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The Direction of Causality between Exports and Firm Performance; microeconomic evidence from Croatia Using the Matching Approach

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The direction of causality between exports and firm performance; microeconomic evidence from Croatia using the matching approach

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ABSTRACT:

This paper contributes to the literature by using propensity score matching to test for causal effects of starting to export on firm performance in Croatian manufacturing firm level data. The results confirm that exporters are endowed with superior characteristics when compared to non-exporters. In the main sample specification there is pervasive evidence of self-selection into export markets, meaning that firms are successful years before they become exporters. Using three different productivity measures, six sample periods and three sample specifications the effect of exports on productivity is significant in some periods but it is not omnipresent. On the other hand, higher sales growth is found to be a more conclusive distinguishing characteristic of the new exporters. As in similar studies, we find that a part of the results depends on the number of export starters in the estimation sample.

Keywords: exports, learning-by-exporting, propensity score matching, productivity, self-selection

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All errors, opinions stated and conclusions contained in paper are solely those of the authors.

1. Introduction

A strong export base is one of the key ingredients in generating sustainable long term growth. This is especially the case in developing and transition countries, where the well established link between the growth of real exports and real GDP has been influential in promoting outward looking trade strategies. Although most evidence on the link between growth and exports is based on macro level data, firms that actually export and most of the measures that policymakers have at their disposal are essentially microeconomic. Due to that, it is crucial to determine the characteristics of the exporters, why it is that some firms export and others do not, and how differences in export behavior relate to productivity differences among firms.

In this paper we present the results of an extensive investigation of exporters in Croatian manufacturing. Croatia is characterized with a substantial trade imbalance and relatively slow exports growth when comparing to similar Central and Eastern European countries. Moreover, Croatia`s short to medium term growth prospects hinge on the future dynamism of the export sector. Using micro data on Croatian manufacturing firms from 2002 until 2012, in this paper we try to determine what kind of firms enter into the export markets and how does exporting affect their performance (total factor productivity, sales, wages, labour productivity, etc.) relative to the non-exporters.

While it is well established that exporters tend to outperform non-exporters, the direction of causality is still not fully investigated. This paper proceeds to document the so called exporter premium, and then tests for two usual hypotheses in the trade literature; self-selection and learning-by-exporting. Firstly, firms may exhibit strong productivity growth years before they enter into the export market, so their success as exporters may be due to firm performance before they started to export. On the other hand, the theoretical and empirical trade literature suggests various positive effects of exporting on firm performance.

This paper contributes to the literature, by using propensity score matching to test for causal effects of starting to export on firm performance (testing learning-by-exporting hypothesis) in Croatian firm level data. The matching approach deals with the causality issue by pairing exporters and non-exporters with similar observable firm characteristics, summarized by the probability to export indicator. Assuming that a vector of observable firm characteristics can capture all the differences between export starters and non-exporters, this procedure allows

testing a counterfactual: are firms more productive after they start to export, relative to their performance if they did not export?

The results confirm the exceptional performance of exporters when compared to non-exporters. Moreover, the self-selection hypothesis is confirmed in the main sample specification, meaning that much of the superior characteristics of new exporters precede their entrance into the export market. Using three different productivity measures, six sample periods and three sample specifications there is scant evidence on learning-by-exporting which holds only in some periods. On the other hand, higher sales growth is found to be a more conclusive distinguishing characteristic of the new exporters, presumably because after paying a sunk cost of entry to foreign markets, export starters have access to relatively larger markets than non-exporters.

The remainder of the paper is organized as follows. Section 2 reviews the literature on exporting and productivity. Section 3 describes the data. Section 4 outlines the empirical strategy and results, while section 5 concludes.

2. Literature review

Research on the relationship between export performance and economic growth is long standing, but the conclusions about how trade and economic growth interact still remain unclear (see for example extensive surveys of empirical literature by Giles and Williams (2000a, 2000b) and (Baldwin (2000)). Case studies show that most development success stories are in some way characterized by high growth of exports (CGD, 2008). While most studies find positive correlation between countries GDP growth and various measures of trade openness, the problem of causality is pervasive throughout the literature.

In 1995 Bernard and Jensen published the first of series of papers that use comprehensive longitudinal data for US to look at differences between exporters and their counterparts in various dimension of firm performance, particularly productivity. Following this seminal paper a growing body of empirical work has focused on the microeconomic aspects of the firm's performance in order to study their export activity, causes and consequences of that activity. A common result is that exporting firms are generally different from non-exporting firms in such a way that they are technologically more sophisticated, tend to be larger, more productive, pay higher wages, etc.

While the differences between exporters and non-exporters are widely documented, the direction of causality is still not fully investigated. Two different hypotheses, which are not mutually exclusive, about how firms' performance is related to export market participation, have been put forward. The first hypothesis points to the self-selection of the more productive firms into export markets. The logic behind that hypothesis lies in the fact that there is a sunk costs associated with selling goods in foreign markets (like transportation, distribution, marketing costs or cost of changes in personnel or domestic products for foreign consumption, etc.) and that less productive firms will be less capable in overcoming them. Roberts and Tybout (1997), Bernard and Jensen (1999) and Bernard and Wagner (2001) find evidence for the existence of sunk cost associated with exporting. Therefore, differences between exporters and non-exporters can be partly explained by ex-ante differences between firms. An alternative theoretical explanation for the firm level linkage between exporting and productivity is that firms may become more efficient after they begin exporting through learning experience or economies of scale effects. This implies that exporting makes firms more productive and this hypothesis is usually called learning-by-exporting hypothesis. In more detail, the differences between exporters and non-exporters may partially arise from ex-post differences between firms.

The literature is quite unanimous on the self-selection hypothesis and empirical evidence is rather robust, while results of learning effect are mixed throughout literature. Bernard and Wagner (1997) find evidence of self-selection of exporters for case of Germany, while Bernard and Jensen (1999) find that exporters have all their desirable characteristics before taking up exporting in US as well. In 2005 Arnold and Hussinger confirm that high productivity German firms self-select themselves into export markets, while exporting itself doesn't play significant role for productivity. Clerides et al. (1998) also find strong evidence for self-selection in their data from Colombia, Mexico, and Morocco. For Taiwan, Aw et al. (2000) find that newly exporting firms outperform other firms before entry, and in some industries they experience productivity improvements following entry. These results are consistent with the self-selection hypothesis, but give only limited support to the learning hypothesis. For Korea (Aw et al. (2000)), the correlation between export status and firm productivity is less pronounced and they find no support for the learning hypothesis as well. Delgado et al. (2002) apply nonparametric methods on a panel of Spanish firms and their results support the self-selection mechanism of highly productive firms into exporting and

only when limiting their sample to young firms do they find some evidence for learning effects.

Although, most studies fail to find that presence in international markets enables firms to achieve further productivity improvements, the exceptions are Kraay (1999) and Bigsten et al. (2004). They find evidence for learning effects for China and several sub-Saharan African countries. Castellani (2002) finds that Italian firms with a very high exposure to foreign markets experience learning effects, while below the export intensity threshold this is not the case. Girma et al. (2004) also find learning effects for export market entrants in Great Britain.

The International Study Group on Exports and Productivity (ISGEP, 2008) used comparable micro level panel data for 14 countries and a set of identically specified empirical models to determine the linkage between exports and productivity. The results show that exporters are more productive than non-exporters for set of analyzed countries. They find strong empirical evidence for self-selection hypothesis, but almost no evidence in favor of learning-by exporting hypothesis.

The seminal paper of this type in Croatia is Lukinić-Čardić (2012), which explored various firm level aspects of Croatian exports. Among other results, the robust export premium of manufacturing firms in Croatia is confirmed, evidence of self-selection is found to be sparse but there is some evidence of learning-by-exporting. We build on this analysis, adding more performance measures, additional sample periods, broader sample specification and employing different econometric techniques which results in somewhat different conclusions.

3. Data

The firm level analysis in this paper is based on the data from financial reports that Croatian non-financial companies are obliged to provide to the Financial agency (FINA). The dataset spans eleven years, from 2002 until 2012. Although, the FINA data reach as far as 1993, 2002 is chosen because there were considerable methodological and regulatory changes prior to that year. The most important change was the introduction of fines for firms that do not send their financial reports to FINA, which resulted in inflation of firms in the dataset in 2002 when comparing to 2001. The dataset covers manufacturing companies in Croatia, so combined with eleven years this amounts to 80256 observations. The variables included in the analysis are the following: sales, number of employees, wage bill, intermediate inputs, capital

and value of exports. Sales variable excludes financial revenue in order to estimate revenue from regular business operations. Number of employees is defined as the average number of workers based on working hours during the year, so that possible effects of longer working hours per employee and possible changes in employment at the end of the year are controlled for. Value added is deflated with the implicit gross value added deflator for manufacturing. Energy costs are deflated with the gross values added deflator for electricity, gas, steam and air conditioning supply sector. Capital is deflated with the GDP deflator.

Intermediate inputs are calculated as a sum of material costs and energy costs, and capital is defined as total assets. The full dataset is equal to around 80% of goods exports in the studied period, after excluding firms that do not employ any workers. Firm level data are usually corrected for outliers, because, inter alia, the data is based on firm self-reporting so errors in reports are possible. The outlier observations are treated in two stages following ECB (2014). Firstly, observations with negative value-added are replaced as missing values and secondly, observations with growth rates belonging to 1st or 99th percentile are dropped.

4. Empirical strategy and results

The following sections provide the explanation of export premium estimation, as well as results of testing self-selection and learning-by-exporting hypotheses using micro data on Croatian manufacturing firms from 2002 until 2012.

4.1. Export premium

In this step the extent of exceptional exporter performance will be estimated i.e. export premium will be calculated. Export premium is defined as the ceteris paribus percentage difference of specific firm characteristics between exporters and non-exporters. The main firm characteristic of our interest are TFP, two measures of labour productivity (one with turnover, the other with value added in the numerator), capital, sales, wages and unit labour cost (ULC). Unit labour cost is obtained by dividing total labour cost by the value of real output. The generalized methods of moments (GMM) framework utilized in this paper to estimate TFP is described in Appendix A1. A common approach in the empirical literature is to estimate export premia by regressing multiple firm performance indicators on an export dummy and a set of control variables (usually including industry, firm size measured by the number of

employees, and year). Specifically, the export premia is estimated from a regression of the following form:

$$\ln \mathrm{X_{it}} = \alpha + \beta Export_{it} + \gamma Control_{it} + \varepsilon_{it} \quad (1)$$

where *i* is the index of the firm, *t* is the index of the year, X_{it} represents the firm characteristics of interest, namely productivity measures in form of TFP, LP1 (revenue based labour productivity) and LP2 (value added based labour productivity) and other performance measures such as capital, sales, wages and ULC; *Export* is a dummy of the current export status (1 if firm *i* is an exporter in year *t*, 0 otherwise); *Control* is a vector of firm specific controls which include sector and size dummies; *e* is the random error. The export premium, computed from the estimated coefficient ß as $100(exp(ß) - 1)$, shows the average percentage difference between exporters and non-exporters after controlling for the characteristics included in the vector of controls. To control for unobserved plant heterogeneity due to time-invariant firm characteristics which might be correlated with the variables included in the empirical model and which might lead to a biased estimate of the exporter premium, a variant of equation (1) is often estimated with fixed firm effects, too. The results of a fixed effect panel regression show a considerable decrease in the export premium when firm fixed effects are controlled for. This is evidence of significant firm specific effects influencing firm performance. After further controlling for firm heterogeneity, the total factor productivity exporter premium drops from the interval of 40% to 60% (depending on the year)[1] which was found in the cross section regressions to 10% in a fixed effects panel.

Table 1. Export premium estimates from fixed effects panel

	TFP	Capital	Sales	ULC	LP1	LP2	Wages
Estimated coefficient	0.09***	0.07***	0.15***	-0.06***	0.09***	0.09***	0.03***
Transformed coefficient	10.2	6.72	16.35	-5.71	9.46	9.21	2.64
No. of observations	65,138	65,138	65,036	64,453	65,138	65,036	64,453

Note:, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. The transformed coefficient was calculated as 100(exp(β)-1). The panel regression is corrected for first order autocorrelation.*
Source: own calculations based on FINA database

Although the analysis presented above documents the different characteristics of exporters and non-exporters, it isn't sufficient to identify causal effects. Better performing firms can self-select into export markets and thus it is not certain if these estimates show the effects of exporting on firm performance. In order to examine the validity of self-selection hypothesis, in the next section ex-ante productivity premium of future export starters will be analyzed.

[1] Table 1 in the Appendix 2 shows the yearly export premium regressions for different firm performance measures.

4.2. Self- selection hypothesis

To shed light on the empirical validity of the hypothesis that more productive firms self-select into export market, the pre-entry differences in productivity between export starters and non-exporters are analyzed next.

In the literature, exporter-starters are defined in different ways, mostly influenced by data restrictions. In this analysis, an export-starter is defined as a firm that exports for the first time and continues to export for three consecutive years. The sample is divided into six sub-periods (2002-2007, 2003-2008, 2004-2009, 2005-2010, 2006-2011, and 2007-2012) in order to obtain higher number of observations in analysis and consistent export behavior data. In each sample non-exporters are defined as firms that didn't export in any of the years in the sample period or prior to the sample period. More formally, the following empirical model will be estimated:

$$\ln X_{it} = \alpha + \beta Export_{iT} + \gamma Control_{it} + \varepsilon_{it}, \quad (2)$$

where *i* is the index of the firm, *t* is the index of the year, *T* is the year of entry into the foreign market, X_{it} represents the firm characteristics of interest in year *t* which include productivity measures in form of TFP, revenue based labour productivity (LP1), value added based labour productivity(LP2), capital, sales, wages and ULC; $Export_{iT}$ is a dummy for the export-entry status (1 if firm *i* is an exporter in year *T*, 0 if it is a non-exporter); *Control* is a vector of firm specific controls which include sector and size dummies; *e* is the random error and $t<T$ in order to asses pre-entry characteristics of future exporters. This equation is estimated for six different periods, and the results are available in Table 2. Regression results confirm the extraordinary performance of new exporters years prior to entry in the foreign markets. Future exporters are generally more productive according to all measures of productivity employed in the analysis. Additionally, they are endowed with more capital, have higher sales, usually pay higher wages and have lower unit labour costs after controlling for firm size and sector.

Table 2. Ex-ante export premium, estimated for six samples and seven firm performance measures

Beginning year	Comparison year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	2002	0.47***	0.56**	0.80***	-0.36***	0.50***	0.59***	0.14*	3,271
	2003	0.72***	0.38	0.90***	-0.49***	0.72***	0.65***	0.22***	3,380
	2004	0.54***	0.65***	0.79***	-0.44***	0.56***	0.52***	0.13**	3,256
2006	2003	0.23	0.87***	0.75***	-0.11	0.28	0.30*	0.14**	3,288
	2004	0.11	0.45	0.36**	-0.08	0.11	0.15	0.06	3,155
	2005	0.28*	0.47*	0.54***	-0.2	0.30*	0.29**	0.09	3,105
2007	2004	0.48**	0.79**	0.91***	-0.35**	0.55**	0.62***	0.19**	3,096
	2005	0.38*	1.00**	0.87***	-0.31***	0.50**	0.57***	0.19*	3,039
	2006	0.32	0.75*	0.75***	-0.42**	0.40*	0.62***	0.1	3,454
2008	2005	-0.07	0.71	0.46*	0.12	-0.05	0.13	0.65	2,968
	2006	0.14	1.14***	0.65***	-0.09	0.21	0.30*	0.11	3,358
	2007	0.2	1.00***	0.53***	-0.28*	0.28*	0.35**	0.04	3,540
2009	2006	0.29	0.89**	0.54	-0.19	0.48*	0.50*	0.28**	3,300
	2007	0.36	0.81**	0.59**	-0.42*	0.47*	0.4	0.15	3,472
	2008	0.64**	0.53	0.92***	-0.42**	0.69***	0.63***	0.53**	3,657
2010	2007	0.19	0.62**	0.34*	-0.24	0.24	0.25	0	3,430
	2008	0.55***	0.82***	0.77***	-0.30**	0.62***	0.62***	0.30***	3,602
	2009	0.45***	0.87***	0.76***	-0.33**	0.49***	0.45***	0.96	3,714

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 165, 234, 127, 137, 144, 157 respectively*.
Source: own calculations based on FINA database

Lukinić-Čardić (2012) also tests equation (2) on a sample of Croatian manufacturing firm but arrives at scant evidence supporting self-selection hypothesis. The reason is that Lukinić-Čardić (2012) uses a different sample specification including only firms with ten or more employees which results in a substantial reduction of export starters. As in similar studies (for example, ISGEP, 2008), parameter significance heavily depends on the number of export starters employed in the analysis. After excluding firms that employ less than ten workers, not more than twenty export starters are available for analysis in each time period. The outcome is that β parameter estimates are significant in some periods but are mostly rendered insignificant.

4.3. Learning-by-exporting hypothesis

This subsection tests the second hypothesis, learning-by-exporting, which suggests that firm productivity increases after entry into the export market. As can be seen in the Table 2 in the Appendix A2, export starters maintain higher *levels* of performance indicators even after starting to export. This is expected as it would be surprising that exporting reduced previously achieved levels of productivity, sales, capital, etc. Thus, it is necessary to test whether performance indicators changed significantly after firms started to export. The empirical model used for measuring post export market entry premium is following one:

$$\%\Delta X_{T+2} = \alpha + \beta Export_{iT} + \gamma Control_{it} + \varepsilon_{it}, \quad (3)$$

where *i*, *t* and $Export_{iT}$ are defined as previously. $\%\Delta X_{T+2}$ represents growth rate premia of export starters two years after starting to export. $Control_{it}$ is a vector of the same firm-specific controls as in the previous equation, and *e* is an error term. Hence, the post-entry differences in *growth* of performance indicators between exporters and firms that keep selling their products on domestic markets only will be estimated. The results in Table 3 indicate that firm productivity performance did not significantly change after starting to export. On the other hand, there is evidence that following entry into export markets, export starters experience higher sales growth and negative growth in unit labour cost, which may be due to access to relative large foreign markets and relatively higher competitive pressure.

Table 3. Ex-post growth rates premia

Beginning year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	-2.33	11.32	45.37	0.15	-2.26	-3.73	0.002	2,501
2006	-0.02	6.85	70.59**	-0.37**	-0.56	0.06*	0.003***	2,695
2007	-4.41	4.82	14.0	-0.22	-4.96	-2.56	0.00	2,523
2008	-4.91	-9.94	27.33**	-0.25**	-5.6	-2.87	-0.003	2,804
2009	-5.96	15.48	33.63**	-0.46	-5.9	-0.95	0.003***	2,76
2010	-1.65	1.6	8.77	-0.14*	-1.86*	-0.84	0.00	2,832

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 165, 234, 127, 137, 144, 157 respectively.*
Source: own calculations based on FINA database

Nonetheless, there is some doubt about the robustness of these results. Firstly, the coefficient of determination in these regressions is usually around 2%, which is not unusual given the problem under study. Galac (2014) searches for a benchmark firm growth model using diverse specifications and a multitude of available determinants of firm growth but does not arrive at much higher R^2 values (usually from 2% to 10%). Secondly, as mentioned in the previous section, similar studies find that a relatively small number of observed export starters usually renders a lot of export premium coefficients insignificant. To check for robustness regarding the number of observations and different sample construction strategies, equation (3) was estimated on two additional sample specifications.

Firstly, the equation was re-estimated on a restricted sample that contains firms which operated during all the sample years prior to starting to export. This specification ensures that all firms existed three years before starting to export which resulted in a considerable reduction of the sample (Appendix A2, Table 3). The estimated coefficients changed

markedly and the export premium for sales is not significant as in the main specification. On the other hand, there is still some evidence of negative ULC growth after starting to export, but the coefficients are evidently different from the previous specification.

Another possible sample specification is to restrict the sample so that it only includes firms that employ 10 or more workers as in Lukinić-Čardić (2012). This sample specification resulted in a substantial loss of observations and again considerable differences in coefficients (Appendix A2, Table 4). In this sample, there are visible productivity improvements of new exporters relative to non-exporters, but there is no significant superior performance in ULC and sales as in the main specifications.

Although there are differences in estimated coefficients throughout the sample specifications, some form of export starter premium can be discerned in each of the specifications. The main issue with these robustness checks is that they significantly reduce the number of export starters and thus may influence the significance of parameter estimates.

Again, the above analysis can only document the differences between export starters and non-exports. Equation (3) does not take into account the possibility of self-selection of better performing firms into export markets so the estimated parameters cannot reveal any causal relationship between exporting and firm performance but can only document the average differences between the two groups under study. In the following section this issue will be addressed.

4.4. Propensity score matching and learning effects

As stated above, a comparison of the average performance of export starters and non-exporters cannot uncover any causal relationship due to self-selection of better performing firms into exporting. The effect of exporting can be viewed as a standard problem of program evaluation with non-experimental data. If participants in the program, in this case - exporters, are not selected randomly from a population but are selected or self-select accordingly to some criteria, the effect of treatment cannot be compared just by observing average performance of the treated and non-treated group. The problem is known in the literature as selection bias. Therefore, a control group from the non-exporters has to be selected so it can be compared with the export-starters in which the distribution of observed characteristics of

control group is as similar as possible to the distribution in the starter group. In more details, for every export starter a non-exporter has to be selected based on observable characteristics.

One of the approaches for evaluation of non-experimental data in social sciences is the matching method. This has become a very popular approach for estimating causal treatment effects, especially when evaluating labour market policies, but it is also used in diverse fields of study. In order to correct for selection bias, the matching method needs to account for all the systematic differences relevant to both the exporting decision and firm productivity. The examination of causal relationship between starting to export on productivity using matching techniques was introduced in the literature by Wagner (2002) and Girma et al. (2003, 2004), and after that has been widely used.

In this analysis, for every export starter a non-exporter has to be selected that was as similar as possible to the export starter in *t-1* period. To do so, we utilize the method of Rosenbaum and Rubin (1983) called propensity score matching. First, the probability of exporting is estimated using a probit regression which relates a dummy variable indicating whether or not a firm is an export starter on all relevant firm characteristics in the previous period. In order to estimate the export decision, we specify an empirical probit model in which export behavior depends on a variety of observed, firm-specific characteristics:

$$P(EXPdummy_{i,t} = 1) = F\,(TFP_{i,t-k}, Control_{i,t-k}), \qquad (4)$$

where *EXPdummy* represents an indicator weather firm *i* is an export starter, *k* is the number of lags, *F* is a normal cumulative density function, and *TFP* is estimated total factor productivity. The control variables include capital, wages, employment as a measure of company size and time dummies to capture time effects not specific to an individual firm. The number of lags *k* varies between 0 and 2 across specifications in order to satisfy the balancing property of the propensity score matching. Bootstrapped standard errors are used to test the significance of the coefficients.

The estimated probability of a firm to become an export starter is then used as a propensity score in the matching procedure. Let P_{it} denote the predicted probability of exporting at *t* for firm *i*, which is eventually an actual exporter. Then, non-exporting firm *j*, which is as similar as possible in terms of its estimated propensity score, is selected as a match for the exporting firm, using the "nearest-neighbor" matching method. Specifically, this matching method

requires that at each point in time, a non-exporting firm j is chosen based on the following criteria:

$$\left|p_{i,t} - p_{j,t}\right| = \min_{j \epsilon \{EXPdummy_{i,t}=0\}} \left(p_{i,t} - p_{j,t}\right) \quad (5)$$

The proposed type of matching procedure is preferable to randomly or indiscriminately choosing the comparison group because it is less likely to suffer from selection bias.

In this paper the matching procedure will be performed following Becker and Ichino's (2002) STATA algorithm. Using this procedure we can confirm whether the probit specification is valid for this situation and that the optimal number of firms in which the propensity scores and the means of company characteristics do not differ from export-starters (treated) and the non-exporters (control) group.

After obtaining the matched sample based on the probability to become an exporter, we proceed to estimate the differences in means within the matched pairs according to various firm performance measures. As it can be seen from Table 4 even after controlling for firm specific characteristics using propensity score matching, exporters remain superior in some aspects. Through six different periods, higher sales are the most distinguishing characteristic of export starters. These results also hold when the sample is restricted to larger firms (Appendix A2, Table 6) and to a lesser extent in a specification when firms must operate in the whole sample period prior starting to export (Appendix A2, Table 5). Additionally, there is some evidence that exporters have higher productivity levels (measured by two labour productivity indicators and total factor productivity) but this result is not robust through different periods and sample specifications. Thus, once the self-selection into the exporter group is appropriately controlled for, only higher sales remain a robust distinguishing characteristic between the two groups.

Table 4. Average treatment effect on the treated (ATT), all variables are in levels

		2002-2007	2003-2008	2004-2009	2005-2010	2006-2011	2007-2012
TFP	*No. of controls*	*381*	*301*	*186*	*295*	*307*	*227*
	ATT	0.11	0.04	0.04	0.18***	0.16**	0.01
Capital	*No. of controls*	*381*	*301*	*186*	*295*	*307*	*227*
	ATT	0.20	0.36	-0.09	0.22*	0.15	0.11
Sales	*No. of controls*	*380*	*301*	*186*	*295*	*307*	*226*
	ATT	0.44***	0.54***	0.22	0.50***	0.51***	0.38**
ULC	*No. of controls*	*381*	*301*	*186*	*294*	*307*	*227*
	ATT	-0.07	0,00	-0.02	-0.11	-0.09*	0.01
LP1	*No. of controls*	*381*	*301*	*186*	*295*	*307*	*227*
	ATT	0.09	0.09	0.02	0.13*	0.18***	0.03
LP2	*No. of controls*	*380*	*301*	*186*	*295*	*307*	*226*
	ATT	0.17**	0.09	0.11	0.19***	0.24***	0.21*
Wages	*No. of controls*	*381*	*301*	*186*	*294*	*307*	*227*
	ATT	0.03	0.05	0.02	0.01	0.09***	0.03

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*
Source: own calculations based on FINA database

Again we have confirmed that exporters have some superior characteristics than non-exporters, but do they grow faster? Table 5 again reveals higher sales growth as a significant difference between export starters and non-exporters. On the other hand, learning effects of exporting are present in some periods but are not pervasive throughout different periods and sample specifications (Appendix A2, Tables 7 and 8).

Table 5. Average treatment effect on the treated (ATT), all variables are in growth rates

		2002-2007	2003-2008	2004-2009	2005-2010	2006-2011	2007-2012
TFP	*No. of controls*	*381*	*301*	*186*	*295*	*307*	*227*
	ATT	18.27***	16.67	35.71***	18.61	5.33	2.25
Capital	*No. of controls*	*381*	*301*	*186*	*295*	*307*	*227*
	ATT	1,385.9	62.19	-2.28	65.89**	245.74**	19.33
Sales	*No. of controls*	*380*	*301*	*186*	*295*	*307*	*226*
	ATT	57.4*	14.96***	17.38	46.78**	24.05***	12.94***
ULC	*No. of controls*	*381*	*301*	*186*	*294*	*307*	*227*
	ATT	-17.9	-19.99	478.81	1.79	-30.13	0.69
LP1	*No. of controls*	*381*	*301*	*186*	*295*	*307*	*227*
	ATT	8.01	14.66	35.73	16.33	8.31	3.29
LP2	*No. of controls*	*380*	*301*	*186*	*295*	*307*	*226*
	ATT	-0.18	3.46	5.69	9.33	11.28***	8.16
Wages	*No. of controls*	*381*	*301*	*186*	*294*	*307*	*227*
	ATT	3.19	2.98	1.02	-4.11	4.87**	5.11

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*
Source: own calculations based on FINA database

5. Concluding remarks

In this paper, we examine the causal relationship between export behavior and different measures of performance at the firm level, using a sample of Croatian manufacturing firms. Firstly, this study confirms that exporters are on average more productive, have higher sales, pay higher wages, utilize more capital in the production process, etc. After establishing the superior characteristics of exporters we proceed to examine the origins of exporter`s better performance. In the main sample specification there is strong evidence that exporter performance predates their entry into export markets. After starting to export, firms have higher growth rates of some performance measures which vary based on sample specification and period under study. The self-selection of better performing firms into export markets does not allow any causal interpretation of these results. Further exploring the direction of causality between exports and firm performance, the issue of self-selection is tackled by pairing exporters and non-exporters with similar observable firm characteristics. This is achieved by utilizing the propensity score matching framework and testing differences in means of various performance variables between export starters and non-exporters in matched samples. The results show that learning effects are present only in some periods, but the most distinguishing characteristic of export starters is higher sales growth.

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Appendix A1

Total factor productivity estimation

Total factor productivity is usually estimated as a residual in a standard Cobb-Douglas production function:

$$Y_{it} = A_{it} K_{it}^{\beta_K} L_{it}^{\beta_L} M_{it}^{\beta_M}.$$

To facilitate the empirical estimation all variables are converted into the logarithm form:

$$y_{it} = a_{it} + \beta_K k_{it} + \beta_L l_{it} + \beta_M m_{it},$$

where the residual can be decomposed into three parts:

$$\ln(A_{it}) = a_{it} = \beta_0 + \omega_{it} + u_{it},$$

so that β_0 represents mean level of efficiency common to all firms and time periods, ω_{it} is a firm specific deviation from mean which is known to the firm, but unobserved by the econometrician and u_{it} is an unobserved firm specific deviation from the mean which is a result of an unexpected shock (ECB, 2014). The difference between ω_{it} and u_{it} is that the former is observed by the firm and thus it influences input choices. On the other hand u_{it} represents an independent and identically distributed random variable which does not affect explanatory variables. Since it is very unlikely that the level productivity ω_{it} is not observed by the firm it will influence the optimal bundle of inputs thus causing the so-called "simultaneity bias". Generally, it can be assumed that the higher the firm-level productivity, the larger the quantities of the inputs chosen by firm. This will result in an upward bias in the technology coefficients of all variable inputs and downward bias of all inputs that are quasi-fixed (Levinsohn and Petrin, 2003). One approach that tries to deal with this problem can be found in Olley and Pakes (1996) who show that under certain conditions, investment and capital stock can be used as a proxy variable for firm level productivity. This approach may have been appropriate for their analysis of the telecommunication sector in the US but in later applications the choice of investment as an instrument proved to be problematic. Specifically, investment tends to be "lumpy", characterized with volatile growth rates and a lot of firms do not invest in a given year so there is a loss of efficiency in estimation. Taking this into account, Levinsohn and Petrin (2003) instrumented unobserved productivity (ω_{it}) with capital stock and material inputs, arguing that, similar as with investment, more productive firms in manufacturing will tend to have higher capital stock and material inputs. Ackerberg

et al (2006) build on the mentioned approaches and add labour as a deterministic function of unobserved productivity and state variables. In Woolridge (2009) these approaches are implemented in the GMM framework which results in efficiency gains. GMM uses cross-equation correlation and multiple moment conditions in order to gain efficiency, while at the same time accounting for serial correlation and heteroskedasticity with the use of the optimal weighting matrix. Woolridge framework for estimating TFP is utilized in this paper following ECB (2014) implementation and STATA code.

Appendix A2

Table 1. Export premium estimates for seven performance measures and eleven time periods

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
TFP											
Exporter coefficient	0.39***	0.45***	0.43***	0.44***	0.45***	0.44***	0.48***	0.43***	0.52***	0.58***	0.51***
Transformed coefficient	48.28	57.07	54.91	55.65	57.26	56.64	62.5	54.59	69.45	79.53	66.6
Capital											
Exporter coefficient	0.56***	0.60***	0.68***	0.62***	0.61***	0.57***	0.69***	0.69***	0.71***	0.62***	0.74***
Transformed coefficient	75.44	82.73	98.02	86.15	84.52	78.52	99.88	99.49	105.14	86.69	109.8
Sales											
Exporter coefficient	0.64***	0.68***	0.70***	0.73***	0.67***	0.69***	0.76***	0.71***	0.81***	0.82***	0.83***
Transformed coefficient	90.82	98	101.62	107.95	96.99	99.94	115.24	104.6	125.38	127.28	129.47
ULC											
Exporter coefficient	-0.27***	-0.29***	-0.30***	-0.29***	-0.30***	-0.30***	-0.31***	-0.28***	-0.38***	-0.41***	-0.35***
Transformed coefficient	-23.93	-25.9	-26.03	-25.65	-26.26	-26.51	-26.74	-24.92	-32.05	-34.22	-29.87
LP1											
Exporter coefficient	0.44***	0.49***	0.49***	0.48***	0.50***	0.49***	0.53***	0.49***	0.58***	0.62***	0.56***
Transformed coefficient	55.46	64.68	64.03	62.2	65.08	64.41	70.92	63.48	79.46	87.33	76.08
LP2											
Exporter coefficient	0.43***	0.46***	0.47***	0.46***	0.45***	0.47***	0.52***	0.48***	0.57***	0.58***	0.55***
Transformed coefficient	54.18	59.43	60.89	59.34	57.95	60.78	69.25	62.81	78.25	79.35	73.76
Wages											
Exporter coefficient	0.16***	0.18***	0.19***	0.18***	0.18***	0.18***	0.21***	0.19***	0.19***	0.20***	0.20***
Transformed coefficient	18.17	20.92	21.56	19.76	20.70	20.30	23.98	21.72	21.24	22.26	22.71

Note:, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. The transformed coefficient was calculated as 100(exp(β)-1).*
Source: own calculations based on FINA database

Table 2. Ex-post exporter premium, levels

Beginning year	Comparison year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	2005	0.55***	0.75***	0.85***	-0.48***	0.59***	0.65***	0.14***	3,307
	2006	0.64***	0.82***	0.92***	-0.42***	0.69***	0.66***	0.27***	3,756
	2007	0.51***	0.64***	0.76***	-0.32***	0.54***	0.51***	0.21***	3,975
2006	2006	0.39***	0.78***	0.67***	-0.38***	0.47***	0.48***	0.09***	3,711
	2007	0.44***	0.87***	0.78***	-0.35***	0.54***	0.57***	0.18***	3,903
	2008	0.4***	0.87***	0.70***	-0.31***	0.50***	0.51***	0.18***	4,160
2007	2007	0.50***	0.58***	0.80***	-0.44***	0.53***	0.57***	0.11**	3,716
	2008	0.57***	0.91***	0.89***	-0.39***	0.65***	0.67***	0.25***	3,956
	2009	0.40***	0.77***	0.66***	-0.29***	0.47***	0.49***	0.21***	4,120
2008	2008	0.45***	0.94***	1.08***	-0.31***	0.51***	0.51***	0.21***	3,855
	2009	0.53***	1.08***	0.94***	-0.35***	0.59***	0.64***	0.23***	3,991
	2010	0.54***	1.07***	0.95***	-0.39***	0.61***	0.64***	0.21***	4,213
2009	2009	0.60***	0.65*	0.78***	-0.49***	0.61***	0.57***	0.12***	3,886
	2010	0.70***	0.73***	0.99***	-0.49***	0.76***	0.73***	0.26***	4,075
	2011	0.67***	0.89***	0.99***	-0.44***	0.74***	0.71***	0.29***	4,117
2010	2010	0.77***	0.74***	1.12***	-0.7***	0.84***	0.85***	0.18***	4,001
	2011	0.78***	0.95***	1.18***	-0.64***	0.88***	0.89***	0.23***	4,006
	2012	0.65***	0.98***	1.1***	-0.45***	0.75***	0.79***	0.28***	3,938

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 165, 234, 127, 137, 144, 157 respectively.*
Source: own calculations based on FINA database

Table 3. Ex-post export premium estimates on a sample restricted to firms that operated during the whole sample period

Beginning year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	-0.73	275.57	5.24	-9.92**	0.03	1.92	-1.02	1,517
2006	4.43	-5.35	-0.81	-5.34	4.82	-4.27	-4.11*	1,220
2007	5.30*	-49.15	4.91	-15.29**	4.36	0.27	3.42	987
2008	7.55	-6.56	12.16	20.96*	6.17	4.19	2.73	846
2009	0.83	24381	6.67*	-12.33	2.42	2.58	0.68	720
2010	-7.54	-4.56	10.25	-6.91	-6.88	3.72	7.36	612

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 31, 17, 14, 9, 9, 9 respectively.*
Source: own calculations based on FINA database

Table 4. Ex-post export premium estimates on a sample restricted to firms that employ ten or more workers

Beginning year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	-8.91	305.78	32.69	100.58	-6.11	4.13	2.88	764
2006	5.55*	265.69*	63.12	22.12*	4.67	5.49*	9.39**	805
2007	11.8	271.63	3.21	4.99	12.13	7.17*	1.58	805
2008	16.81***	143.53	32.49**	-8.18	16.30***	13.4	2.23	842
2009	1.65	263.53	13.0	-3.67	3.52	6.65**	6.07***	772
2010	3.82	660.94	2.1	24.42	5.78	4.25	1.64	737

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Number of export-starters for years 2005, 2006, 2007, 2008, 2009 and 2010 is 23, 27, 14, 16 ,18 ,14 respectively.*
Source: own calculations based on FINA database

Table 5. Levels ex-post export premium estimates on a matched sample restricted to firms that operated during the whole sample period

		2002-2007	2003-2008	2004-2009	2005-2010	2006-2011	2007-2012
TFP	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	0.02	0.14	0.17	0.19	0.73**	-0.14
Capital	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	0.27	0.34	0.16	-0.34	0.45	-0.61
Sales	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	0.45**	0.12	0.12	-0.19	0.90***	-0.19
ULC	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	0.11	-0.03	-0.15	-0.24	-0.65**	0.35
LP1	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	-0.09	-0.01	0.19	0.16	0.68***	-0.15
LP2	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	0.08	-0.12	0.16	-0.06	0.40***	-0.04
Wages	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	0.03	-0.05	0.05	-0.08	0.11	0.2**

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: own calculations based on FINA database

Table 6. Levels ex-post export premium estimates on a matched sample restricted to firms that employ ten or more workers

		2002-2007	2003-2008	2004-2009	2005-2010	2006-2011	2007-2012
TFP	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	0.04	0.18**	0.050	0.11	0.07	0.08
Capital	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	0.16	0.28	-0.47*	0.40	0.19	0.03
Sales	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	0.17*	0.35***	0.05	0.28*	0.12	0.35**
ULC	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	-0.01	-0.16**	-0.03	-0.09	-0.14	-0.07
LP1	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	-0.01	0.19	0.07	0.07	0.12	0.13
LP2	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	-0.02	0,3***	0.11	0.10	0.19	0.27**
Wages	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	-0.02	0.03	0.08	-0.01	-0.02	-24.15

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: own calculations based on FINA database

Table 7. Growth rate ex-post export premium estimates on a matched sample restricted to firms that operated during the whole sample period

		2002-2007	2003-2008	2004-2009	2005-2010	2006-2011	2007-2012
TFP	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	-0.79	14.06	-5.80	-2.00	-22.82	16.96
Capital	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	120.66***	20.87	-10.99	12.49	15.47	8.07
Sales	*No. of controls*	*92*	*50*	*42*	*26*	*27*	*27*
	ATT	9.69	18.13	1.38	11.23	4.55	33.97
ULC	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	-390.02	27.67	-18.19	1.92	-8.58	-7.34
LP1	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	-0.75	15.37	-5.78	-1.89	-21.03	20.36
LP2	*No. of controls*	*92*	*50*	*42*	*26*	*27*	*27*
	ATT	2.88	5.68	1.61	2.46	4.17	22.03
Wages	*No. of controls*	*92*	*50*	*42*	*27*	*27*	*27*
	ATT	-1.42	4.41	-2.72	2.67	7.9**	24.99

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: own calculations based on FINA database

Table 8. Growth rate ex-post export premium estimates on a matched sample restricted to firms that employ ten or more workers

		2002-2007	2003-2008	2004-2009	2005-2010	2006-2011	2007-2012
TFP	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	15.58*	29.28	4.88	21.66***	1.62	-24,15
Capital	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	2,970.43	102.80	-9.92	-8.44	172.19	24.51
Sales	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	92.59**	20.09**	3.48	8.43**	11.67***	-33.70
ULC	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	6.09	-133.67	-4.33	-30.29	-5.44	-1.39
LP1	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	10.91	28.85	4.76	21.04**	4.67	-25.10
LP2	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	8.55	4.59	2.71	6.43	4.67	-8.16
Wages	*No. of controls*	*175*	*163*	*92*	*93*	*89*	*84*
	ATT	2.80	5.34**	4.04**	3.27	2.22	1.69

*Note: ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Standard errors are bootstrapped.*

Source: own calculations based on FINA database