placing the natural logarithm of sales as the dependent variable, we can investigate the impact of treatment on sales.[12]

The results are shown in Table 9. The coefficient on the DiD term is 0.218(±0.063), meaning that treatment increased the sales of firms in the treatment group by an average of 0.218 in natural logs. This term is somewhat tricky to interpret for two reasons. The first is that an increase of 0.218 in natural logs translates to different dollar amounts depending on the initial log value. The second is that OLS regressions give information about the effects of the regressors at the conditional mean of the dependent variable only, meaning that the coefficient is only valid for the average of the logged sales value of the sample.

To aid with the interpretation of the impact of treatment on sales, we perform quantile regressions. Quantile regressions allow one to test the behaviour of the coefficients on the conditional distribution of the dependent variable (e.g. logged sales). This allows one to translate the resulting DiD coefficient into a specific dollar amount, and thereby calculate the percentage sales increase in dollar terms. Quantile regressions are calculated for percentiles between 0.05 and 0.95, in steps of 0.01.

The resulting coefficients are transformed into percentage sales increases using the value of sales at the specified percentile, and plotted against sales (see Figure 3). The results show that treatment has a large and positive effect for firms on the lower end of the sales distribution, dropping steadily as sales volume increases. For example, for firms with sales of $100,000, $1 million and $10 million, the percentage sales increase translates to 6.7%(±2.7%), 1.8%(±1.1%), and 1.0%(±1.0%). In summary, treatment boosted the sales of firms with relatively low annual sales, with this effect decreasing in percentage terms and in significance as sales volumes increase. We tested the impact of treatment on export sales, but the results were only marginally significant.

3.6 The impact of treatment on job growth and productivity

If treatment led to an increase in sales, it stands to reason that firms may have simultaneously increased the number of employees. To investigate any potential effect, we follow the same analytical structure as for sales. Table 10 shows the impact of treatment on the natural logarithm of the number of full-time employees. The DiD coefficient is positive and significant, indicating that employment did rise as a result of treatment. To aid with the interpretation of this effect, we perform quantile regressions along the employment axis for quantiles between percentiles of 0.1 and 0.9, in steps of 0.05.[13] The resulting coefficients are transformed into percentage employment increases using the number of employees at the specified percentile, and plotted against the number of full-time employees (see Figure 4).

At first glance, the results are somewhat surprising. For firms with, for example 11 employees, the results indicate that one should expect a 4.2%(±0.9%) rise in the number of employees. This translates into an increase of 0.5 employees. The percentage increase in the number of

[12] Unlike in previous subsections, we do not drop firms according to their certification or exporter status, as we are interested in the general effect of treatment.
[13] Larger steps are required as the natural log of small discreet numbers rises in steps.

employees falls as the size of the firm increases, but in terms of absolute numbers, the employee count rises.

For firms with 50 employees, treatment results in an average increase of 1 employee. At around 100 employees, the percentage increase in the number of employees starts to rise again, causing the absolute number of additional employee count to rise rapidly. For firms with 150 employees, our calculations imply an average of four extra employees were hired due to treatment. We tested the impact of treatment on productivity[14] and capacity utilization, but the results were not significant.

4. Robustness checks

4.1 Propensity score matching

Matching methods are based on the idea that directly matching groups of treatment and control group observations, based on a combination of their observable characteristics, allows one to calculate the counterfactual change in the treatment group if there were no treatment. The propensity score matching method (Rosenbaum, P.R. & Rubin, D. B., 1983), collapses a vector of pre-treatment characteristics, *X*, into a single variable (i.e. the propensity score), and uses this as the matching estimator. The central advantage of propensity score matching (PSM) is that, by combining covariates into a single score, it can balance treatment and non-treatment groups without losing a large number of observations. The alternative is to balance across a host of covariates simultaneously, which in turn needs large numbers of observations to avoid the "dimensionality problem".[15] However, PSM also has several disadvantages, namely that it accounts only for observable covariates, and requires a good model which explains why units were selected into treatment. For this part of the paper, we follow the approach used by Huttunen, (2007).

The first step is to calculate the propensity scores. In this study, the propensity score is the conditional probability of an enterprise investing in quality control or attending a quality-related training. This is a binary choice model, and is described below:

Equation (4) $$T_{it} = \begin{cases} 1 & if \beta X_{it} + \gamma_j + \gamma_s + \varepsilon_{it} > 0 \\ 0 & otherwise \end{cases}$$

where T_{it} is a binary variable that defines whether firm *i* received a quality-related training at time *t*, and X_{it} is a vector of controls. To control for unobservable country and sector effects, γ_j and γ_s are included as fixed effects. The propensity score is estimated by a parametric logit model where the controls are fixed to the values they had in 2006 (see Table 11).

The next step is to compare the difference in the outcome before and after the treatment of treated firms with the difference in the outcome of the non-treated firms over the same period.

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[14] In this case, productivity was simply defined as the sales per full-time employee.

[15] The dimensionality problem is a sparsity problem. As one increases dimensionality, the parameter space increases so fast that for a given level of statistical significance per volume, the number of observations would have to increase exponentially.

This controls for the possible bias that is due to the effect of unobservable factors (Heckman, Ichimura & Todd, 1997). The formal specification for the Average Effect of Treatment on Treated (ATT) for all types of difference-in-differences matching estimators can be written as:

Equation (5) $$\widehat{ATT}(S) = \sum_{i \epsilon T \cap S_P} \frac{1}{N^T} \left[(Y(1)_{it} - Y(0)_{it-1}) - \sum_{j \epsilon C \cap S_P} \omega_{ij} \left(Y(0)_{jt} - Y(0)_{jt-1} \right) \right]$$

where $Y(1)_i$ is the treatment outcome for firm *i*, $Y(0)_j$ is the non-treatment outcome for firm *j* (comparison group outcome), *t* is time, N^T is the number of firms in the treatment group, *T*, *C* denotes the set of control units, S_P denotes the region of 'common support',[16] and ω_{ij} is the weight used to match control firms with each treatment firms.

We tried several matching estimators, including nearest neighbour (NN) and kernel matching. While NN matching uses only those control group observations that are closest to treated units, kernel matching uses all control group observations, but weights each observation according to its distance from the treated unit. For kernel matching, we use an epanechnikov weighting function. To select the bandwidth, we plotted the ATT coefficient as a function of the bandwidth, and performed a visual inspection, identifying the region where the coefficient exhibited the most stable behaviour.

4.2 Results from matching methods

Results from the propensity score matching method are listed in Table 12. Four outcomes are tested as robustness checks on the results reported in Section 4: the effectiveness of treatment for firms acquiring IRQC, retaining IRQC, becoming exporters, and retaining exporter status. When matching, we test whether the balancing property holds, that is, whether observations in the matched and unmatched groups have the same distribution of observable characteristics independent of treatment status. We find that our samples are well balanced in all cases.

For the first outcome, the coefficients derived from using nearest neighbour and kernel matching are all remarkably similar, varying between 0.29 – 0.31. Furthermore, these coefficients are consistent with the coefficient derived from the DiD regression model presented in Section IV (0.303±0.019). For the second outcome, the coefficients derived using our three matching estimators vary between 0.38-0.39. Taking the standard errors into account, which range from 0.05 to 0.07, these results are again consistent with the DiD regression model presented in Section IV (0.431±0.045).

For the third outcome, transitioning from non-exporter to exporter, the coefficients are only marginally significant, varying from 0.06-0.07, with t-statistics ranging from 2.6-3.1. Even so, the coefficients are broadly in line with the coefficient derived from the DiD regression model. For the fourth outcome tested, the coefficients derived from propensity score matching (which range from 0.07-0.011) are not significant for the nearest neighbour methods, and only marginally so when using the kernel estimator. These coefficients are somewhat lower than the one derived from the DiD regression model (0.171±0.033). In conclusion, for three of the

[16] This is the region where the treated and non-treated units have the same propensity score values.

four specifications checked, we found that propensity score matching provides complementary evidence for the results presented in Section IV.

5. Discussion

In this paper, we conduct a difference-in-difference estimation to investigate whether using quality control services or receiving a quality-related training results in a higher chance of acquiring or retaining an internationally recognised quality certificate, or becoming or remaining an exporter. We also investigate whether such trainings resulted in increased sales, employment, and other firm performance metrics.

Results from Section IV.i show that firms which underwent treatment were 7.6 times more likely to acquire an IRQC compared to untreated firms, and 2.1 times more likely to retain their certification status, if they held a IRQC in 2006, compared to untreated firms. Treatment also had an impact on firm's export status, with those that underwent treatment being 3.0 times more likely to transition from non-exporter to exporter status. For firms which were already exporters in 2006, treatment led to a 24% increased chance that they remained exporters in 2010, although this last result was only marginally significant when using propensity score matching.

Although the treatment question and the outcome variable are relatively well matched (i.e. one would expect a '*training to obtain quality certification*' to result in increased propensity to hold an IRQC and consequently to export), there are some limitations. The first of these is that the treatment question also includes the concept of '*improve[d] quality control*' which one would not necessarily expect to lead to the acquisition of a quality certificate. It is unfortunate that the treatment question contains two concepts, but this latter concept may help explain the variety of result found in this paper. Treatment seems to have a positive effect on firms which already held an IRQC and were exporters. This may be because once a firm holds an IRQC or is an exporter, they invest more in improving quality control as they must continually adapt to changing technical regulations. Those that don't, face falling foul of compliance requirements.

Results from Section IV.iii show that firm size, defined in terms of number of full-time employees, matters. Splitting the sample into 10 bins according to firm-size, we find that the larger the firm, the more likely it is that treatment results in firms gaining an IRQC. This also applies to size if defined by sales. This is in line with the economic literature, indicating that, apart from access to knowledge, firms also need to be able to absorb knowledge (Cohen and Levinthal 1990; Daniel H. Kim 1998). In fact, while quality certification has beneficial returns - such as improved legitimacy, cost reduction and increased trade opportunities – adopting certification is costly and highly demanding in terms of personnel and time resources. For this reason SME might find it difficult to get certified (Bansal & Hunter, 2003; Raines, 2002; Prakash & Potoski, 2007). Larger firms have more resources to make use of the training received and get a quality certificate than small firms.

In fact, even in cases where SMEs acquire the knowledge about standards and quality certification, and even get to the stage of adapting to the market's requirements, they still need to demonstrate compliance. Many developing countries do not have domestic certification bodies recognised in the export market. SMEs are then compelled to use foreign certification bodies and the costs rise accordingly. In such cases, only the larger firms have the financial resources to complete the certification process.

Related to absorptive capacities are financial constraints, cited by Graffham, Karehu & MacGregor, (2007) as the main obstacle to establish and maintain quality standards in Kenya, rather than the lack of technical knowledge. In line, standards are found to be more beneficial for middle-income farmers, who can bear the related costs of compliance, compared to their low-income counterparts (Hansen & Trifkovic, 2014).

Another explanation may be down to the quality of the trainings. If higher quality trainings are in turn more expensive, then they should be both more accessible to larger firms and more likely to be selected by larger firms. Unfortunately, there is no information in the dataset to control for the quality of trainings.

Section IV.iv assess whether publically funded (or partially publically funded) treatments were more effective than self-funded treatments. The results, shown in Table 8, suggest that publically funded treatments may be more effective than self-funded treatments, however this finding is not statistically robust. It would be more accurate to infer that the source of funding does not have a strong impact on the effectiveness of the treatment. Furthermore, the source of funding should not be confused with the legal status of the treatment provider. In other words, just because a treatment was partially or fully funded from public funds, it does not mean the provider was a public entity. Indeed, in many cases the provider may be the firm itself.

Section IV.v and Section IV.vi investigate whether treatment led to a positive outcomes on a variety of firm performance metrics. The results show that firm sales increased after treatment, although the rise was statistically significant for only the firms with the lowest annual sales. We tested the impact on treatment on export sales, but the results were only marginally significant, owing mainly to the larger errors as a result of exporters making up only one-third of the sample. We also tested the impact of treatment on employment, and found treatment resulted firms of all sizes hiring more full-time employees. The size of the effect follows a U-shape pattern, with the smallest firms increasing employment by 4-7%, medium sized firms 2-3%, and large firms by 2-4%. We also tested the impact of treatment on productivity and capacity utilization, but found no results of significance.

The evidence supporting positive firm performance outcomes has two important implications. The first is that, firm managers who choose to invest in quality management are likely to see sales rise, as well as the size of their company expand. The lack of evidence for improvements in capacity utilization and productivity may indicate that treatment mostly helped firms attract new customers or secure larger orders from existing ones. Presumably, the acquisition or retention of an IRQC, which signals competence and quality to buyers, and in turn instils confidence, is the main mechanism behind the increase in sales. Indeed, although not reported in the results section, the impact of treatment on sales is twice as high for the subsample which did not hold an IRQC in 2006 but subsequently did in 2010. Unfortunately, we cannot assess the impact of treatment on profits, nor the return on investment of treatment, as Enterprise Surveys did not record such information.

The second implication of these results regards policymakers. Policymakers seeking to improve the quality management of firms will be content to learn that the average treatment used by firms in Latin America is effective, although whether such treatment represents value for money is another question. In any case, policymakers should note that there is no great difference in the effectiveness of treatment whether it was publically or privately funded. Indeed, there is marginal evidence supporting the notion that publically funded treatments may be slightly more effective than privately funded ones. Nevertheless, it is true that treatment is much less effective for smaller firms. The reasons for this are not clear, but as described earlier, lower absorptive capacities and limited financial resources are likely to play an important role. Policymakers may want to direct resources towards these firms with tailored quality management programmes and implementation support. Doing so would contribute to the overall health of the SME sector, and in turn lower certification-related barriers to entry. Finally, policymakers will also be content with the finding that treatment increased the number of exporters even if direct exports themselves did not increase.

6. Conclusions

In this paper we present the results of a difference-in-difference estimation aimed at investigating the effects of quality-related trainings in 14 Latin American countries. Our results indicate that, compared to control groups, programs to improve quality control or quality-related trainings help firms acquire IRQC (7.6 times more likely), retain their IRQC (2.1 times more likely), transition from non-exporter to exporter status (3.0 times more likely), and to maintain their exporter status (24% more likely).

Further regressions also indicate that larger firms, defined either in terms of number of full-time employees or in terms of annual sales, seem to benefit more from quality-related training than smaller firms. The lower absorptive capacities of smaller firms may explain why treatment on smaller firms is less effective. We also confirm that publically funded treatments were no less effective compared to privately funded treatments. Finally, treatment led to an increase in sales and employment, but no significant increase in exports, productivity or capacity utilization.

What can policymakers draw from the above results? The first is that, in general, investments in quality control and quality-related trainings in Latin American led to a variety of beneficial outcomes for these firms. Value for money, however, is another question, and unfortunately we have no way of assessing this dimension. For any given firm in the treated group, the probability that they would gain an IRQC was about 34.9% compared to 4.6% in the control group; a large difference. Offering training to small firms may be less effective than doing so for larger firms. However, because we cannot control for the quality of the training, it may be the case that smaller firms simply purchase inferior trainings. Furthermore, policymakers may wish to implement specific programmes to help SMEs improve quality, which in turn should help reduce certification related barriers to entry for these firms. Finally, policymakers can also take comfort in that fact that the results are significant no matter the funding source.

7. References

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8. Annex

Table 1: Description of variables

Name	Description	Mean	Std. dev
Outcome variables			
Certification status	A binary variable equal to (1) if the firm had an internationally-recognized quality certificate, and (0) if it did not.	0.24	0.43
Export status	A binary variable equal to (1) if the firm is an exporter, and (0) if it is not. A firm is considered an exporter in our sample if 1% or more of its sales come from direct export.	0.29	0.45
Independent variables			
Treat	A treatment dummy which controls for time-invariant differences between the treated and non-treated firms. The question asked was, "*Over the last three years, did this establishment use any services or programs to improve quality control or training to obtain quality certification?*"	0.44	0.50
Time	A time dummy which controls for time-variant differences between 2006 and 2010.	0.50	0.50
Treat*Time	An interaction between the treatment and time dummies, which isolates the effect of being treated over time on an outcome variable.	-	-
Funding	A binary variable indicating the source of the financing for the treatment: (1) entirely financed by the firm, (0) entirely or partially financed by public resources.	0.86	0.34
Fixed effects			
Sector	A two-step categorical variable indicating the sector the firm was operating in, in 2006: (1) is equal to manufacturing and (2) to services.	-	-
Country	A variable indicating which country the firm is operating in: (0) Argentina, (1) Bolivia, (3) Chile, (4) Colombia, (5) Ecuador, (6) El Salvador, (7) Guatemala, (8) Honduras, (9) Mexico, (10) Nicaragua, (11) Panama, (12) Paraguay, (13) Peru, (14) Uruguay.	-	-
Firm-level controls			
Firm size	The natural logarithm of the number of full-time employees in 2006.	3.46	1.39
Sales	The natural logarithm of annual sales for 2006 in thousands. Sales were converted from local currency to USD using the real annual exchange rate.	6.74	2.03
Firm age	A two-step categorical variable defined by the median value, 23 years of age: (1) the age of the firm is below 23 years old, (2) the age of the firm is above 23 years old.	1.50	0.50
Manager's experience	A 6-step categorical variable, with each interval equivalent to 10 years of management experience. Therefore, 0 is up to 10 years' experience, 1 is between 10 and 20 years' experience, and so on.	1.74	1.14
Size of locality	A binary variable indicating if the firm is situated in the capital city or a city of 1 million people or more (1), or a smaller locality (0).	0.76	0.43
Holding an IRQC in 2006	A binary variable equal to (1) if the establishment had an internationally-recognized quality certificate in 2006, and (0) if it did not.	0.22	0.41
Exporter status in 2006	A binary variable equal to (1) if the establishment is an exporter in 2006, and (0) if it was not. A firm is considered an exporter in our sample if it 1% or more of its sales come from direct export.	0.23	0.42

Table 2: Descriptive statistics for the sample by treatment status

Indicator	Treated		Non-treated		Difference
	Observations	Mean	Observations	Mean	
2006: Certification status	2716	0.38	3444	0.09	0.29
2010: Certification status	2718	0.51	3452	0.08	0.43
2006: Export status	2732	0.31	3472	0.17	0.15
2010: Export status	2732	0.33	3472	0.15	0.18
2006: Number of employees	2722	183	3462	66	118
2010: Number of employees	2720	257	3458	84	174
2006: Firm age (years)	2700	28.2	3422	24.4	3.72
2010: Firm age (years)	2722	32.4	3458	27.9	4.51
2006: Sales (thousands USD; ln)	2524	7.40	3132	6.22	1.18
2010: Sales (thousands USD; ln)	2426	8.09	2962	6.69	1.40
2006: Manager's experience (years)	2634	20.4	3286	20.8	-0.38
2010: Manager's experience (years)	2524	22.2	3248	22.6	-0.41
2006: Locality	2732	0.75	3472	0.77	-0.02
2010: Locality	2732	0.75	3472	0.77	-0.02

Note: In 2006 there were technically no 'treated' or 'non-treated' firms. Therefore, the label is retroactively applied to identify sample differences.

Table 3: How effective was treatment for uncertified firms?

Outcome variable: certification status							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Treat	0.004	-0.005	-0.006	-0.007	-0.007	-0.007	-0.008
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Time	0.051***	0.052***	0.047***	0.046***	0.046***	0.046***	0.046***
	(0.012)	(0.012)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Treat*Time	0.287***	0.285***	0.299***	0.303***	0.303***	0.303***	0.303***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Ln(Firm size) (2006)		0.016***	0.002	0.002	0.002	0.003	0.002
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Ln(sales) (2006)			0.013***	0.013***	0.013***	0.013***	0.012***
			(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Manager's Experience (2006)				-0.001	-0.001	-0.001	-0.001
				(0.004)	(0.004)	(0.004)	(0.004)
Locality (2006)					0.008	0.007	0.007
					(0.010)	(0.010)	(0.010)
Firm age (2006)						-0.006	-0.006
						(0.008)	(0.008)
Exporter status (2006)							0.020
							(0.012)
Sector effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.001	-0.046***	-0.082***	-0.080***	-0.084***	-0.078***	-0.078***
	(0.007)	(0.010)	(0.017)	(0.017)	(0.019)	(0.020)	(0.020)
Observations	4,838	4,820	4,375	4,163	4,163	4,163	4,163
R-squared	0.221	0.224	0.239	0.244	0.244	0.244	0.245

Note: Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). This regression drops firms which held an IRQC in 2006. Thus, the DiD coefficient represents how effective treatment was for firms transitioning from uncertified to certified status.

Table 4: Does treatment help firms retain their IRQCs?

Outcome variable: certification status							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Treat	-0.037**	-0.044***	-0.041***	-0.040***	-0.040***	-0.040***	-0.037**
	(0.015)	(0.014)	(0.013)	(0.012)	(0.012)	(0.013)	(0.013)
Time	-0.653***	-0.651***	-0.636***	-0.632***	-0.632***	-0.632***	-0.631***
	(0.059)	(0.058)	(0.058)	(0.060)	(0.061)	(0.061)	(0.061)
Treat*Time	0.447***	0.444***	0.432***	0.432***	0.432***	0.432***	0.431***
	(0.045)	(0.045)	(0.041)	(0.045)	(0.045)	(0.045)	(0.045)
Ln(Firm size) (2006)		0.023**	0.024	0.021	0.021	0.021	0.018
		(0.009)	(0.019)	(0.018)	(0.018)	(0.019)	(0.019)
Ln(sales) (2006)			-0.001	0.001	0.001	0.001	-0.000
			(0.013)	(0.013)	(0.013)	(0.012)	(0.012)
Manager's Experience (2006)				0.002	0.001	0.001	0.001
				(0.007)	(0.008)	(0.009)	(0.009)
Locality (2006)					0.005	0.005	0.004
					(0.024)	(0.023)	(0.023)
Firm age (2006)						0.000	-0.000
						(0.021)	(0.021)
Exporter status (2006)							0.039**
							(0.015)
Sector effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.139***	1.031***	1.028***	1.023***	1.022***	1.021***	1.009***
	(0.023)	(0.032)	(0.051)	(0.050)	(0.050)	(0.065)	(0.063)
Observations	1,364	1,362	1,264	1,229	1,229	1,229	1,229
R-squared	0.377	0.386	0.376	0.372	0.372	0.372	0.374

Note: Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). This regression drops firms which did not hold an IRQC in 2006. Thus, the DiD coefficient represents how effective treatment was for firms to stay certified over the period of investigation.

Table 5: Did treatment help firms transition from non-export to exporter status?

Outcome variable: exporter status							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Treat	0.015	0.017	-0.000	-0.005	-0.006	-0.006	-0.006
	(0.011)	(0.013)	(0.012)	(0.013)	(0.012)	(0.012)	(0.012)
Time	0.050***	0.050***	0.051***	0.051***	0.048***	0.048***	0.048***
	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Treat*Time	0.086***	0.086***	0.085***	0.091***	0.095***	0.095***	0.095***
	(0.019)	(0.018)	(0.019)	(0.019)	(0.018)	(0.018)	(0.018)
Ln(Firm size) (2006)		0.030***	0.028**	0.030**	0.030**	0.030**	0.028**
		(0.006)	(0.009)	(0.010)	(0.010)	(0.011)	(0.011)
Ln(sales) (2006)			0.002	0.002	0.002	0.002	0.000
			(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Manager's Experience (2006)				-0.012**	-0.012**	-0.012**	-0.012**
				(0.004)	(0.004)	(0.005)	(0.005)
Locality (2006)					0.008	0.008	0.008
					(0.013)	(0.013)	(0.013)
Firm age (2006)						-0.003	-0.001
						(0.014)	(0.013)
Certification status (2006)							0.073***
							(0.018)
Sector effects	Yes	Yes	Yes	Yes	Yes	Yes	
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	
Constant	0.100***	0.015	0.011	0.032	0.028	0.031	0.044
	(0.010)	(0.022)	(0.029)	(0.034)	(0.033)	(0.034)	(0.032)
Observations	4,790	4,774	4,308	4,136	4,136	4,136	4,102
R-squared	0.046	0.059	0.060	0.063	0.063	0.063	0.068

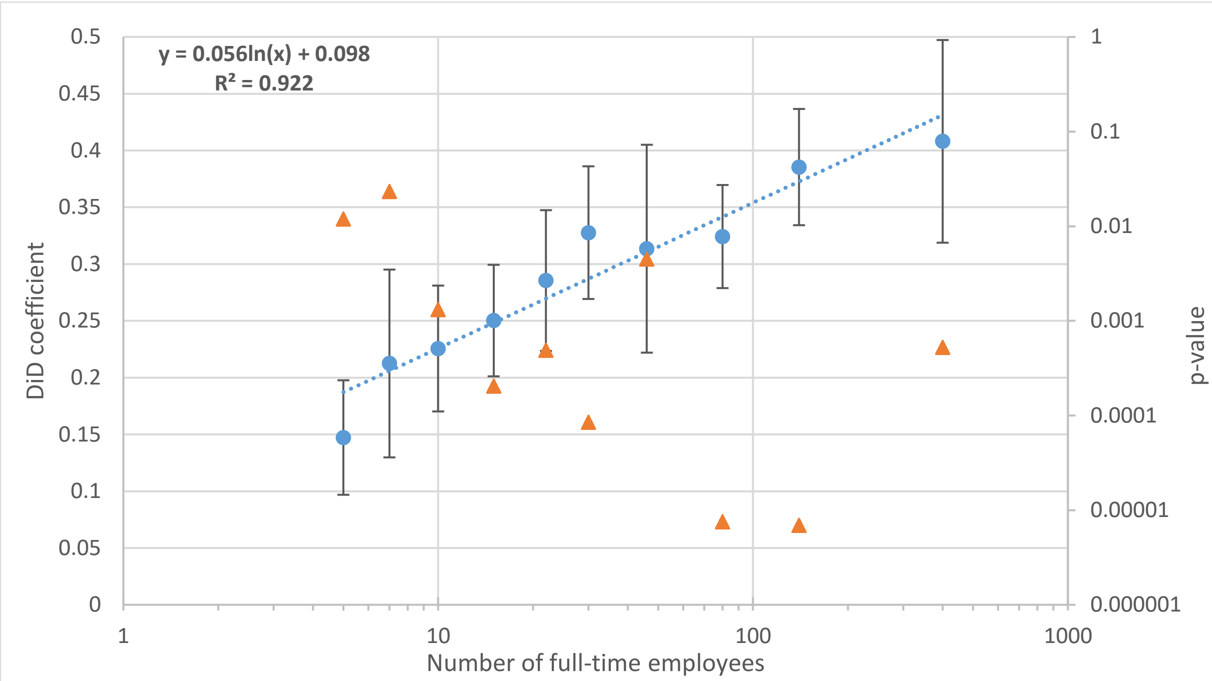
Note: Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). This regression drops firms which were exporters in 2006. Thus, the DiD coefficient represents how effective treatment was for firms to transition from non-export to exporter status.

Table 6: Did treatment help exporters retain their exporter status?

Outcome variable: exporter status							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Treat	-0.014	-0.025*	-0.034*	-0.034*	-0.036**	-0.036**	-0.040**
	(0.014)	(0.014)	(0.016)	(0.016)	(0.016)	(0.017)	(0.016)
Time	-0.301***	-0.301***	-0.303***	-0.294***	-0.294***	-0.294***	-0.295***
	(0.039)	(0.039)	(0.039)	(0.040)	(0.040)	(0.040)	(0.040)
Treat*Time	0.172***	0.171***	0.171***	0.171***	0.171***	0.171***	0.171***
	(0.034)	(0.034)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Ln(Firm size) (2006)		0.013**	-0.006	-0.007	-0.005	-0.005	-0.006
		(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Ln(sales) (2006)			0.019**	0.019**	0.018**	0.018**	0.017**
			(0.007)	(0.008)	(0.007)	(0.007)	(0.007)
Manager's Experience (2006)				-0.002	-0.001	-0.001	-0.000
				(0.007)	(0.007)	(0.008)	(0.008)
Locality (2006)					-0.035*	-0.036*	-0.036*
					(0.018)	(0.018)	(0.017)
Firm age (2006)						-0.005	-0.007
						(0.014)	(0.014)
Certification status (2006)							0.016
							(0.011)
Sector effects	Yes	Yes	Yes	Yes	Yes	Yes	
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	
Constant	1.033***	0.984***	0.922***	0.935***	0.952***	0.957***	0.963***
	(0.021)	(0.034)	(0.043)	(0.040)	(0.040)	(0.050)	(0.050)
Observations	1,432	1,428	1,346	1,270	1,270	1,270	1,262
R-squared	0.184	0.188	0.193	0.190	0.192	0.192	0.193

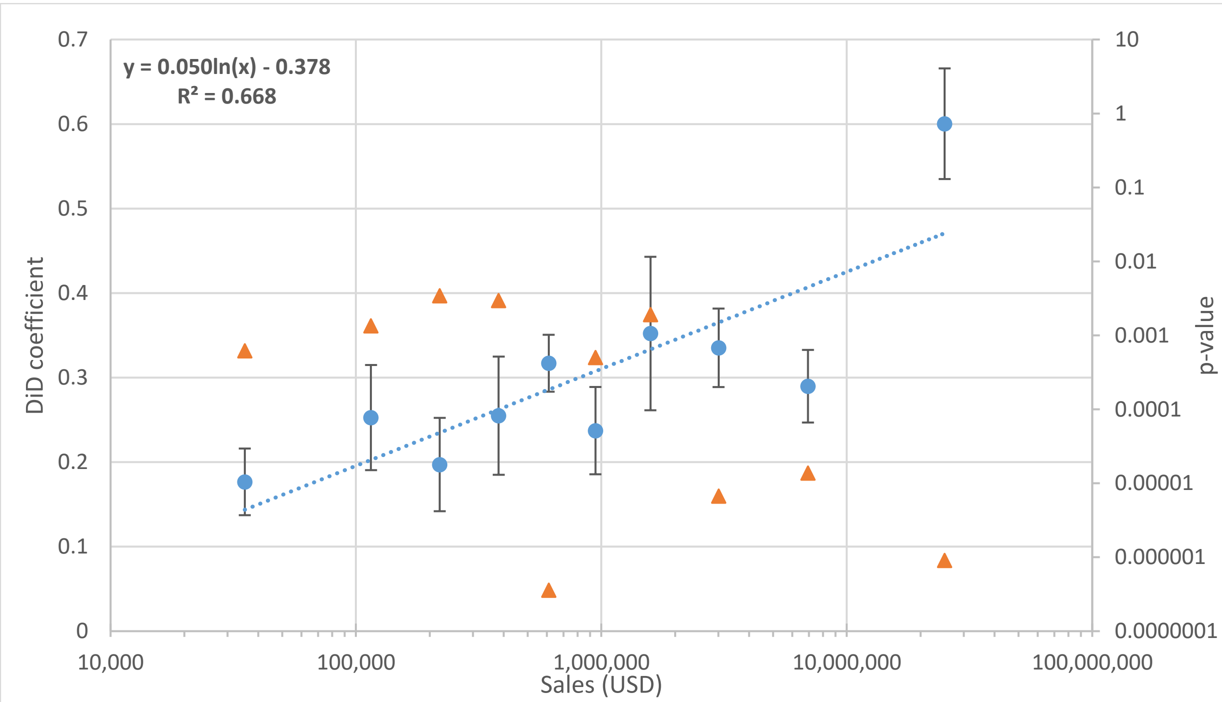
Note: Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). This regression drops firms which were not exporters in 2006. Thus, the DiD coefficient represents how effective treatment was for firms to retain their exporter status.

Figure 1: Does the effectiveness of treatment depend on the number of employees?



Note: Before executing the regression, firms which held an IRQC in 2006 were dropped. This is done to facilitate the interpretation of the DiD coefficient, which now exclusively represents how effective treatment was for firms transitioning from uncertified to certified status. The DiD coefficient is represented by the blue dots with error bars. The p-value of the coefficients are represented by cyan triangles.

Figure 2: Does the effectiveness of treatment depend on firm sales?



Note: Before executing the regression, firms which held an IRQC in 2006 were dropped. This is done to facilitate the interpretation of the DiD coefficient, which now exclusively represents how effective treatment was for firms transitioning from uncertified to certified status. The DiD coefficient is represented by the blue dots with error bars. The p-value of the coefficients are represented by cyan triangles.

Table 7: Descriptive statistics for the sample by source of funding

Indicator	Publically or partially publically funded		Self-funded		Difference
	Observations	Mean	Observations	Mean	
2006: Certification status	372	0.38	2334	0.38	0.00
2010: Certification status	366	0.55	2342	0.51	0.04
2006: Export status	372	0.35	2350	0.31	0.04
2010: Export status	372	0.37	2350	0.33	0.04
2006: Number of employees	372	161.7	2340	186.4	-24.7
2010: Number of employees	370	288.3	2340	252.2	36.1
2006: Firm age (years)	372	28.8	2318	28.1	0.7
2010: Firm age (years)	370	32.9	2342	32.4	0.5
2006: Sales (thousands USD; ln)	338	7.01	2176	7.46	-0.45
2010: Sales (thousands USD; ln)	346	7.62	2072	8.16	-0.55
2006: Manager's experience (years)	356	22.0	2268	20.2	1.78
2010: Manager's experience (years)	348	22.7	2166	22.1	0.66
2006: Locality	372	0.77	2350	0.75	0.02
2010: Locality	372	0.77	2350	0.75	0.02

Table 8: Does the source of the funding for the treatment matter?

Certification status							
VARIABLES	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Funding	0.417***	0.417***	0.425***	0.446***	0.446***	0.446***	0.446***
	(0.060)	(0.060)	(0.058)	(0.050)	(0.050)	(0.050)	(0.050)
Time	-0.002	-0.007	-0.008	-0.002	-0.001	-0.002	-0.000
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)
Funding*Time	-0.091	-0.094	-0.091	-0.111*	-0.111*	-0.111*	-0.111*
	(0.059)	(0.059)	(0.059)	(0.052)	(0.052)	(0.052)	(0.052)
Ln(Firm size) (2006)		0.032***	0.002	0.005	0.004	0.005	0.005
		(0.007)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Ln(sales) (2006)			0.026***	0.025***	0.025***	0.025***	0.025***
			(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Manager's Experience (2006)				-0.002	-0.003	-0.001	-0.001
				(0.008)	(0.008)	(0.008)	(0.008)
Locality (2006)					0.033	0.032	0.032
					(0.024)	(0.024)	(0.024)
Firm age (2006)						-0.017	-0.016
						(0.019)	(0.019)
Exporter status (2006)							0.021
							(0.025)
Sector effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.028***	-0.078***	-0.152***	-0.160***	-0.173***	-0.155***	-0.157***
	(0.008)	(0.023)	(0.035)	(0.036)	(0.038)	(0.042)	(0.041)
Observations	1,678	1,670	1,530	1,464	1,464	1,464	1,464
R-squared	0.212	0.223	0.237	0.242	0.243	0.244	0.244

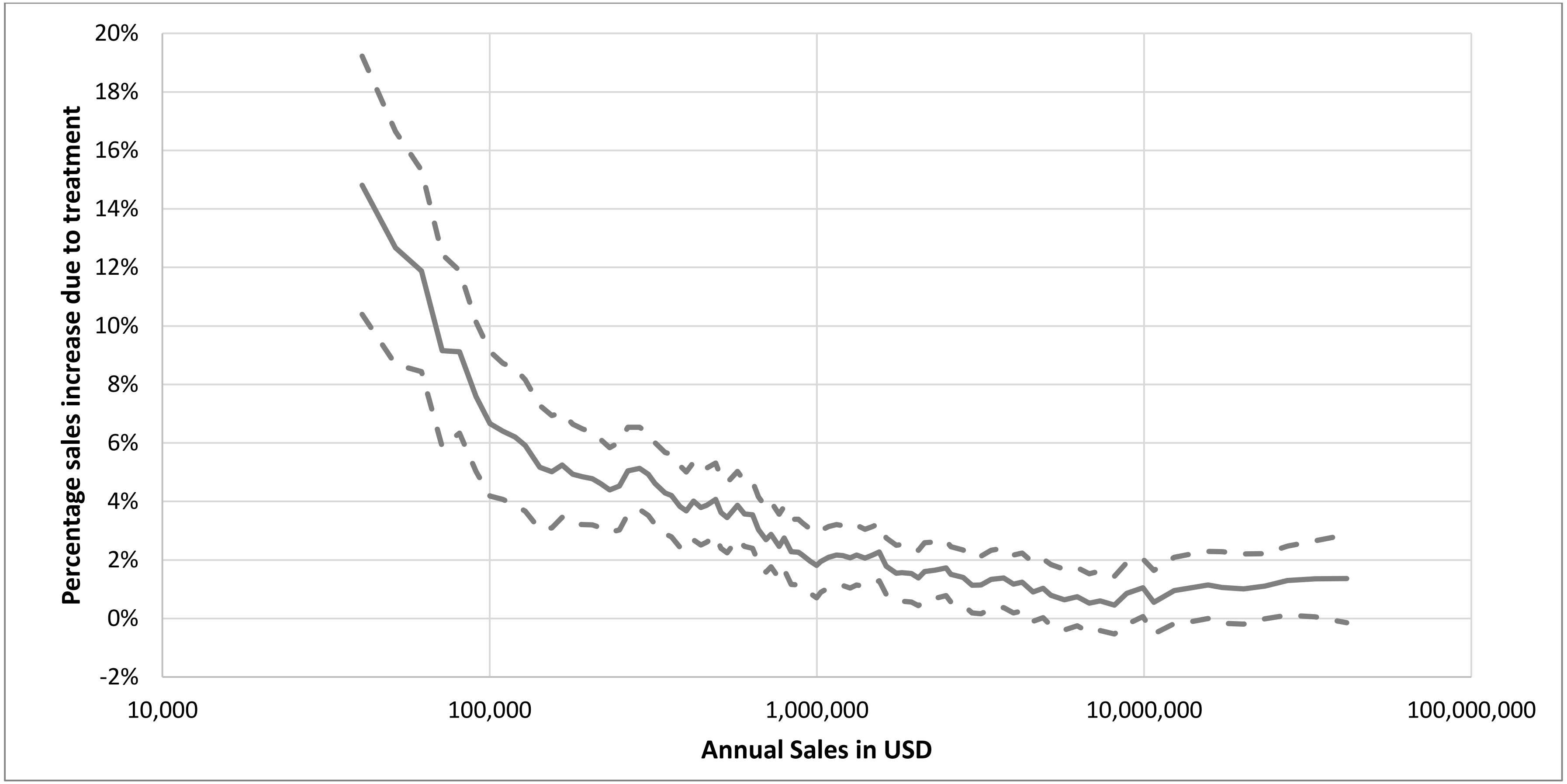
Note: Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1). This regression drops firms which did not receive treatment, and firms which held an IRQC in 2006. Funding is a dummy variable where, when equal to 1, it selects for self-funded treatments and when equal to 0, for publically or partially-publically funded treatments. Thus, the DiD coefficient represents how effective self-funded treatments were compared to publically or partially-publically funded treatments.

Table 9: Does treatment lead to sales growth?

Outcome variable: Sales (ln)							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Treat	1.160***	0.238***	0.221***	0.222***	0.221***	0.143***	0.138***
	(0.103)	(0.046)	(0.047)	(0.047)	(0.047)	(0.046)	(0.045)
Time	0.439***	0.402***	0.411***	0.411***	0.411***	0.416***	0.415***
	(0.087)	(0.085)	(0.085)	(0.085)	(0.085)	(0.084)	(0.083)
Treat*Time	0.222**	0.238***	0.231***	0.231***	0.231***	0.217***	0.218***
	(0.077)	(0.069)	(0.069)	(0.069)	(0.069)	(0.064)	(0.063)
Ln(Firm size) (2006)		1.099***	1.104***	1.102***	1.100***	1.067***	1.053***
		(0.025)	(0.025)	(0.025)	(0.026)	(0.029)	(0.030)
Manager's Experience (2006)			-0.008	-0.008	-0.012	-0.007	-0.008
			(0.019)	(0.019)	(0.021)	(0.021)	(0.021)
Locality (2006)				0.065	0.066	0.065	0.060
				(0.062)	(0.062)	(0.064)	(0.063)
Firm age (2006)					0.033	0.025	0.027
					(0.063)	(0.061)	(0.061)
Certification status (2006)						0.370***	0.339***
						(0.081)	(0.078)
Exporter status (2006)							0.173**
							(0.065)
Sector effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	6.556***	2.976***	2.991***	2.961***	2.927***	2.986***	2.971***
	(0.065)	(0.093)	(0.087)	(0.084)	(0.106)	(0.096)	(0.094)
Observations	5,532	5,518	5,276	5,276	5,276	5,233	5,233
R-squared	0.192	0.672	0.673	0.673	0.673	0.678	0.678

Note: Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Figure 3: The increase in sales due to treatment



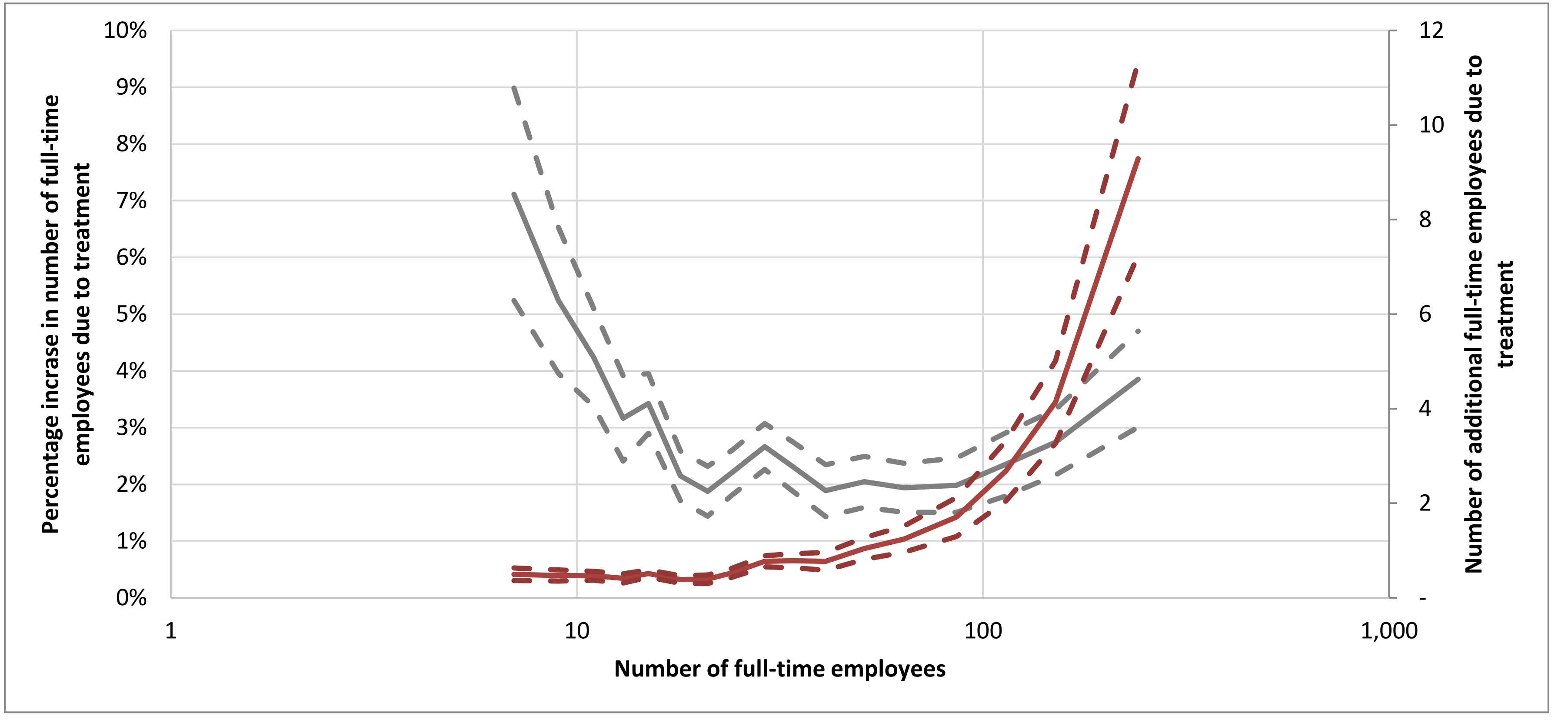
Note: The values in this plot were calculated by executing quantile regressions between percentiles of 0.05 and 0.95, in steps of 0.01. The solid line is the value of the DiD coefficient, transformed into a percentage sales increase. The dashed lines are the one standard deviation errors.

Table 10: Does treatment lead to employment growth?

Outcome variable: Sales (ln)							
VARIABLES	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Treat	0.783***	0.051***	0.044**	0.046**	0.047**	0.047**	0.047**
	(0.072)	(0.011)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Time	0.070*	0.070*	0.068*	0.076*	0.076*	0.076*	0.076*
	(0.035)	(0.034)	(0.034)	(0.036)	(0.036)	(0.036)	(0.036)
Treat*Time	0.152***	0.143***	0.139***	0.131***	0.131***	0.131***	0.131***
	(0.044)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Ln(Firm size) (2006)		0.910***	0.907***	0.906***	0.906***	0.906***	0.907***
		(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)
Manager's Experience (2006)			0.033	0.035	0.035	0.035	0.039
			(0.031)	(0.032)	(0.032)	(0.032)	(0.032)
Locality (2006)				-0.002	-0.003	-0.003	-0.003
				(0.006)	(0.006)	(0.006)	(0.006)
Firm age (2006)					0.033*	0.033	0.033
					(0.018)	(0.019)	(0.019)
Certification status (2006)						0.001	0.000
						(0.012)	(0.012)
Exporter status (2006)							-0.022
							(0.023)
Sector effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.317***	0.349***	0.355***	0.361***	0.346***	0.345***	0.347***
	(0.044)	(0.052)	(0.048)	(0.045)	(0.042)	(0.043)	(0.042)
Observations	6,199	6,189	6,141	5,861	5,861	5,861	5,861
R-squared	0.115	0.863	0.866	0.863	0.864	0.864	0.864

Note: Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Figure 4: The increase in employment due to treatment



Note: The values in this plot were calculated by executing quantile regressions between percentiles of 0.1 and 0.90, in steps of 0.05. The solid grey line is the value of the DiD coefficient, transformed into a percentage employment increase. The dashed grey lines are the one standard deviation errors. The solid red line is the value of the number of additional full-time employees due to treatment. The dashed red lines are the one standard deviation errors.

Table 11: Results for logit regression on control variables

Outcome	Participation in treatment		
Independent variables	**Coef.**	**Std. Error**	**P>z**
Firm size in 2006 (ln)	0.236***	(0.056)	0.000
Firm sales in 2006 (ln)	0.091**	(0.039)	0.020
Manager's experience in 2006	0.004	(0.041)	0.916
Size of locality	-0.096	(0.109)	0.376
Age of enterprise in 2006	0.026	(0.096)	0.782
Exporter status in 2006	0.174	(0.117)	0.137
Holding an IRQC in 2006	1.462***	(0.120)	0.000
Sector effects	Yes		
Country effects	Yes		
Constant	-1.949***	(0.240)	
Observations	2,682		
Pseudo R2	0.1596		
LR chi2(21)	589.12		

Note: Robust standard errors are in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 12: Propensity score matching robustness checks.

	Average Treatment effect on Treated (ATT)			
Outcome	**Nearest Neighbour (1)**	**Nearest Neighbour (2)**	**Kernel (epanechnikov)**	**Bandwidth (epanechnikov)**
Gaining an IRQC (t-stat)	0.31±0.02 (15.2)	0.31±0.02 (15.3)	0.29±0.02 (15.2)	0.021
Retaining an IRQC (t-stat)	0.38±0.07 (5.71)	0.39±0.06 (6.45)	0.38±0.05 (7.38)	0.046
Becoming an exporter (t-stat)	0.07±0.03 (2.86)	0.06±0.2 (2.66)	0.06±0.02 (3.12)	0.104
Remaining an exporter (t-stat)	0.07±0.05 (1.26)	0.09±0.05 (1.76)	0.11±0.04 (2.63)	0.21

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