



CROATIAN NATIONAL BANK

The Direction of Causality Between Exports and Firm Performance; Microeconomic Evidence from Croatia Using the Matching Approach

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Motivation

- ❑ Croatia`s short to medium term growth prospects hinge on the future dynamism of the export sector.

- ❑ Croatia is characterized with a substantial trade imbalance and relatively slow exports growth when comparing to similar Central and Eastern European countries.

- ❑ How to spur exports?

- ❑ But a more general question is still not resolved:
 - What is the direction of causality between exports and growth?
 - To what extent exports are exogenous to growth?



Micro dataset

- ❑ Firm level financial reports data
- ❑ Outlier treatment
- ❑ Manufacturing sector
- ❑ Around 80 000 observations
- ❑ Dataset spans 11 years (2002-2012)

Empirical strategy and results



Are exporters better? (1)

□ Export premia:

$$\ln X_{it} = \alpha + \beta \text{Export}_{it} + \gamma \text{Control}_{it} + \varepsilon_{it}$$

where:

i ... the index of the firm,

t ... the index of the year,

X_{it} ... the firm characteristics of interest (TFP, LP1 (revenue based labour productivity), LP2 (value added based labour productivity) and other performance measures such as capital, sales, wages and ULC);

Export ... dummy of the current export status (1 if firm i is an exporter in year t , 0 otherwise);

Control ... vector of firm specific controls which include sector and size dummies;

e ... random error.

Are exporters better? (2)

	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 $100(\exp(\beta)-1)$.

Source: own calculations based on FINA database

YES!

Are exporters better? (3)

- To control for unobserved plant heterogeneity – FE panel
- Exporter premium noticeably lower, but still significant

	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 $100(\exp(\beta)-1)$. The panel regression is corrected for first order autocorrelation.*

Source: own calculations based on FINA database

Testing validity of two hypothesis in trade:

Self-selection hypothesis

More productive firms self-select themselves to export market?

Testing the **ex-ante** differences in performance between export starters and non-exporters

AND / OR

Learning-by-exporting hypothesis

Firms may become more efficient after they begin exporting through learning experience?

Testing the **ex-post** differences in performance between export starters and non-exporters

Self - selection hypothesis (1)

- Testing the **ex-ante** differences in performance between export starters and non-exporters:

$$\ln X_{it} = \alpha + \beta \text{Export}_{iT} + \gamma \text{Control}_{it} + \varepsilon_{it}$$

where:

T ... the year of entry into the foreign market,

Export_{iT} ... represents an export starter in year T , provided that she exports for three consecutive years (including year T),

$t < T$... in order to analyze pre-entry characteristics of new exporters up to three years before starting to export

- Only **new exporters** at time T and **non-exporters** are included in the sample.
- The sample is divided into six sub-periods (2002-2007, 2003-2008, 2004-2009, 2005-2010, 2006-2011, and 2007-2012).

Self - selection hypothesis (2)

Estimation results: the extraordinary performance of new exporters years prior to entry in the foreign markets is confirmed.

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

Learning by exporting hypothesis (1)

- Testing the **ex-post** differences in performance between export starters and non-exporters after starting to export:

$$\% \Delta X_{T+2} = \alpha + \beta \text{Export}_{iT} + \gamma \text{Control}_{it} + \varepsilon_{it},$$

where:

T ... the year of entry into the foreign market,

Export_{iT} ... represents an export starter in year T , provided that she exports for three consecutive years (including year T),

$\% \Delta X_{T+2}$... represents growth rate premia of export starters two years after starting to export

- Again, the sample is divided into six sub-periods (2002-2007, 2003-2008, 2004-2009, 2005-2010, 2006-2011, and 2007-2012).

Learning by exporting hypothesis (2)

- The results indicate that firm productivity performance did not significantly change after starting to export.
- Export starters experience higher sales growth and negative growth in unit labour cost.

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***	2,760
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



Learning by exporting hypothesis (3)

- Some considerations about results:
 - Robustness checks – *different sample specification?*
 - 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 – *propensity score matching*

Propensity score matching and learning effects (1)

- ❑ The effect of exporting can be viewed as a standard problem of program evaluation with non-experimental data.
- ❑ One of the approaches for evaluation of non-experimental data in social sciences is the **matching method**
- ❑ Control group from the non-exporters has to be selected so it can be compared with the export-starters
- ❑ 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 - **propensity score matching** method (Rosenbaum and Rubin (1983))

Propensity score matching and learning effects (2)

Two step estimation procedure:

1st step: Estimating the probability of exporting (Probit model)

$$P(\text{EXPdummy}_{i,t} = 1) = F(\text{TFP}_{i,t-k}, \text{Control}_{i,t-k}),$$

Estimated probability is used as a propensity score for matching procedure

2nd step: Non-exporting firm, similar as possible in terms of estimated propensity score, is selected as match for exporting firm-
“Nearest-neighbor” matching method:

$$|p_{i,t} - p_{j,t}| = \min_{j \in \{\text{EXPdummy}_{i,t}=0\}} (p_{i,t} - p_{j,t})$$

Propensity score matching and learning effects (3)

- Differences in means within the matched pairs according to various firm performance measures:

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	<i>No. of controls</i>	381	301	186	293	307	227
	ATT	0.11	0.04	0.04	0.18***	0.16**	0.01
Capital	<i>No. of controls</i>	381	301	186	293	307	227
	ATT	0.20	0.36	-0.09	0.22*	0.15	0.11
Sales	<i>No. of controls</i>	380	301	186	293	307	226
	ATT	0.44***	0.54***	0.22	0.50***	0.51***	0.38**
ULC	<i>No. of controls</i>	381	301	186	294	307	227
	ATT	-0.07	0.00	-0.02	-0.11	-0.09*	0.01
LP1	<i>No. of controls</i>	381	301	186	293	307	227
	ATT	0.09	0.09	0.02	0.13*	0.18***	0.03
LP2	<i>No. of controls</i>	380	301	186	293	307	226
	ATT	0.17**	0.09	0.11	0.19***	0.24***	0.21*
Wages	<i>No. of controls</i>	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

Propensity score matching and learning effects (4)

- Differences in means within the matched pairs according to various firm performance measures:

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	<i>No. of controls</i>	381	301	186	295	307	227
	ATT	18.27***	16.67	35.71***	18.61	5.33	2.25
Capital	<i>No. of controls</i>	381	301	186	295	307	227
	ATT	1,385.9	62.19	-2.28	65.89**	245.74**	19.33
Sales	<i>No. of controls</i>	380	301	186	295	307	226
	ATT	57.4*	14.96***	17.38	46.78**	24.05***	12.94***
ULC	<i>No. of controls</i>	381	301	186	294	307	227
	ATT	-17.9	-19.99	478.81	1.79	-30.13	0.69
LP1	<i>No. of controls</i>	381	301	186	295	307	227
	ATT	8.01	14.66	35.73	16.33	8.31	3.29
LP2	<i>No. of controls</i>	380	301	186	295	307	226
	ATT	-0.18	3.46	5.69	9.33	11.28***	8.16
Wages	<i>No. of controls</i>	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 FDNA database

Conclusion – summing up

- ❑ Exporters are on average more productive, have higher sales, pay higher wages, utilize more capital, etc.
- ❑ ***Self-selection***: Strong evidence that exporter performance predates their entry into export market
- ❑ ***Learning-by-exporting***: After starting to export, firms have higher growth rates of some performance measures which vary based on sample specification and period under study.
- ❑ ***Exploring causality by utilizing propensity score matching***: Learning effects are present only in some periods, but the most distinguishing characteristic of export starters is sales growth.

Comparison of results with the literature

□ Self-selection:

- Bernard and Wagner (1997), Arnold and Hussinger (2005) - Germany
- Bernard and Jensen (1999) - US
- Clerides, Lach and Tybout (1998) - Columbia, Mexico and Morocco
- Aw, Chung and Roberts (2000) – Taiwan, Korea

□ Learning-by-exporting:

- Kraay (1999) – China
- Bigsten et. al – sub-Saharan African countries
- Castellani (2002) – Italy
- Girma, Greenway and Kneller (2004) – Great Britain

In sum: the literature consistently finds evidence to support self-selection hypothesis, but majority of studies fail to find any convincing evidence of learning-by-exporting hypothesis.

Thank you for your attention !