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THE ROLE OF SUBSIDIES FOR EXPORTS: EVIDENCE FOR PORTUGUESE MANUFACTURING FIRMS

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The role of subsidies for exports

Evidence for Portuguese manufacturing firms[1]

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Abstract: Using a longitudinal database (1996-2003) at the plant level, this paper aims to shed light on the causal nexus between production-related subsidies and exports, in Portugal. Given that there is a selection of firms for subsidies we implement a propensity score matching approach in order to evaluate adequately the effects of subsidies on both the probability of domestic firms to begin exporting and on the probability of increasing the export share of already exporters. At one hand, we find no impact of subsidies on the ability of domestic firms to become exporters; at the other hand, some evidence of positive effects of subsidies are detected on export shares, especially for higher levels of subsidy per employee and for specific sectors as a clear sectoral heterogeneity is observed. Complementarily, some weak positive effects of subsidies are noticed in employment but no evidence is observed for firms´ sales or efficiency.

Keywords: Subsidies, Exports, Portugal, Matching.

JEL codes: F13, F14, H29.

[1]This paper contains statistical data from the National Institute of Statistics of Portugal (INE). The data is used under the permission of INE but does not imply the endorsement of INE in relation to the interpretation or analysis of the statistical data.

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1. Introduction

Exports are decisive for economic growth, especially in downturn cycles when domestic aggregate demand is weak. At the other hand, it is well known that firms, in order to export, must overcome several difficulties and costs. So, most governments apply various export promotion policies, even if direct export subsidization is forbidden by World Trade Organization (WTO) rules. In this framework, general production-related subsidies may have an important role in promoting exports, without violating WTO rules. Complementarily, some recent theoretical models (e.g., Melitz, 2003 or Chaney, 2008) and some recent empirical studies (e.g., Wagner, 2007) found the existence of entry sunk costs of exporting; such costs could be surpassed through the benefits of public supports like subsidies. In this line, export promotion policies may enhance domestic firms to exporting activities.

However, there are few proofs that governmental exporting promotional policies are, indeed, effective in removing or at least reducing such difficulties to exports. This lack of evidence may result from the fact that there are diverse institutional arrangements (both formal and informal designed to help reducing such sunk costs of exporting) deriving complex the task of distinguish the mechanisms which are effective in promoting exports and which are not; moreover, such complexity may open path to misuses, abuses (e.g., Nogués, 1989) and even for a practical impossibility of controlling firms´ subsidies.

Also important is the fact that the existence of complete data, at the firm level, on public subsidies designed to help exporting is scarce, making difficult such test. Additionally, there is a methodological difficulty to such test given that it is impossible to observe the same firms with and without such subsidies and supports; in fact, only indirectly the impact of public support to exports has been analyzed. All these facts increase the doubt on this subject: are public policies of export promotion ineffective or are we not methodologically able to obtain proofs of it?

In line with some few and recent papers (which investigate such mentioned connections between production-subsidies and exports), we use large firm level datasets and matching procedures (as. Gorg et al., 2008 for Irish firms or Girma et al., 2009a for German firms). The main motivation of this paper is to present significant evidence of the links between production related subsidies granted to Portuguese firms and their

export performance. In order to do it, we use the most representative panel data available for manufacturing firms in Portugal for the period 1996-2003 and we apply a propensity score matching approach to uncover the nexus of causality from subsidies to exports.

The main contribution of this paper to the related literature is to present, for the first time, for Portuguese firms evidences of the relationships between subsidies and exports. In line with previous conclusions, for other countries, we also notice that production subsidies have little impact on the probability of domestic firms to begin exporting. Moreover, we also found some evidence that only high levels of subsidies per employee may have the ability to increase, for already exporters, their share of exports in total sales.

The rest of the paper is organized as follows: Section 2 presents a brief summary on the main related literature. Section 3 describes the data used for this study. Section 4 presents some evidence on subsidies and exports in Portuguese firms. In Section 5 we present the main econometric results obtained. Section 6 presents a brief extension of the analysis of subsidies effects on other firms´ variables. Section 7 concludes.

2. Literature on subsidies and exports

Theoretically, export subsidies can increase exports as they may help to support some of the exporting inherent costs; moreover, subsidies could also support an higher price level for exporters, thus inducing more sales and eventually more earnings. Of course, export subsidies present also some dangers namely when their allocation relies on subjective mechanisms based on arbitrary decisions, case in which the competition among firms in order to obtain them may instead generate negative impacts[4].

Despite the importance of public policies to promote exporting activities, there are, however, few empirical studies that have investigated this issue. A first wave of such empirical studies relied on industry level–data[5] and only recently firm-level data begun to be used for such type of studies. In 2000, Alvarez and Crespi studied the activity of the Chilean export promotion agency with direct firm-level sample data and

[4] See Mitra (2000) for an example of this situation.
[5] See Helmers and Trofimenko (2009) for a review of such literature.

found a positive effect of such public policies on firms´ exports (both in the extensive margins and in intensive margin). Bernard and Jensen (2004) studied the determinants of exporting activity in the US, investigating amongst other things, whether export promotion expenditures at the state level influenced the decision of US plants to export or not; their findings suggest little evidence that such policies are able to encourage participation of US domestic manufacturers in the global market. By contrast, Martincus and Carballo (2008) and Helmers and Trofimenko (2009) still using exports subsidies, find some positive effects on export performances of such subsidies, using firm level data for Peru and Colombia, respectively.

Other studies, not disposing of direct data on export promotion subsidies, opt to study instead the effects of overall production-related subsidies on firms´ export performance. Gorg et al. (2008) found, for Irish firms that production subsidies were not capable to motivate domestic firms to become exporters; nevertheless, they found subsidies, with a minimum level, being able to enhance the performance of already exporters. Girma et al. (2009b) had found similar results for Chinese as they noticed production subsidies stimulate exports of already exporting capital intensive firms. In 2009, applying a matching approach to investigate the causal effect of production subsidies on export activities, Girma et al. (2009a) also found no impact of subsidies on the probability a domestic firms to start exporting but they also found weak evidence for a positive impact of subsidies on the growth of the share of exports in total sales, in West Germany but no evidence in East Germany.

3. Data

Production-subsidies are financial assistance that firms receive from government, local authorities or from European Union aiming to lower firms´ production costs and the prices of produced goods or even to provide a proper payment for factors of production. In accounting terms Government grants are assistance by government in the form of transfer resources to an enterprise, in return for past or future compliance of certain conditions related to the operational activities of the company. It is important to remark that these production subsidies are not specifically created to promote exports.

Our data source is the Portuguese National Statistics Institute (INE) balance sheet information (IAE). IAE provides information of firms' balance sheets,[6] and uses a survey sample of all manufacturing Portuguese firms, from 1996-2003. We used as variables: number of employees, turnover, production-subsidies, imports, exports, number of employees specifically devoted to R&D activities, foreign capital, capital, labour costs, earnings. Firms are classified according to their main activity, as identified by INE standard codes (CAE), which are correlated with Eurostat Nace 1.1 taxonomy. Despite being unbalanced, our database contains information for an average of 4,500 firms per year. Capital is proxied by tangible fixed assets at book value (net of depreciation). All nominal variables are measured in 1996 Euros and are deflated using 2 digit industry-level price indices provided by INE; for capital stock we use the same deflator for all sectors.

Given that we needed a firm-level productivity measure and since it is highly probable that profit-maximizing firms immediately adjust their input levels, each time they notice productivity shocks, productivity and input choices are likely to be correlated and thus Total Factor Productivity (TFP) estimation involves problems. Thus, in line with several authors (e.g., Maggioni, 2009), TFP is estimated using the semi-parametric method of Levinsohn and Petrin (2003). This method recognizes the simultaneity bias as firms observe the productivity shocks but econometricians do not. Thus, we compute TFP as the residual of a Cobb-Douglas production function in which: the firm value added is the independent variable; capital, labour and unobservable productivity level are the dependent ones. Besides, this method assumes that intermediate inputs present a monotonic positive relationship with productivity and thus could be used as proxies for TFP. Given data availability, we use intermediate inputs as the deflated values of "supplies and services consumed from thirds" at book value. We estimate production function for every 2-digit sector separately.

[6] Since 2004, INE has changed its methodology and works with the universe of Portuguese manufacturing firms but before 2004 the only data available is the one we use. INE ensures the representativity of the sample used.

4. Evidences on exports and subsidies

Table 1 shows that, in the period 1996-2003 26% of Portuguese firms received production-related subsidies, at least for one year. Of the firms receiving subsidies 80% were already exporters and only 20% non-exporters. The status of subsidized firm is highly stable; in fact, subsidies´ support was persistent as 31% of all subsidized firms reported to have obtained operating subsidies in each and every year and more than half of firms had subsidies for at least 6 years out of 8 (Table 2).

Table 1 – Production-Subsidies in Portuguese firms (1996-2003)

Firms with subsidies	Firms without subsidies	Total of firms observed
2,831 (26%)	7,922 (74%)	10,753 (100%)

Source: Own calculations

Table 2 – Subsidies persistency in Portuguese firms (1996-2003)

Number of years with subsidy	8	7	6	5	4	3	2	1
% of firms subsidized	31%	9%	9%	10%	10%	12%	9%	10%

Source: Own calculations

Subsidies represented, on average for that period, 1,4% of sales for subsidized firms but there was a time heterogeneity as reflected in Table 3. A sectoral heterogeneity was also observed as firms belonging to sectors like: food and beverage, furniture and recycling sectors obtained the higher values of subsidies per sales and in most cases the higher values of subsidies per employees (Appendix A).

Table 3 – Subsidies by year and employee

Year	1996	1997	1998	1999	2000	2001	2002	2003
Weight of subsidies on sales(%)	1,8%	1,8%	1,4%	1,3%	1,1%	2,2%	0,9%	0,8%
Subsidy by employee (€)	232	243	280	258	291	178	185	189

Source: Own calculations

Subsidies, for subsidized firms, are much concentrated. For Portuguese firms, international trade and subsidies are much more concentrated than employment or sales, as measured by the Theil index for inequality assessment (Table 4).

Table 4 – Concentration of Portuguese firms' employees, sales, trade and production subsidies (average 1996-2003)

Variable	Theil Index
Employees	0.68
Sales	1.43
Exports	2.33
Imports	2.52
Subsidies	2.35

Source: Own calculations.

For the same period, we analyzed firm heterogeneity in association with trade status, considering exporting and importing activities. For that purpose, in each year, all firms were classified into four mutually exclusive categories/groups: Non-Traders (NT), Only Exporters (OE), Only Importers (OI) and Two-Way Traders (TWT). In our database around 74% of firms are engaged in international activities and the propensity to export was on average of 63% while the propensity to import was of 69%. Along 1996-2003, the degree of global engagement of Portuguese firms grew as in 1996, TWT represented 45% of firms, but in 2003 they corresponded to 53. There is also clear evidence that NT and TWT status appear to be highly stable, while the OE and OI status seem to be more unstable[7]. Nevertheless, the time persistency of our exporting firms was, on average, of 3.8 over 8 years of our sample data-time lag. Moreover, 18% of firms were exporters for every single year of the whole period, "persistent exporters", while 25% exported in only one single year.

Subsidies and exports are positively related as observed in Table 5. We use as dependent variables in column (1) and line (1) a dummy for exporter status in each year and in column (1) and line (2) a variable for export shares in total sales; each of those variables are regressed on a constant, a dummy for subsidized firms, sectoral codes and

[7] For further details on this analysis see Silva et al. (2010).

size. In column (2) similar regressions are performed but firm fixed effects are added. We perform regressions using logit models for export status dummy and fractional logit models for export shares[8]. All regression coefficients are positive and statistically significant, even when controlling for firm fixed effects and sectoral and time effects. These positive coefficients mean that subsidized firms, when compared with non-subsidized firms, are more probably exporters (first line of regressions) and among exporters subsidized firms present a higher share of exports relative to total sales (second line of regressions). The consistency of such coefficients is confirmed by the fact that, although not reported, such correlation is observable for each and every year between 1996 and 2003. However, those positive coefficients do not mean the existence of any causality relationship between subsidies and exports.

Table 5 – Subsidies and exports (average 1996-2003)

	Independent variable: Subsidized firms (dummy)	Independent variable: Subsidized firms (dummy) (firms fixed effects)
Dependent variable: Exports (Dummy)	0.566 (0.00)	0.131 (0.10)
Dependent variable: Exports (Share)	0.271 (0.00)	0.112 (0.09)

Source: Own calculations.

5. Evaluating the effects of subsidies on exports

In order to investigate the causal effects of production-related subsidies on the probability to export and on export shares of total sales, we must use a different methodology, beyond regression analysis. In fact, the alleged positive relationship may be the result of both causality directions: (i) on one hand, a production-subsidy may help firms to support fixed costs related with the beginning of exporting activities or to deal with particular markets´ difficulties; moreover, subsidies have the ability of reducing some variable costs of already exporters thus inducing an increase in export shares in total sales; (ii) at the other hand, new exporting firms or firms reaching to export to particular destinations may gain the right to collect some subsidies that governments use to reward such performances. Thus, the causality may run in both directions; not to mention the fact that there may exist other firms´ characteristics

[8] We use fractional logit models given the fact that the share of exports in total sales is a percentage variable with a high probability at zero due to the large share of firms with no exports. See Papke and Wooldrige (1996)

beyond subsidies and exports that can influence simultaneously both: Girma et al. (2009a) mention as a clear example of such variables the influence of R&D activities on this issue.

Other important fact to remember when dealing with such methodological issues is that subsidies are not given to firms at random but instead their allocation is (or should be) the result of a conscious selection from governments. In fact, we can admit two opposite selection methods: (i) one relies on the fact that subsidies are granted conditional on the observation of some criteria[9] that firms must fill, like: certain products exported, certain types of workforce employed, certain markets achieved, certain types of firms or sales from certain regions of the country; (ii) the other selection method relies on the possibility of subsidies to be granted on the basis of firms´ connectedness and proximity with Government or public officials and related members. Although opposites both introduce a selection criteria on subsidized firms thus requiring other methods than simple regression analysis in order to properly evaluate the effects of subsidies on firms´ performances.

Additionally, by assuming subsidies (whatever form they have) are not randomly given to firms means one cannot assess their effects simply by a simple comparison between subsidized and non-subsidized firms. In line with Girma et al. (2009a), we argue that this situation closely claims for the use of matching methods. In fact, the ideal method for evaluating subsidies´ effects would be to compare two situations for the same firm: (i) its performances in some year – e.g., exports – in the case it had received a public subsidy with, (ii) the performance on the same moment had it not received such support, which would be the counterfactual situation. Given that the information about the counterfactual will never be available, several authors (in line with Heckman et al. 1998) argue that an adequate way to obtain an appropriate evaluation on the effects of the subsidies is to build a "control group" of firms that did not receive subsidies in that year but was as similar as possible with those firms receiving subsidies in that moment (the treated ones or starters).

By using matching techniques, we hope to build consistent counterfactuals to every subsidy "starter", while using a generic non-subsidized firm as the comparison

[9] Sometimes the complexity or opacity of those criteria can create situations of negative effects of subsidies on firms´ performances given the fact that some of them feel discouraged from applying for subsides (see Helmers and Trofimenko, 2009, for further discussion).

group would not allow us to make causal inferences, since the observed differences after subsidies begin could exist previously in a pre-subsidy period and remain after it.

Assuming the possibility of building such group of control firms, then we would match every treated firm with one or several control firms (the most similar to the first) and therefore we would assume that differences between both performances in the future to be the result of such treatment (subsidy) that one firm received and the other (control) did not.

We are interested in two complementary approaches: at one hand, we want to evaluate the impact of subsidies on the probability of non-exporting firms to begin exporting; at the other hand, we are interested in evaluating the effects of subsidies on the exporting performance of already exporters.

In order to apply such methodology to the study of the causal effect of subsidies on starting to export, we consider as the treated group of firms, for every year from 1998 to 2002, the firms which, in each year, fill the following cumulative conditions: (i) without subsidies two years before, (ii) without subsidies in the year before, (ii) with subsidies in the year considered, (iv) never exported until that year. The control group for each year is made by the firms which had not subsidies in the whole period 1996-2002 and which did not export until the analyzed year. Appendix B presents the number of treated and control firms that were used.

At the other hand, in order to study the causal effect of subsidies on the share of exports in total sales, we consider as treated group of firms, for every year from 1998 to 2002, the firms which, in each year, fill the following cumulative conditions: (i) without subsidies two years before, (ii) without subsidies in the year before, (ii) with subsidies in the year considered, (iv) with exports in the previous year. The control group is made by the firms which have not subsidies in the whole period 1996-2002 and which exported in the previous year. Appendix C presents the number of treated and control firms that were used for this test.

In order to apply matching procedures we must start by estimating the propensity score. Ideally, it would be important, as a first step, to select as control firms those that show the most identical features to the treated group of firms. The control group of firms should have n-1 (out of n) similar features to the treated group and differ only in

the n^{th} feature, which would be the fact that some were subsidized in that year and others don´t. In fact, the true purpose of matching is to pair each new subsidized firm, in each year – on the basis of some observable variables, named as covariates – with a larger control group of firms that remain non-subsidized but had similar probabilities to receive such support.

Given the potentially strong variety of firm observable variables that may be used to pair treated with non-treated firms (e.g., productivity, size, ownership, capital, sector or time effects), a problem of dimension of treatable variables arises. This problem is solved by computing an average index – the so called "propensity score" –, in line with the method of Rosenbaum and Rubin (1983). Using this propensity score, from among a large group of non-treated firms we are able to find the ones which happen to be the most similar to the new subsidized, on average terms and over the pre-treatment period.

This particular propensity score is performed using a probit regression of a dummy variable equal to 1 if a firm is subsidized (treated) in that year and 0 otherwise. Such dummy is, as a base model, regressed on several lagged one year[10] variables that are assumed to be relevant[11] in the selection of firms to be subsidized: number of employees, total factor productivity, wages, a dummy for the existence of R&D workforce, a foreign capital dummy, earnings, sales, two digit sectoral dummies. To free up the functional form of the propensity score we also included higher order polynomials and interaction terms. Nevertheless, in the search of the higher quality match, different specifications were used for different years and that option revealed to be more adequate than using only a single specification for all time cohorts of treated and control firms; Appendixes D and E present the different propensity score probits that we used in each year for each of the two models.

When performing these estimations in each year, we also observed the importance of the different covariates for the dependent variables; although with some heterogeneity we noticed some regularities as firms´ sector, previous importer status and foreign capital share were most frequently important factors explaining firms probability of receiving subsidies (Appendix F). Otherwise, the efficiency level, the

[10] In order to respect the Conditional Independence Assumption.

[11] Given that we are using general production subsidies and not specific ones we opt to consider as determinants for subsidy selection common variables mostly used on the previous empirical works on this subject (e.g., Girma et al., 2009 or Gorg et al. 2008).

presence of R&D within the firm or wages were not significant in explaining the probability of a firm to receive a subsidy.

After propensity scores are obtained, several algorithms could be used to establish the match between treated and control firms. We tested, with similar results, the use of two of those weighting schemes: kernel matching and nearest neighbour matching. Kernel matching defines a neighbourhood for each treated observation and assigns a positive weight to all control observations within the neighbourhood while the weight is otherwise zero. By using more observations, kernel matching reduces the variance of the estimator as compared to the nearest neighbour and produces less bias. The nearest neighbour algorithm matches a starter with a single "non starter" that has the closest propensity score; thus, given their properties on variance, we will present results based on the Epanechnikov kernel.[12]

At this stage, after propensity score matching is performed, there is the need to evaluate the matching quality; this means to compare the average level of the covariates in the pre-treatment period, before and after matching and to look for differences between treated and control units. If there are differences between the matched control sample and treated firms, the matching was not fully successful. We implemented a balancing test proposed by Becker and Ichino (2002) and a standard *T*-test for equality of means. In the former test, we split the sample into intervals so that the average propensity score for the treated and the control does not differ in each interval. Then, within each interval, we checked that the means of each feature do not differ between treated and control units. We made sure that the balancing property is satisfied for every specification of the propensity score (and thus for each cohort of starters and controls separately). For the second test, we performed a standard *T*-test for equality of means of the covariates to check if significant differences remain after conditioning on the propensity score. We computed the *T*-test for the mean values at *t*-1 (the year before subsidies are received). The quality of the matching is confirmed as in Appendixes D and E is evident the high percentage reduction in bias between treated and controls achieved after the matching, thus ensuring we choose the right specification for propensity score. We also ensure the common support condition which means that we

[12] We use a bandwith of 0,001. Moreover, the results show little sensivity on the weighting regime used or on the bandwith interval.

drop subsidy starters which presented in each year a propensity score higher (lower) than the maximum (minimum) score of non-subsidized firms.

Given that our purpose is to evaluate the effects of subsidies on both the probability to a domestic firms to begin exporting and on the export share of total sales of already exporters we compute[13] the average treatment effect on the treated (ATT) as follows: (i) for the first case we are interested in the differences between the percentage of export starters (the outcome variable) among the subsidized firms (treated) and the same percentage for non treated firms; (ii) for the second case ATT means the difference in the change of the export share of total sales (the outcome in question) between the treated firms (new subsidized in each year) and the same outcome for matched non treated firms (firms that remain non-subsidized in that year). We assess ATT both for the year in analysis (year $_t$) and for the next one (year $_{t+1}$). When performing that second ATT we are controlling for unobservable, time-invariant differences between treated and untreated firms, thus, in practice we implement a difference-in-differences matching estimator, as suggested by Blundell and Costa Dias (2000) and Heckman et al. (1998). So, we compare the change in exports´ performance between the group of new subsidized and the most similar group of non-subsidized firms. Results for causal effects of subsidies on starting to export reported in Table 6.

Table 6 - Causal effects of subsidies on starting to export, 1998-2002

	ATT (prob.exp $_t$)	ATT (prob.exp $_{t+1}$)
1998	-0.017^{+} (0.015)	-0.011^{+} (0.011)
1999	0.001^{+} (0.009)	-0.057^{+} (0.101)
2000	0.166* (0.098)	0.222 (0.121)
2001	-0.221^{+} (0.155)	0
2002	0.001^{+} (0.041)	0.067^{+} (0.123)
Pooled years	0.017^{+} (0.041)	-0.037^{+} (0.035)

Source: Own calculations.
Notes: We report bootstrapped standard errors (500 replications). If nothing mentioned coefficients are significant at 1%.**: mean significant at least at 5%. * means coefficients are significant at least at 10%. $^{+}$ means coefficients are not significant.

[13] We use psmatch2 command (version 3.0) for Stata 10.1

Although varying in accordance to the specific year, we find little evidence of subsidies to cause domestic firms to start exporting. Moreover, that effect is even lower one year after the subsidy was received. The only exception is the year 2000, in which subsidies seem to generate a higher probability of exporting. Curiously, we notice that in 2000 the subsidy per employee was the highest for all studied years, giving rise to the speculation that causal effects depend on the subsidy level per capita

Results for the causal effects of subsidies on the share of exports in total sales are reported in Table 7. There is no evidence, for all years, that subsidies cause any increase in exports´ share of total sales. This absence of effects occurs both for the year subsidies start and for the next one. Although not reported, we have also tested similar effects for two years after the subsidy reception but the effects are still none.

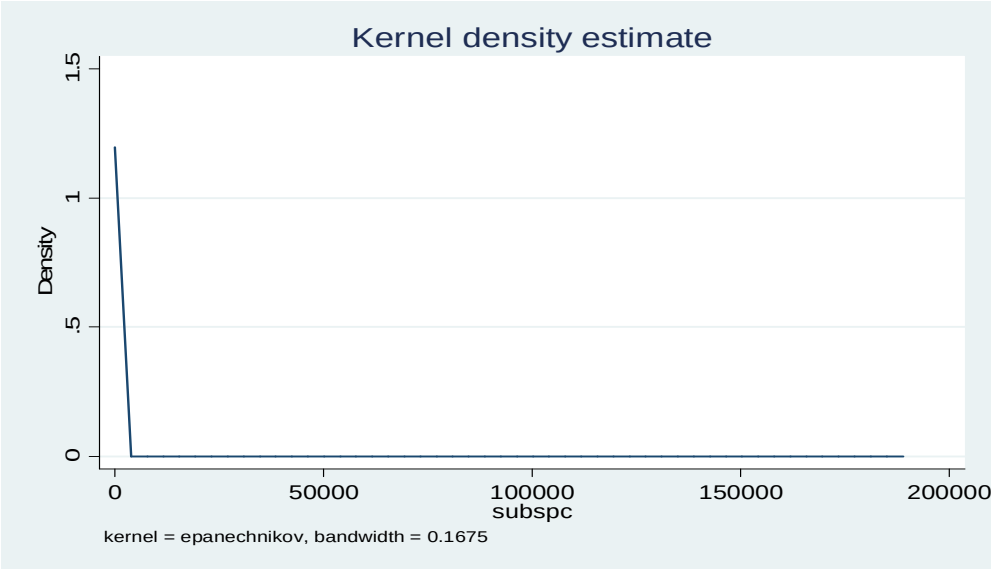
Table 7 - Causal effects of subsidies on export shares, 1998-2002

	ATT (Exp Share $_{t}$)	ATT (Exp Share $_{t+1}$)
1998	-0.002^{+} (0.021)	-0.015^{+} (0.023)
1999	-0.003^{+} (0.041)	-0.028^{+} (0.025)
2000	-0.022^{+} (0.035)	-0.032^{+} (0.038)
2001	-0.031^{+} (0.035)	0.011^{+} (0.032)
2002	-1.541^{+} (11.71)	-0.861^{+} (4.523)
Pooled years	-0.087^{+} (0.097)	-0.098^{+} (0.087)

Source: Own calculations.
Notes: We report bootstrapped standard errors (500 replications). If nothing mentioned coefficients are significant at 1%. **: mean significant at least at 5%. * means coefficients are significant at least at 10%. $^{+}$ means coefficients are not significant

Given that subsidies present a considerable heterogeneity in what respects values per employee and average levels by year (Table 3) and by industrial sector (Appendix A), it would be of interest to perform an analysis of subsidies´ effects using not a binary treatment approach as we do, but instead a continuous treatment approach, varying between zero and a certain maximum amount. However, the use of a generalized propensity score is hampered by the highly skewed distribution of subsidies per employee and even by the dominant share of non-subsidized firms (Figure 1).

Figure 1



Note: subspc means subsidies per employee

Nevertheless, in order to study the impact of subsidy level on the causality nexus for the probability of exporting and for the export share in total sales, we repeated all previous tests but with one difference: we add an additional condition to treated firms – treated firms had to have received, in each year, a subsidy per employee higher than the double of each year´s average subsidy per employee – in order to evaluate only highly subsidized firms and not all subsidized firms.

This computation meant a reduction in the number of "treated firms" by an average of 40% given the initial number. The results of such causality effects of high subsidies on the usual two dependent variables are expressed in Tables 8 and 9.

Table 8 - Causal effects of high subsidies p.e. on starting to export, 1998-2002

	ATT (prob.exp $_t$)	ATT (prob.exp $_{t+1}$)
1998	0	-0.031^{+} (0.024)
1999	-0.011^{+} (0.091)	0
2000	0.251 (0.128)	0.194* (0.116)
2001	0	0.143^{+} (0.145)
2002	0	-0.111^{+} (0.23)

Source: Own calculations

Notes: We report bootstrapped standard errors (500 replications). If nothing mentioned coefficients are significant at 1%. **: mean significant at least at 5%. * means coefficients are significant at least at 10%. $^{+}$ means coefficients are not significant

In what concerns the causal effects of subsidies on the probability of domestic firms to begin exporting no difference exists between Tables 8 and 6 – in general, subsidies do not create higher propensity to start exporting, whatever level the subsidy per employee reaches. In fact, as in Table 6 there are only evidences of positive effects of subsidies for firms receiving grants in 2002, the year of highest level of subsidies per employee.

Differently, the comparison between Tables 9 and 7 suggests that higher levels of subsidies per employee generate a stronger increasing effect on export shares of already exporters, suggesting that exporting firms receiving important subsidies may be able to overcome high entry costs associated with difficult markets and thus taking good care of such supports by increasing the quality of products, lowering their exporting prices or both. In fact, while in Table 7 there was no evidence of any positive effects of subsidies, in Table 9 almost half of the observations suggest that higher levels of subsidies per employee induce increases in exports´ share in total sales.

Table 9 - Causal effects of high subsidies p.e. on export shares, 1998-2002

	ATT (Exp Share $_t$)	ATT (Exp Share $_{t+1}$)
1998	0.016^{+} (0.032)	0.091* (0.052)
1999	-0.039^{+} (0.041)	0.028* (0.022)
2000	-0.023^{+} (0.061)	0.096** (0.058)
2001	0.113** (0.059)	-0.045^{+} (0.062)
2002	0.007^{+} (0.09)	-0.072^{+} (0.131)

Source: Own calculations.
Notes: We report bootstrapped standard errors (500 replications). If nothing mentioned coefficients are significant at 1%. **: mean significant at least at 5%. * means coefficients are significant at least at 10%. $^{+}$ means coefficients are not significant

Additionally, in order to take advantage of a sectoral analysis for the whole period 1998-2002 we pooled all year cohorts and perform a separate ATT for each of the 23 two digit industry sectors available. In what concerns the study of the probability of starting to export for domestic firms the very limited number of observations, for some sectors, did not allow us to perform all such analysis; nevertheless, we notice that the probability of domestic firms to become exporters was only confirmed for the group of sectors related with the machinery cluster, involving all types of machines (electrical

type, office type, motor vehicles and general machinery). Inversely, for food and beverage sector the subsidies reduced the probability of domestic firms to become exporters. For all other sectors no evidence of any kind of effects was noticed.

As for the change in export shares of already exporters, the number of observations available allowed us to perform ATT computations for the majority of two digit industrial sectors. Results in Appendix G show that on one hand, there are positive effects of subsidies in export shares for basic metals, general machinery and electrical machinery; at the other hand, some sectors testify negative effects of subsidies on export share of total sales: food and beverages, textiles, pulp and paper, fabricated metal products. However, given the limitations of the dimension of our sample for most groups, additional precaution is needed in what concerns general conclusions.

6. Assessing the effects of subsidies in general firms´ performances

Given that production subsidies present in our database are not specifically oriented to export enhancing but aim, in general[14], to promote employment, to support specific industries eventually in specific region and to help specific firms in difficulties it would be of most interest to analyze their impact on general firm performances.

According to Community European Treaty[15], state aids to firms have in common the fact that they are granted by a member State or through State resources, they favor certain undertakings or the production of certain goods, but also distort or threaten to distort competition and they affect trade between member States. This definition clearly includes the idea that state interventions could be necessary in order to reach a better allocation of resources but simultaneously they may harm the competition environment with negative consequences. In this framework the consequences of subsidies to firms either could be positive or negative and previous studies are not sufficient to support a clear statement on what´s to be expected on this issue.

Gadd et al. (2009) present a summary on previous research on this subject: on one hand, some positive effects on employment and on the dynamics of turnover and employment are reported for subsidized firms; at the other hand, negative effects on productivity growth rates are also observed in subsidized firms. The very study of Gaad

[14] In this paper we do not refer to R&D subsidies on firms´ innovation activities.
[15] http://www.europa.eu.int/comm/competition/state_aid/legislation/aid3.html

et al. (2009) for Swedish firms, using a propensity score matching approach, concluded that subsidies enhanced employment growth levels of subsidized firms but there was no positive effect on firms´ productivity.

Using our database for Portuguese manufacturing firms (1996-2003) we performed other ATT computations for the subsidies effects on several other variables: earnings, sales, employment and total factor productivity. Results of Tables 10 present subsidies effects on domestic firms and Table 11 presents the same effects but on already exporters.

For both types of firms, we can observe, for most years, positive effects on employment; these positive effects are stronger one year after subsidy is received and weaker on the same year firms get subsidies. No effects of subsidies are reported on earnings and on total factors productivity. In what concerns sales, there are contradictory effects as for most cases there are negative effects in the following year subsidy is received but also some positive effects are noticed

Table 10 - Causal effects of subsidies on earnings, sales, productivity and employment, 1998-2002 for firms initially not exporters

	Earnings $_t$	Earnings $_{t+1}$	Sales $_t$	Sales $_{t+1}$	TFP $_t$	TFP $_{t+1}$	Employm. $_t$	Employm. $_{t+1}$
1998	13^{+} (68)	151^{+} (162)	32^{+} (52)	-176^{*} (138)	-63^{+} (55)	-176^{+} (211)	4^{*} (3,1)	10^{+} (8,9)
1999	73^{+} (108)	251^{+} (252)	-62^{+} (62)	-1736^{*} (938)	-61^{+} (45)	-216 (70)	2^{+} (3,1)	7^{*} (4,9)
2000	-20^{+} (28)	-83^{+} (73)	439^{*} (328)	79^{+} (75)	-88^{+} (72)	-76^{+} (115)	3^{+} (3,1)	10^{*} (7,9)
2001	13^{+} (127)	-127^{+} (256)	-1151^{+} (1979)	1489^{+} (1510)	76^{+} (88)	-29^{+} (21)	6^{+} (7,1)	9^{*} (7,1)
2002	-244^{*} (151)	-47^{+} (91)	-603^{*} (392)	-264^{+} (562)	-77^{+} (66)	-45^{+} (84)	5^{+} (4,9)	3^{+} (4,2)

Source: Own calculations.
Notes: We report bootstrapped standard errors (500 replications). If nothing mentioned coefficients are significant at 1%. **: mean significant at least at 5%. * means coefficients are significant at least at 10%. $^{+}$ means coefficients are not significant

Overall, effects (both positive and negative) seem to be more robust for domestic firms than for already exporters. Moreover, such superior strength of subsidies´ effects also seems to perform more clearly in the following year after subsidy reception than in the same year it occurs.

Table 11 - Causal effects of subsidies on earnings, sales, productivity and employment, 1998-2002 ATT with DID estimators; firms already exporters

	Earnings $_t$	Earnings $_{t+1}$	Sales $_t$	Sales $_{t+1}$	TFP $_t$	TFP $_{t+1}$	Empl. $_t$	Empl. $_{t+1}$
1998	-60^{+} (186)	157^{+} (223)	243^{+} (1110)	1436^{+} (1339)	-16^{+} (43)	-30^{+} (58)	-1^{+} (1,9)	5^{+} (5,9)
1999	-60^{+} (186)	157^{+} (223)	-160^{+} (451)	102^{+} (778)	-46^{+} (42)	93** (51)	1^{+} (1,9)	4* (2,2)
2000	339^{+} (297)	448^{+} (472)	857^{+} (864)	1850* (1280)	49^{+} (83)	-43^{+} (80)	2^{+} (4,9)	7* (4,2)
2001	-243^{+} (426)	-248^{+} (446)	-1513^{+} (1416)	-1134^{+} (816)	36^{+} (68)	-79^{+} (116)	4* (2,9)	5* (3,2)
2002	443^{+} (416)	428^{+} (444)	+910^{+} (901)	-812^{+} (1017)	21^{+} (55)	153** (104)	3^{+} (4,9)	-7^{+} (9,2)

Source: Own calculations.
Notes: We report bootstrapped standard errors (500 replications). If nothing mentioned coefficients are significant at 1%.**: mean significant at least at 5%. * means coefficients are significant at least at 10%. $^{+}$ means coefficients are not significant

7. Concluding remarks

This paper investigates, for the first time for Portuguese firms, the link between production-subsidies and exports. Although positively related those variables´ connections may suffer from endogeneity and sample selection. Thus, in order to really uncover their relationship we apply a propensity score matching approach to reveal the causal effects of subsidies on exports. In this sequence, we found that subsidies received by domestic firms had no impact on their capacity to become exporters and that subsidies granted to already exporters show no significant effects on their exporting performances. Nevertheless, we also found some evidence that highly subsidized exporters (relative to per employee levels) improve their exporting performances.

Our findings are consistent with the other two known related studies for Germany and Ireland: both works also suggest that production subsidies may be used by firms to improve their exporting abilities through enhanced production skills and reduced selling prices but subsidies seem to be less effective in helping domestic firms to deal with sunk costs of foreign markets eventually because the nature of the firms´ main difficulty is not a financial one but rather relies on informational skills. At a complementary level we also found subsidies to have small impact on firms´ sales, total productivity and earnings; employment seems to be the only variable for which some positive effects of subsidies are noticed, in line with previous research for other countries. Further research is needed in order to explain these facts.

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APPENDIX A – Average 1996 - 2003

Sector code	Sector Description	Subsidies / Sales (%)	Subsidies per employee
15	Food, beverages	3.1	2870
17	Textiles	0.6	250
18	Wearing apparel	1.1	263
19	Leather	0.6	223
20	Wood	0.7	338
21	Pulp and paper	0.3	280
22	Printing	2.2	652
24	Chemicals	0.6	567
25	Rubber, plastic	0.4	285
26	Non-metalic mineral product	0.8	307
27	Basic metals	0.3	191
28	Fabricated metal products	0.5	230
29	Machinery	0.6	256
30	Office machinery and computers	0.7	585
31	Electrical machinery	0.3	223
32	TV and communication equipment	0.5	330
33	Medical, precision and optical instruments	0.8	438
34	Motor vehicles	0.9	390
35	Other transport equipment	1.2	802
36	Furniture	4.4	302
37	Recycling	11.2	3204
	Average	1.4	891

Source: Own calculations

APPENDIX B – Treated and control firms for matching (Export starting)

	TREATED	CONTROL
1998	22	160
1999	17	261
2000	14	172
2001	11	125
2002	15	114

Source: Own calculations
Note: firms without subsidies in each year: 677

APPENDIX C – Treated and control firms for matching (Export share)

	TREATED	CONTROL
1998	108	478
1999	132	491
2000	78	478
2001	75	482
2002	78	483

Source: Own calculations
Note: firms without subsidies in each year: 677

APPENDIX D – Probit model used in each year (export beginning)

Year	Covariates used and % reduction bias
1998	R&D(96%), number of employees (11%), forcap (99%), imp (15%), wages 93%), tfp (29%), sales (93%), pscore (99%)
1999	Sectoral dummies, number of employees (18%), sales (50%), imp (96%), forcap (31%.), wages (10%), tfp (11%), pscore (98%)
2000	Sectoral dummies, number of employees (18%), sales (50%), imp (96%), forcap (31%.), wages (10%), tfp (11%), pscore (98%)
2001	Number of employees (58%), sales (15%), wages (80%), tfp (91%), pscore (99%)
2002	Sectoral dummies, number of employees (88%), sales (98%), tfp (61%), pscore (82%)

Note: for each year we present also the propensity score reduction bias after matching
pscore means that covariate has no sufficient observations
Complete results of probit estimations available on request

APPENDIX E – Probit model used in each year (export share)

Year	Covariates used and % reduction bias
1998	Sectoral dummies; R&D (96%), number of employees (25%), wages (43%), imp (95%), sales (27%), pscore (99%)
1999	Sectoral dummies; R&D (26%), number of employees (85%), wages (18%), imp (85%), sales (97%), tfp (65%) pscore (99%)
2000	Sectoral dummies; R&D (39%), number of employees (95%), forcap (35%.), wages (68%), imp (96%), sales (92%), pscore (99%)
2001	R&D (69%), number of employees (20%), forcap (26%.), wages (83%), imp (93%), sales (25%), pscore (96%)
2002	Sectoral dummies (92%), number of employees (82%), wages (80%), tfp (71%), pscore (99%)

Note: for each year we present also the propensity score reduction bias after matching
n.a.: means that covariate has no sufficient observations
Complete results of probit estimations available on request

APPENDIX F – Variables with importance in the probability of receiving subsidies for firms

Years	Variables
1998	R&D (+), Imports (+),
1999	Imports (+), forcap (+)
2000	Sectoral dummies;
2001	Sectoral dummies; Imports (+)
2002	Sectoral dummies; forcap

Source: Own calculations

APPENDIX G – Average 1996 - 2003

Sector code	Sector Description	Probability of exporting (t)	Probability of exporting (t+1)	Growth exp.sha (t)	Growth exp.sha (t+1)
15	Food, beverages	-0.07^{+}	-0.259	0.002^{+}	**-0.134***
17	Textiles	0.14^{+}	0.333^{+}	0.264^{+}	**-0.178***
18	Wearing apparel			-0.469^{+}	-0.078^{+}
19	Leather			-0.103^{+}	0.249^{+}
20	Wood	0	0	-0.079^{+}	0.275^{+}
21	Pulp and paper			**-0.338***	**-0.053****
22	Printing			0.029^{+}	-0.005^{+}
24	Chemicals			-0.082^{+}	-0.053^{+}
25	Rubber, plastic			-0.782^{+}	-0.806^{+}
26	Non-metalic mineral product			0.151^{+}	-0.094^{+}
27	Basic metals			0.147^{+}	**0.211***
28	Fabricated metal products			**-2.145***	**-2.219***
29	Machinery			-0.262^{+}	0.652^{+}
30	Office machinery and computers			n.a.	n.a.
31	Electrical machinery			**0.902***	-0.153^{+}
32	TV, communication equipment			-0.015^{+}	-0,152^{+}
33	Medical, precision, optical instruments			-0.015^{+}	-0,152^{+}
34	Motor vehicles			-7.841^{+}	-10.12^{+}
35	Other transport equipment			n.a.	n.a.
36	Furniture			-1.65^{+}	0.082^{+}
37	Recycling			n.a.	n.a.

Source: Own calculations

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