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

MILJANA VALDEC, MSc*
JURICA ZRNC, mag. oec.*

Article**
JEL: D21, F12, F14, L25, L6
doi: 10.3326/fintp.39.1.1

* The authors would like to thank two anonymous referees for their useful comments and suggestions. The views expressed in this paper are those of the authors and do not necessarily reflect the view of the Croatian National Bank.
** Received: June 1, 2014
Accepted: November 23, 2014

The article was awarded as the best regular category paper in the annual award of the Prof. Dr. Marijan Hanžeković Prize for 2014.

Miljana VALDEC
Croatian National Bank, Trg hrvatskih velikana 3, 10000 Zagreb, Croatia
e-mail: miljana.valdec@hnb.hr

Jurica ZRNC
Croatian National Bank, Trg hrvatskih velikana 3, 10000 Zagreb, Croatia
e-mail: jurica.zrnc@hnb.hr

FINANCIAL THEORY AND PRACTICE
39 (1) 1-30 (2015)

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 have characteristics superior to those of 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 multiple firm performance indicators, panel and cross section data models together with various sample specifications there is scant evidence on learning-by-exporting which holds true only in a few cases. On the other hand, higher sales growth is found to be a more conclusive distinguishing characteristic of 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

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 of the evidence for the link between growth and exports is based on macro-level data, the characteristics of firms that actually export and most of the measures that policymakers have at their disposal are essentially microeconomic. Accordingly, it is crucial to determine the characteristics of exporters, why it is that some firms export and others do not, and how differences in export behaviour relate to productivity differences among firms.

In this paper we present the results of an extensive investigation of exporters by using a firm-level dataset covering the Croatian manufacturing sector which spans the period from 2002 until 2012. The novelty of the paper arises from the fact that this is one of the first analyses that examines closely the productivity and trade nexus on a firm-level basis in Croatia. In this paper we try to determine what kind of firms enter export markets and how exporting affects their performance (total factor productivity, sales, wages, labour productivity, etc.) and how this compares with that of non-exporters. Each empirical section consists of multiple robustness checks along various dimensions, including a number of econometric models, variables and sample specifications.

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 the export market, so

FINANCIAL THEORY AND PRACTICE
39 (1) 1-30 (2015)

their success as exporters may be due to good 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.

To tackle the problem of self-selection into export markets we construct a sample of treated and control firms by using propensity score matching. 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 proposition: are firms more productive after they start to export than they would be 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 many of the superior characteristics of new exporters precede their entrance into the export market. Using multiple firm performance indicators, panel and cross section data models together with various sample specifications there is scant evidence for learning-by-exporting, which obtains only in few cases. On the other hand, higher sales growth is found to be a more conclusive distinguishing characteristic of the new exporters, presumably because after paying the sunk cost of entry to foreign markets, export starters have access to 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

In 1995 Bernard and Jensen published the first in a series of papers that use comprehensive longitudinal data for the 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 a firm's performance in order to study its export activity and the causes and consequences of that activity. A common result is that exporting firms are generally different from non-exporting firms in being technologically more sophisticated, tending to be larger, more productive, paying higher wages and so on.

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 be-

hind that hypothesis lies in the fact that there are 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) and that less productive firms will be less capable of absorbing them. Roberts and Tybout (1997), Bernard and Jensen (1999), and Bernard and Wagner (2001) find evidence for the existence of sunk costs 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 effects of economies of scale. This implies that exporting makes firms more productive and this hypothesis is usually called the 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 the learning effect are mixed in the literature. Bernard and Wagner (1997) find evidence of self-selection of exporters for the case of Germany, while Bernard and Jensen (1999) find that exporters have all their desirable characteristics before taking up exporting in the US as well. In 2005 Arnold and Hussinger confirm that high-productivity German firms self-select themselves into export markets, while exporting itself does not play a significant role in 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 export starters outperform other firms even before entry, but that in some industries there may be some productivity improvement associated with exporting. While, these results are consistent with the self-selection hypothesis, they give only limited support to the learning hypothesis. On the other hand, Aw et al. (2000) show that for Korea the correlation between export status and firm productivity is less pronounced and they find no support for the learning hypothesis. Delgado et al. (2002) apply nonparametric methods to a panel of Spanish firms and their results support the self-selection hypothesis, and only when limiting their sample to young firms do they find that post-entry growth is greater for young entering exporters compared to young non-exporting counterparties.

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 the set of analysed countries. They find strong empirical evidence for the self-selection hypothesis, but almost no evidence in favour of the learning-by exporting hypothesis.

Although, most studies fail to find that presence in international markets enables firms to achieve further productivity improvements, there are exceptions. Kraay

(1999) and Bigsten et al. (2004) 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.

Some of the most convincing evidence of ex-post productivity improvement was found in studies for Slovenia. Damijan, Polanec and Prasnikar (2004) find that Slovenian firms' productivity depends on the number of destinations they serve, and that sunk costs seem to be higher for exporters to developed destinations. Also they find evidence of post-export market entry productivity gains, but they state that exporters can benefit from exporting only when serving more demanding advanced markets. De Loecker (2007) uses a similar dataset of Slovenian firms, and applies matching methodology in order formally to evaluate the causal effect of exports on productivity. He finds that firms exporting to low-income and high-income countries enjoy productivity gains with respect to non-exporters, but additional gains are smaller for firms that export only to low-income destinations.

In recent empirical studies, authors use new empirical approaches and are investigating new dimensions like the relationships between: exports and productivity taking into account export market characteristics, import and productivity, international trade and productivity in services sector, and outward foreign direct investment and productivity (Wagner, 2011). In 2008, Pisu finds that exporters in Belgium that sell their products to more developed economies have superior ex-ante productivity levels than firms exporting to less developed countries and non-exporters, while there is no causal effect of exporting on productivity. Positive correlation of ex-ante productivity measures with the development level of the export destination country is also documented for Spain (Blanes-Cristobal et al., 2007), Italy (Serti and Tomasi, 2009), and Portugal (Silva et al., 2010a). On the other hand, evidence for different causal effects of exporting on productivity by destination of exports is rare and inconclusive. Silva et al. (2010b) finds that learning effects are higher for new exporters that are also importers.

A similar study for 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, while evidence for self-selection and learning by exporting is found to be sparse. We build on this analysis, adding more performance measures, additional sample periods, broader sample specification and employing different econometric models 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, FINA data go back 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 as compared to 2001. The dataset covers manufacturing companies in Croatia, so combined with eleven years this amounts to 80,256 observations. The variables included in the analysis are the following: sales, number of employees, wage bill, intermediate inputs, capital and value of exports. The sales variable excludes financial revenue in order to estimate revenue from business operations. Number of employees is defined as the average number of workers based on hours of work 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 value added deflator for electricity, gas, steam and air conditioning supply sector. Capital is deflated with the GDP deflator.

Table 1

Comparison of exporters and non-exporters

Non exporters				
	1-49 employees	**50-249 employees**	**250 and more**	**Total**
Turnover	316	4,079	17,134	450
Capital	189	2,439	8,915	266
No. of workers	7	94	437	10
Value added	221	2,548	10,722	304
Wages	7.59	8.47	9.64	7.62
No. of observations	51,083	1,348	116	52,547
Exporters				
	1-49 employees	**50-249 employees**	**250 and more**	**Total**
Turnover	991	7,217	64,480	6,272
Capital	408	3,716	32,692	3,120
No. of workers	13	113	691	76
Value added	679	4,204	34,131	3,508
Wages	9.85	10.02	11.32	9.98
No. of observations	20,625	5,299	1,785	27,709

Note: The measurement unit is thousands of EUR except for labour which represents number of workers. The entries in this table are averages across the sample period. The number of observations is the number of firm years, that is $\Sigma_i^n i\,\theta_i$, *where* i *represents a firm and* θ_i *represents the number of years a firm* i *operated during the sample period. This measurement is due to the fact that firms stop existing or new firms start operating at a given year.*

Source: Own calculations based on the FINA database.

Intermediate inputs are calculated as the sum of material costs and energy costs and capital is defined as tangible 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 information 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 the 1st or 99th percentile are dropped.

After data preparation and outlier cleaning, we proceed to describe the characteristics of the dataset along basic variables. For detailed discussion of the characteristics of exporters versus non-exporters we direct the reader to Lukinić-Čardić (2012) who provides detailed descriptive characteristics on various dimensions regarding the firm export status. Table 1 shows that the basic divide between exporters and non-exporters is quite vivid in every firm performance measure. Exporting firms of all sizes employ more factors of production and have higher output than non-exporters.

4 EMPIRICAL STRATEGY AND RESULTS

In the following sections we test for superior characteristics of exporters, then provide possible reasons for this by testing the 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. Usually, better exporter performance according to various measures is called the export premium. Export premium is defined as the ceteris paribus percentage difference of specific firm characteristics between exporters and non-exporters. The main firm characteristics of our interest are TFP, two measures of labour productivity (one with value added, the other with turnover 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 the appendix. A common approach in the empirical literature is to estimate export premiums 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 premium is estimated from a regression of the following form:

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

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

(value added based labour productivity), LP2 (revenue-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 that include sector-, time- and size-dummies; *e* is the random error. The export premium, computed from the estimated coefficient βas100(*exp(β)* – 1), shows the average percentage difference between exporters and non-exporters after controlling for the characteristics included in the vector of controls.

Table 2

Export premium estimates from pooled OLS

Firm characteristic	TFP	LP1	LP2	Capital	Sales	ULC	Wages
Estimated coefficient	0.47***	0.52***	0.50***	0.65***	0.74***	-0.32***	0.19***
Transformed coefficient	60.5	68.8	65.4	91.3	109.0	-27.7	21.2
Observations	80,256	80,256	80,150	80,256	80,150	79,548	79,548
R^2	0.36	0.31	0.13	0.48	0.64	0.35	0.15

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.

Throughout the different firm performance measures, the β coefficients from the equation (1) are highly significant and imply stark differences in performance between exporters and non-exporters. Taking into account the size of the firm, the sector and the time when a firm operated, exporters are on average more productive according to various measures, have higher sales and more capital. Moreover they pay higher wages, but have lower unit labour costs than non-exporters.

Furthermore, if additional observables are included in the analysis like whether a firm is an importer and whether it is at least partially foreign owned, the export premium drops but still remains highly significant and positive (appendix, table A1).

Although the analysis presented above documents the different characteristics of exporters and non-exporters, it is insufficient for the identification of causality. 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 the self-selection hypothesis, in the next section the ex-ante productivity premium of future export starters will be analysed.

4.2 SELF-SELECTION HYPOTHESIS

To shed light on the empirical validity of the hypothesis that more productive firms self-select into the export market, the pre-entry differences in firm performance between export starters and non-exporters will be analysed below.

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 on which we base the analysis in this section consists only of export starters and firms that never exported during the period under study. The empirical model that we estimate is:

$$\ln X_{it} = \alpha + \beta_1 Starter_{it+1} + \beta_2 Starter_{it+2} + \beta_3 Starter_{it+3} + \gamma Control_{it} + \varepsilon_{it}, \qquad (2)$$

where i is the index of the firm, t is the index of the year, *Starter* is a dummy variable that is equal to one if the firm starts to export at time t, X_{it} are the firm characteristics of interest in year t which include productivity measures in form of TFP, value added based labour productivity (LP1), sales based labour productivity (LP2), capital, sales, wages and ULC; *Control* is a vector of firm specific controls which include sector, time and size dummies; e is the random error. Regression results (table 3) 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 have more capital, have higher sales, usually pay higher wages and have lower unit labour costs after controlling for firm size and sector. Moreover, this superiority remains even after controlling for more firm-level observables such as whether a firm is an importer and whether foreign capital is involved (appendix, table A2).

Table 3

Self-selection estimates from pooled OLS

	t-1	t-2	t-3	Observations	R^2
TFP	0.55***	0.49***	0.31**	43,137	0.31
LP1	0.62***	0.55***	0.36**	43,137	0.27
LP2	0.63***	0.55***	0.42***	43,069	0.07
Capital	0.75***	0.74**	0.69***	43,137	0.31
Sales	0.85***	0.76***	0.67***	43,069	0.47
ULC	-0.40***	-0.35***	-0.22***	42,624	0.32
Wages	0.21***	0.20***	0.14***	42,624	0.09

Note:, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. Regression errors are heteroscedasticity robust.*

Source: Own calculations based on FINA database.

Lukinić-Čardić (2012) also tests for self-selection on Croatian manufacturing firm-level data, but arrives at scant evidence supporting the self-selection hypoth-

esis. The reason is that Lukinić-Čardić (2012) uses a different sample specification, including only firms with ten or more employees. Moreover, the data are not pooled; instead, multiple cross-section regressions are used, which results in a substantial reduction of export starters in each cross section specification. As in similar studies (for example, ISGEP, 2008), parameter significance heavily depends on the number of export starters employed in the analysis. In order to check for the robustness of our results first we employ a specification as in Lukinić-Čardić (2012) but on the sample used in this paper which includes firms with one or more workers and minor differences in control variables (for example we measure size with size dummies corresponding to the number of workers a firm employs, but Lukinić-Čardić measures size by total assets numerical variable).

Table 4

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

Beginning year	Comparison year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observ.
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***	-0.20	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***	0.10	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	0.20	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*	0.40	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	-0.00	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.

The specification is the following cross section OLS:

$$\ln X_{it-3} = \alpha + \beta Starter_{it} + \gamma Control_{it-3} + \varepsilon_{it}, \quad (3)$$

$$\ln X_{it-2} = \alpha + \beta Starter_{it} + \gamma Control_{it-2} + \varepsilon_{it}, \quad (4)$$

$$\ln X_{it-1} = \alpha + \beta Starter_{it} + \gamma Control_{it-1} + \varepsilon_{it}, \quad (5)$$

where each of the specifications (3), (4) and (5) are repeated for each t = 2005, 2006, ..., 2010 which represents the time a cohort of export starters began to export. In our time period, from 2002 to 2012, there are six possible time points a firm could start to export given our definition of an export starter: 2005, 2006, 2007, 2008, 2009 and 2010. Thus the regressions (3) to (5) are repeated six times, which amounts to eighteen cross section regressions for each of the seven firm performance variables; the results are presented in table 4. The results clearly indicate a strong presence of self-selection throughout different time periods. Only after excluding firms that employ fewer than ten workers, which results in not more than twenty export starters present in each sample period, the self-selection estimates become mostly insignificant (appendix, table A3).

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 A4 in appendix, 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. Hence, we employ a fixed effects model as in Silva et al. (2010b) which allows us to take into account unobserved heterogeneity between firms, although it does not deal with the endogeneity issue but is considered a useful starting point. The specification is the following:

$$\%\Delta X_{it+s} = \alpha + \beta Starter_{it} + \gamma Control_{it} + a_i + \varepsilon_{it} \quad (6)$$

where i, t and $Starter_{it}$ are defined as previously. $\%\Delta Xi_{t+s}$ represents growth rate of a performance variable$s$ periods ahead. There are s different growth rates for which separate fixed effects regressions are undertaken: (1) $\%\Delta X_{it+0} = \frac{X_{it}}{X_{it-1}} - 1$, (2) $\%\Delta X_{it+1} = \frac{X_{it+1}}{X_{it}} - 1$, and (3) $\%\Delta X_{it+2} = \frac{X_{it+2}}{X_{it+1}} - 1$. $Control_{it}$ is a vector of the same firm-specific controls as in the equation (2), a_i is a firm specific effect 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 market only will be estimated. The results in table A5 in the appendix indicate that firm productivity performance did not significantly change after starting to export. The results provide no evidence for learning by exporting, even when including more observables like FDI and import status (appendix, table A6). Moreover, the coef-

ficient of determination is extremely low, which is not unexpected given the general specification employed and the intrinsic difficulty of predicting firm-level outcomes. 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 values (usually from 2% to 10%).

On the other hand, the only other similar study on Croatian data (Lukinić-Čardić, 2012) arrives at some weak evidence of learning by exporting with repeated cross section regressions. In this spirit we test the following specification:

$$\%\Delta X_{t+2} = \alpha + \beta Export_{it} + \gamma Control_{it} + \varepsilon_{it}, \quad (7)$$

where $\%\Delta X_{t+2} = \frac{X_{t+2}}{X_t} - 1$ represents a change in performance measure during the two periods from starting to export. Again, the results show no signs of learning by exporting (table 5). With this specification, there is some 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 relatively large foreign markets with their concomitantly relatively higher competitive pressures.

Table 5

Ex-post growth rates premiums

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	14.00	-0.22	-4.96	-2.56	0.000	2,523
2008	-4.91	-9.94	27.33**	-0.25**	-5.60	-2.87	-0.003	2,804
2009	-5.96	15.48	33.63**	-0.46	-5.90	-0.95	0.003***	2,760
2010	-1.65	1.60	8.77	-0.14*	-1.86*	-0.84	0.000	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 remains low (usually around 2%). Secondly, as mentioned in the previous section, similar studies find that a relatively small number of observed export starters usually render export premium coefficients insignificant. To check for robustness regarding the number of observations and different sample construction strategies, equation (7) was estimated on two additional sample specifications.

FINANCIAL THEORY AND PRACTICE
39 (1) 1-30 (2015)

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, table A7). The estimated coefficients changed markedly and the export premium for sales is not significant, unlike the main specification. On the other hand, there is still some evidence of negative ULC growth after exports are started, 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, table A8). 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-exporters. Equation (7) 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 the 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 to the 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 the 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 since then has been widely used.

In this analysis, for every export starter a non-exporter has to be selected, 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 to all relevant firm characteristics in the previous period. In order to estimate the export decision, we specify an empirical probit model in which export behaviour depends on a variety of observed, firm-specific characteristics:

$$P(EXPdummy_{i,t} = 1) = F(X_{i,t-k}, Control_{i,t-k}), \tag{8}$$

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 X_i stands for different productivity variables as already defined in the paper. The control variables include sector, size and time dummies, a dummy indicating if the firm imports, and a dummy indicating if the firm has a foreign component in its capital, and so on. In equation (8) sector dummies are defined according to Eurostat aggregation of manufacturing industry according to technological intensity in 4 respective sectors (high-technology, medium-high-technology, medium-low-technology, and low-technology).

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, and matching is restricted to common support region. This means that matching will be performed using propensity scores that belong to the intersection of the supports of the propensity score of treated and controls (see for more details Becker and Ichino, 2002). Although those conditions reduce the number of treated and controls used in matching process, they are necessary in order to ensure that only firms with similar characteristics are matched.

The estimated probability of a firm becoming 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 an export starter. Then, non-exporting firm *j*, which is as similar as possible in terms of its estimated propensity score, is se-

lected as a match for the exporting firm, using the "nearest-neighbour" 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:

$$\left|p_{i,t} - p_{j,t}\right| = \min_{j \epsilon \{EXPdummy_{i,j}=0\}} \left(p_{i,t} - p_{j,t}\right) \tag{9}$$

The proposed type of matching procedure is preferable to choosing the comparison group randomly or indiscriminately, 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. Namely, the sample is split into *k* equally spaced intervals with respect to the propensity score p_i, and then we test whether the average propensity score of treated and control units does not differ in every interval. If the test fails in one interval, the interval is split up in half and the test of difference in means is repeated again until it holds in every interval. After that we test for the necessary condition of the balancing hypothesis. This condition is considered satisfied if, within each interval, the means of each characteristic do not differ between treated and control units. On the other hand, if the means of one or more characteristics differ we employ a richer set of observables in equation (8).

Table 6

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

Firm characteristic		s	s+1	s+2
TFP	No. of controls	246	227	207
	ATT	0.20	0.30**	0.29**
LP1	No. of controls	249	209	195
	ATT	0.21	0.27	0.21
LP2	No. of controls	246	217	203
	ATT	0.21**	0.25**	0.24**
Capital	No. of controls	246	227	207
	ATT	0.43**	0.46**	0.40**
Sales	No. of controls	251	223	200
	ATT	0.57***	0.62***	0.74***
ULC	No. of controls	248	207	190
	ATT	-0.12	-0.12	-0.09
Wages	No. of controls	272	222	198
	ATT	0.11***	0.17***	0.17***

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

Source: Own calculations based on FINA database.

After obtaining the matched sample based on the probability of becoming an export starter, we proceed to estimate the differences in means within the matched pairs according to various firm performance measures. The difference in means is calculated as follows:

$$\beta_{LBE}^{s} = \frac{1}{N_s}\sum_{i}(X_{is}^{starter} - \sum_{j \in C(i)} w_{ij} X_{js}^{control}) \quad (10)$$

where N denotes the number of firms that started to export and $C(i)$ the set of control firms that are matched to an export starter i. As there can be multiple control units ascribed to each treated unit, the number of control units matched to an export starter i is denoted as N_i^C and the weight for the control unit is equal to $w_{ij} = 1/N_i^C$ if $j \in C(i)$ and zero otherwise. The outcome variables $X^{starter}$ and $X^{control}$ are the usual firm performance variables used throughout this paper, s is the number of years after starting to export and $s=0,1,2,$ while X_s represents the performance variable s periods after starting to export.

Table 7

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

Firm characteristic		s	s+1	s+2	cum
TFP	No. of controls	246	227	203	203
	ATT	0.42	0.16	-0.03	0.16
LP1	No. of controls	249	209	185	185
	ATT	0.58***	0.07	-0.09	0.52
LP2	No. of controls	246	217	193	193
	ATT	0.40**	0.15*	0.00	0.17**
Capital	No. of controls	246	227	203	203
	ATT	22.56	0.04	0.09	0.90
Sales	No. of controls	251	223	194	194
	ATT	1.85***	0.25*	0.15***	0.54***
ULC	No. of controls	253	207	179	179
	ATT	0.02	-0.11	-0.14	-0.16
Wages	No. of controls	272	221	188	187
	ATT	0.11***	0.10***	0.01	0.11***

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

Source: Own calculations based on FINA database.

Results in table 6 show that even after controlling for firm specific characteristics using propensity score matching, exporters remain superior in some aspects. Higher sales are the most distinguishing characteristic of export starters, even just a few years after starting to export. These results also hold true when the sample

is restricted to larger firms (appendix, table A10) and to a lesser extent in a specification when the sample is restricted to firms that existed three years prior to starting to export (appendix, table A9). Additionally, there is some evidence that exporters have higher productivity levels (measured by sales-based labour productivity indicators and total factor productivity), higher capital and wages; however, this result is not robust through sample specifications. Thus, once the self-selection into the exporter group is appropriately controlled for, higher sales remain a characteristic that will differentiate the two groups.

Again we have confirmed that exporters have some characteristics superior to non-exporters, but do they grow faster? In order to answer this question we change the outcome variable X in the specification (10) with growth rates relative to the previous period. Additionally, we add a cumulative growth rate outcome variable, which gathers growth rates from starting to export until two year after entry as in de Loecker (2007). Results in table 7 again reveal higher sales growth as a significant difference between export starters and non-exporters; this might be because export starters have access to larger markets than non-exporters. On the other hand, learning effects of exporting are present in some periods but are not pervasive throughout sample specifications (appendix, tables A11 and A12).

5 CONCLUDING REMARKS

In this paper, we examine the causal relationship between export behaviour 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 an exporter's better performance.

In the main sample specification there is strong evidence that exporters' performance predates their entry into export markets. This may be due to the fact that in order to become an exporter a firm needs to pay various sunk costs such as transportation, distribution, marketing costs or cost of changes in personnel or domestic products for foreign consumption. After starting to export, firms have higher growth rates of some performance measures which vary based on sample specification and the period under study, but 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, and

that the most distinguishing characteristic of export starters is higher sales growth. This suggests that export starters, after paying for the sunk cost of exporting, have access to larger markets, which enable them to grow faster than they otherwise would. On the other hand, new exporters do not show robust productivity improvements, implying that there are limited effects of starting to export on aggregate productivity developments.

APPENDIX

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:

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

so that β_0 represents the 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 that 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, as with investment, more productive firms in manufacturing will tend to have higher capital stock and material inputs. Ackerberget 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 heteroscedasticity 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.

Table A1

Export premium estimates from POLS, with FDI and import dummies

Firm characteristic	TFP	LP1	LP2	Capital	Sales	ULC	Wages
Estimated coefficient	0.28***	0.31***	0.29***	0.40***	0.78***	-0.19***	0.12***
Transformed coefficient	32.6	36.3	33.1	49.6	117.6	-17.0	12.7
Observations	80,256	80,256	80,150	80,256	80,150	79,548	79,548
R^2	0.39	0.35	0.19	0.50	0.67	0.37	0.18

Note:, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. The transformed coefficient was calculated as 100(exp(β)-1). Regression errors are heteroscedasticity robust.*

Source: Own calculations based on FINA database.

Table A2

Self-selection estimates from POLS, with FDI and import dummies

	t-1	t-2	t-3	Observations
TFP	0.34***	0.27***	0.18**	43,137
LP1	0.38***	0.31***	0.22***	43,137
LP2	0.38***	0.30***	0.28***	43,069
Capital	0.43***	0.41***	0.51***	43,137
Sales	0.52***	0.44***	0.48***	43,069
ULC	-0.23***	-0.18***	-0.12*	42,624
Wages	0.13***	0.12***	0.10	42,624

Note:, ** and *** refer to 10%, 5% and 1% statistical significance levels, respectively. The transformed coefficient was calculated as 100(exp(β)-1). Regression errors are heteroscedasticity robust.*

Source: Own calculations based on FINA database.

TABLE A3

Ex-ante export premium, estimated for six samples and seven firm performance measures (l >10)

Beginning year	Comparison year	TFP	Capital	Sales	ULC	LP1	LP2	Wages	Observations
2005	2002	0.59**	0.35	0.62***	-0.47*	0.61**	0.63***	0.14	584
	2003	0.65***	0.23	0.61***	-0.40**	0.66***	0.56***	0.24***	595
	2004	0.20	0.04	0.25	-0.17	0.21	0.25	0.04	574
2006	2003	0.20	-0.42	0.01	-0.04	0.16	0.05	0.12	558
	2004	0.06	-0.30	0.14	0.06	0.04	0.18	0.16**	533
	2005	0.18	-0.39	0.24	0.05	0.14	0.25	0.20**	500
2007	2004	0.14	0.45	0.49	-0.15	0.15	0.33*	0.00	517
	2005	0.08	0.36	0.33	-0.14	0.09	0.21	-0.04	485
	2006	0.09	-0.42	0.12	-0.15	0.00	0.08	-0.09	736
2008	2005	-0.07	-0.04	0.10	0.17	-0.14	-0.03	0.03	469
	2006	0.20	0.57*	0.41*	-0.19	0.23	0.30	0.03	704
	2007	0.13	0.86***	0.45***	-0.17	0.18	0.34**	0.00	777
2009	2006	0.16	0.76*	0.29	-0.28	0.25	0.29	-0.03	740
	2007	0.17	0.93*	0.26	-0.28	0.29	0.32	-0.00	800
	2008	0.04	0.35	0.20	-0.14	0.06	0.11	-0.08	784
2010	2007	0.02	1.49***	1.24	-0.07	0.21	0.14	0.13	736
	2008	0.26	1.24*	0.51***	-0.15	0.44*	0.47**	0.29**	797
	2009	0.22	1.24**	0.40	-0.11	0.37	0.27	0.14	777

*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 A4
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	0.40***	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***	-0.70***	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***	1.10***	-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 A5

Ex-post exporter premium, fixed effects, growth rates

	t	t+1	t+2	Observations	R^2
TFP	25.84	4.60	12.75	24,134	0.00
LP1	25.46	6.64	11.94	24,134	0.00
LP2	4.31	7.12	-0.25	24,075	0.00
Capital	305.49*	-454.41***	-2.17	24,134	0.00
Sales	31.41***	-10.13	1.91	24,075	0.01
ULC	17.52	-5.88	-9.23	23,730	0.00
Wages	5.73*	3.64	-2.91	23,730	0.02

*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.

TABLE A6

Ex-post exporter premium with FDI and importer dummies, fixed effects, growth rates

	t	t+1	t+2	Observations	R^2
TFP	25.60	4.99	13.56	24,134	0.00
LP1	26.10	7.11	12.86	24,134	0.00
LP2	4.69	7.48	0.12	24,075	0.00
Capital	304.13*	-449.15***	-2.31	24,134	0.00
Sales	31.21***	-9.85	2.39	24,075	0.01
ULC	18.10	-5.17	-8.30	23,730	0.00
Wages	5.67	3.67	-2.87	23,730	0.02

*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.

TABLE A7

Ex-post export premium estimates on a sample restricted to firms that existed three years prior to starting to export

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	24,381	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 A8

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	11.80	271.63	3.21	4.99	12.13	7.17*	1.58	805
2008	16.81***	143.53	32.49**	-8.18	16.30***	13.40	2.23	842
2009	1.65	263.53	13.00	-3.67	3.52	6.65**	6.07***	772
2010	3.82	660.94	2.10	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 A9

Levels ex-post export premium estimates on a matched sample restricted to firms that existed three years prior to starting to export

Firm characteristic		s	s+1	s+2
TFP	No. of controls	88	82	74
	ATT	-0.04	0.06	0.13
LP1	No. of controls	88	73	68
	ATT	0.11	0.25	0.22
LP2	No. of controls	88	74	68
	ATT	-0.01	0.04	0.09
Capital	No. of controls	88	82	74
	ATT	0.03	0.11	0.24
Sales	No. of controls	86	73	69
	ATT	0.12	0.42*	0.37**
ULC	No. of controls	88	78	69
	ATT	-0.14	-0.22	-0.15
Wages	No. of controls	88	74	65
	ATT	0.06	0.11	0.09

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

Source: Own calculations based on FINA database.

TABLE A10

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

Firm characteristic		s	s+1	s+2
TFP	No. of controls	103	95	87
	ATT	0.02	0.14	-0.02
LP1	No. of controls	102	94	90
	ATT	-0.02	0.15	0.02
LP2	No. of controls	103	94	87
	ATT	-0.04	0.00	-0.01
Capital	No. of controls	103	95	87
	ATT	0.39	0.46**	0.53**
Sales	No. of controls	105	94	87
	ATT	0.38***	0.19***	0.41**
ULC	No. of controls	102	96	83
	ATT	0.07	0.05	-0.05
Wages	No. of controls	105	95	86
	ATT	0.07	0.09*	0.06

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

Source: Own calculations based on FINA database.

Table A11

Growth rate ex-post export premium estimates on a matched sample restricted to firms that existed three years prior to starting to export

Firm characteristic		s	s+1	s+2	cum
TFP	No. of controls	88	82	74	74
	ATT	0.02	0.07	0.02	0.10
LP1	No. of controls	88	73	66	66
	ATT	0.07	0.21	-0.07	0.08
LP2	No. of controls	88	74	66	66
	ATT	0.11	0.00	0.04	0.00
Capital	No. of controls	88	82	74	74
	ATT	0.75	0.30	0.45	3.10
Sales	No. of controls	86	73	64	64
	ATT	0.26*	0.19***	0.08	0.26***
ULC	No. of controls	88	77	64	64
	ATT	-0.22	0.06	-0.17	-0.19
Wages	No. of controls	88	74	61	61
	ATT	0.10	0.09**	-0.01	0.07

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

Source: Own calculations based on FINA database.

Table A12

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

Firm characteristic		s	s+1	s+2	cum
TFP	No. of controls	103	95	84	84
	ATT	0.11	0.17	-0.08	0.02
LP1	No. of controls	102	94	86	86
	ATT	0.06	0.20	-0.09	0.06
LP2	No. of controls	103	94	83	83
	ATT	0.05	0.09	0.00	0.05
Capital	No. of controls	103	95	84	84
	ATT	48.95	0.14	0.32	2.58
Sales	No. of controls	105	94	84	84
	ATT	2.11***	0.11	0.05	0.11**
ULC	No. of controls	102	96	83	83
	ATT	0.39	0.00	-0.06	-0.15
Wages	No. of controls	105	95	83	83
	ATT	0.12	0.03	-0.02	0.01

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

Source: Own calculations based on FINA database.

REFERENCES

1. Ackerberg, D., Caves, K. and Garth, F., 2006. Structural identification of production functions. *MPRA Paper,* No. 38349. Available at: <http://mpra.ub.uni-muenchen.de/38349/>.
2. Alvarez, R. and López, R. A., 2005. Exporting and Performance: Evidence from Chilean Plants. *Canadian Journal of Economics*, 38(4), pp. 1384-1400. doi: 10.1111/j.0008-4085.2005.00329.x
3. Arnold, J. H. and Hussinger, K., 2005. Export Behavior and Firm Productivity in German Manufacturing: A Firm-Level Analysis. *Review of World Economics*, 141(2), pp. 219-243. doi: 10.1007/s10290-005-0026-8
4. Aw, B. Y., Chung, S. and Roberts, M. J., 2000. Productivity and Turnover in the Export Market: Micro-level Evidence from the Republic of Korea and Taiwan (China). *The World Bank Economic Review,* 14(1), pp. 65-90. doi: 10.1093/wber/14.1.65
5. Baldwin, R., 2000. Trade and Growth: Still Disagreement about the Relationships. *Organisation for Economic Co-operation and Development Working Paper.* ECO/WKP(2000)37. Available at: <http://www.oecd.org/eco/growth/1885708.pdf>.
6. Becker, S. O. and Ichino, A., 2002. Estimation of average treatment effects based on propensity scores. *The Stata Journal*, 2(4), pp. 358-377. Available at: <http://www.stata-journal.com/sjpdf.html?articlenum=st0026>.
7. Bernard, A. B. and Jensen, B., 1995. Exporters, Jobs, and Wages in U.S. Manufacturing: 1976-1987. *Brookings Papers on Economic Activity. Microeconomics,* pp. 67-119. doi: 10.2307/2534772
8. Bernard, A. B. and Jensen, B., 1999. Exceptional Exporter Performance: Cause, Effect, or Both? *Journal of International Economics,* 47(1), pp. 1-25. doi: 10.1016/S0022-1996(98)00027-0
9. Bernard, A. B. and Jensen, B., 2004a. Exporting and Productivity in the USA. *Oxford Review of Economic Policy,* 20(3), pp. 343-357. doi: 10.1093/oxrep/grh020
10. Bernard, A. B. and Jensen, B., 2004b. Why Some Firms Export. *Review of Economics and Statistics,* 86(2), pp. 561-569. doi: 10.1162/003465304323031111
11. Bernard, A. B. and Wagner, J., 1997. Exports and Success in German Manufacturing. *Review of World Economics/Weltwirtschaftliches Archiv*, 133(1), pp. 134-137. doi: 10.1007/BF02707680
12. Bernard, A. B. and Wagner, J., 2001. Export Entry and Exit by German Firms. *Review of World Economics/WeltwirtschaftlichesArchiv*, 137(1), pp. 105-123. Available at: <http://link.springer.com/article/10.1007%2FBF02707602#page-1>.
13. Bigsten, A. [et al.], 2004. Do African Manufacturing Firms Learn from Exporting? *Journal of Development Studies*, 40(3), pp. 115-141. doi: 10.1080/00220380420002132 29

14. Blanes-Cristóbal, J. V. [et al.], 2008. Do sunk exporting costs differ among markets? Evidence from Spanish manufacturing firms. *Economics Letters,* 101(1), pp. 110-112. doi: 10.1016/j.econlet.2008.06.012
15. Blundell, R. and Costa Dias, M., 2000. Evaluation Methods for Non-Experimental Data. Fiscal Studies, 21(4), pp. 427-468. doi: 10.1111/j.1475-5890.2000.tb00031.x
16. Castellani, D., 2002. Export Behavior and Productivity Growth: Evidence from Italian Manufacturing Firms. *Review of World Economics/Weltwirtschaftliches Archiv*, 138(4), pp. 605-628. doi: 10.1007/BF02707654
17. Clerides, S. K., Lach, S. and Tybout, J., 1998. Is Learning-by-Exporting Important? Micro Dynamic Evidence from Colombia, Morocco, and Mexico. *Quarterly Journal of Economics*, 113(3), pp. 903-947. doi: 10.1162/003355398555784
18. CGD – Commission on growth and development, 2008. *The Growth Report Strategies for Sustained Growth and Inclusive Development*. Available at: <http://siteresources.worldbank.org/EXTPREMNET/Resources/489960-1338997241035/Growth_Commission_Final_Report.pdf>.
19. Damijan, J. P., Polanec, S. and Prasnikar, J., 2004. Self-selection, Export Market Heterogeneity and Productivity Improvements: Firm-level Evidence from Slovenia. *LICOS Discussion Paper*, No. 148. Available at: <http://www.econ.kuleuven.be/licos/publications/dp/dp148.pdf>.
20. Damijan, J. P. and Kostevc, C., 2006. Learning-by-exporting: Continuous productivity improvements or capacity utilization effects? Evidence from Slovenian Firms. *Review of World Economics,* 142(3), pp. 599-614. doi: 10.1007/s10290-006-0083-7
21. Damijan, J. P., Polanec, S. and Prasnikar, J., 2007. Outward FDI and Productivity: Micro-evidence from Slovenia. *The World Economy,* 30(1), pp. 135-155. doi: 10.1111/j.1467-9701.2007.00876.x
22. De Loecker, J., 2007. Do exports generate higher productivity? Evidence from Slovenia. *Journal of International Economics,* 73(1), pp. 69-98. doi: 10.1016/j.jinteco.2007.03.003
23. Delgado, M., Farinas, J. C. and Ruano, S., 2002. Firm Productivity and Export Markets: A Nonparametric Approach. *Journal of International Economics*, 57(2), pp. 397-422. doi: 10.1016/S0022-1996(01)00154-4
24. ECB, 2014. Micro-based evidence of EU competitiveness: The COMPNET database. *ECB Working paper series,* No. 1634. Available at: <http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1634.pdf>.
25. Eurostat. *Aggregations of manufacturing based on NACE Rev. 2*. Available at: <http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an3.pdf >.
26. Galac, T., 2014. *Mikroekonomski aspekti utjecaja globalne krize na rast nefinancijskih poduzeća u RH*. Zagreb: Hrvatska narodna banka.
27. Girma, S., Greenaway, D. and Kneller, R., 2003. Export market exit and performance dynamics: a causality analysis of matched firms. *Economics Letters,* 80, pp. 181-187. doi: 10.1016/S0165-1765(03)00092-2
28. Girma, S., Greenaway, D. and Kneller, R., 2004. Does Exporting Lead to Better Performance? A Microeconometric Analysis of Matched Firms. *Review of*

International Economics, 12(5), pp. 855-866. doi: 10.1111/j.1467-9396.2004.00486.x

29. Giles, J. A. and Williams, C. L., 2000a. Export-led growth: a survey of the empirical literature and some non-causality results. Part I. *Journal of International Trade & Economic Development,* 9(4), pp. 261-337. doi: 10.1080/09638190050086177
30. Giles, J. A. and Williams, C. L., 2000b. Export-led growth: a survey of the empirical literature and some non-causality results. Part II. *Journal of International Trade & Economic Development,* 9(4), pp. 445-470. doi: 10.1080/09638190750056867
31. ISGEP-International Study Group on Exports and Productivity, 2008. Understanding Cross-Country Differences in Exporter Premia: Comparable Evidence for 14 Countries. *Review of World Economics*, 144(4), pp. 596-635. 10.1007/s10290-008-0163-y
32. Kraay, A., 1999. Exportations et Performances Economiques: Etude d'un Panel d'Entreprises Chinoises. *Revue d'Economie du Développement,* 7(1-2), pp. 183-207. Available at: <http://siteresources.worldbank.org/DEC/Resources/ExportsandEconomicPerformance.pdf>.
33. Levinsohn, J. and Petrin, A., 2003. Estimating Production Functions Using Inputs to Control for Unobservables. *Review of Economic Studies*, 70(2), pp. 317-341. doi: 10.1111/1467-937X.00246
34. Lukinić-Čardić, G., 2012. *Proizvodnost i izvoz u Hrvatskoj*. Magistarski rad.
35. Olley, G. S. and Pakes, A., 1996. The dynamics of productivity in the telecommunications equipment industry. *Econometrica*, 64(6), pp. 1263-1297. doi: 10.2307/2171831
36. Roberts, M. J. and Tybout, J., 1997. The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs. *American Economic Review,* 87(4), pp. 545-564. Available at: <http://www.econ.psu.edu/~mroberts/pubaer.pdf >.
37. Rosenbaum, P. R. and Rubin, D., 1983. The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika*, 70(1), pp. 41-55. doi: 10.1093/biomet/70.1.41
38. Serti, F. and Tomasi, C., 2007. Self-Selection and Post-Entry effects of Exports: Evidence from Italian Manufacturing firms. *LEM Papers Series.* No. 2007/20. Available at: <http://www.lem.sssup.it/WPLem/files/2007-20.pdf>.
39. Serti, F. and Tomasi, C., 2009. Self-selection along different export and import markets. Laboratory of Economics and Management – Sant'Anna School of Advanced Studies LEM. *Working Paper 2009/18*. Available at: <http://econpapers.repec.org/paper/ssalemwps/2009_2f18.htm >.
40. Silva, A., Afonso, O. and Africano, A. P., 2010a. Do Portugese Manufacturing Firms Self Select to Exports? Universidade de Porto FEP. *Working Papers* No. 371. Available at: <http://www.fep.up.pt/investigacao/workingpapers/10.04.22_wp371.pdf >.

41. Silva, A., Afonso, O. and Africano, A. P., 2010b. International trade involvement and performance of Portuguese manufacturing firms: causal links. *InstitutoPolitécnico do Porto – ESEIG*, mimeo. Available at: <http://www.eseig.ipp.pt/docentes/amn/wp-content/uploads/2010/07/Silva.pdf >.
42. Wagner, J., 1995. Exports, Firm Size, and Firm Dynamics. *Small Business Economics,* 7(1), pp. 29-39. doi: 10.1007/BF01074314
43. Wagner, J., 2002. The causal effect of exports on firm size and labour productivity: First evidence from a matching approach. *Economics Letters,* 77(2), pp. 287-292. doi: 10.1016/S0165-1765(02)00131-3
44. Wagner, J., 2007. Exports and productivity: a survey of the evidence from firm-level data. *The World Economy,* 30(1), pp. 60-82. doi: 10.1111/j.1467-9701.2007.00872.x
45. Wagner, J., 2011. International trade and firm performance: A survey of empirical studies since 2006. *University of Lüneburg Working Paper Series in Economics*, No. 210. Available at: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1918234>.
46. Wooldridge, J. M., 2009. On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters*, 104(3), pp. 112-114. doi: 10.1016/j.econlet.2009.04.026