

**THE YOUNG ECONOMISTS' SEMINAR to
16th Dubrovnik Economic Conference**



Organised by



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*Exports and Productivity Link in Manufacturing:
Microeconomic Evidence from Croatia*

Hotel "Grand Villa Argentina",
Dubrovnik
June 23, 2010

Draft version

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Exports and productivity link in manufacturing: Microeconomic evidence from Croatia

(Preliminary results)

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Abstract

This paper presents data on the microstructure of Croatian exports and examines labour productivity differences between exporting and non-exporting firms. In addition, the market-selection and the learning-by-exporting hypotheses are examined. Empirical work is based on a sample of Croatian manufacturing firms over the 2002-2007 period. Evidence on exporter productivity premia is strong and robust. Results do not indicate that more productive firms self-select in the export market but there is some evidence supporting the learning-by-exporting hypothesis.

Key words: exports, productivity, firm-level data, self-selection, learning-by-exporting

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1 Introduction

The Croatian economy during the 2002-2007 period was characterized by macroeconomic stability, solid economic growth, low inflation and a stable exchange rate, significant amounts of foreign direct investment and financial deepening. Also, the EU accession process intensified in this period. However, the Croatian external position has been continuously deteriorating: the merchandise trade and current account deficits have been increasing, as has external debt, leading to substantial external vulnerabilities. Domestic companies have failed to significantly penetrate the world's export markets. Under pressure from strong competition in developed markets, they actually began to turn to less-demanding markets. While studies analyzing aggregate as well as industry-level data on Croatian exports exist, the aim of this paper is to present microeconomic data on Croatian exports, focusing on the link between productivity and exports.

Empirical research on export activities based on detailed firm-level data has increased significantly over the last decade. It has been confirmed for many countries that exports are concentrated in a small number of firms and that exporters are significantly different from non-exporting firms. They are on average larger, more productive, pay higher wages, etc. Special attention has been given by researchers to exploring the positive link between exports and productivity and the causal relationship between them. The question is whether only the best firms start exporting or whether exporting helps firms become better. This is usually explained by two hypotheses which are not mutually exclusive: the self-selection and learning-by-exporting hypothesis. According to the self-selection hypothesis, only firms with higher productivity begin exporting to other countries. According to the learning-by-exporting hypothesis, exporters increase their productivity after entering foreign markets.

The paper proceeds as follows. In the next section aggregate indicators of Croatian exports are analyzed. Structural features of Croatian exporters based on firm level data are presented in Section 3. After that, empirical literature on the link between productivity and exports is summarized. In Sections 5 and 6 the methodology and data used in econometric analysis are explained. The main empirical results are presented in Section 7. The paper ends with concluding remarks.

2 Croatian exports: macroeconomic view

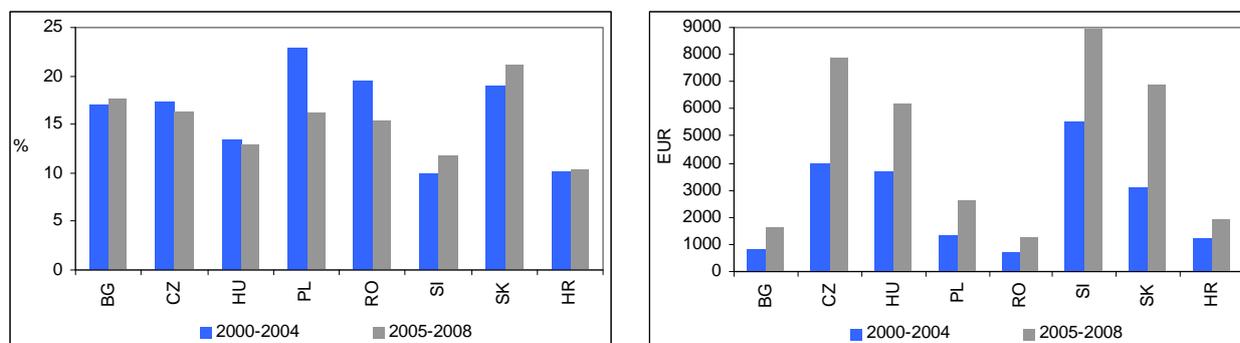
Aggregate data show that during the 1990s Croatian exports stagnated: in the 1993-1999 period they ranged from 3.4 to 4.1 billion EUR. Since 2000 exports began to intensify², which can partly be explained by foreign trade liberalization, the effects of enterprise restructuring in the 1990s and easier access to domestic bank financing and foreign sources of funds. At the same time imports of goods grew faster than exports, among other things due to the growth of imports of investment equipment, delayed post-war reconstruction of durable consumer goods, credit growth, reductions of import tariffs, etc. (Škuflić and Jurlin, 2003). Such developments caused continuous growth of the foreign trade deficit, which is higher than in any of the new EU member countries from Central and Eastern Europe³.

² For comparison, in the 1994-1999 period the average annual growth rate of exports was 3.7% and in the 2000-2008 period 10.2%.

³ Bulgaria (BG), Czech Republic (CZ), Hungary (HU), Poland (PL), Romania (RO), Slovakia (SK) and Slovenia (SI).

Low competitiveness of Croatian exports is particularly evident when export results are compared to other countries. In the 2000-2008 period Croatia achieved the lowest average annual growth rate of exports in the selected group of countries. Indicators on per capita exports are equally disappointing - Croatian per capita exports are higher only compared to Romania and Bulgaria (see Figure 1).

Figure 1: Average annual growth rate of exports (in %) and exports per capita (in EUR)



Source: Eurostat

An important indicator of international trade flows is openness, given that according to traditional trade theory openness implies a more rational production process, enables optimal allocation of resources and indicates the potential for rapid growth and restructuring (Boromisa and Mikic, 2003). In this respect, the fact that Croatia is one of the countries with the lowest degree of openness is worrisome. The low level of openness is particularly evident in comparison with Slovakia, Hungary and the Czech Republic. In these countries the share of total trade in GDP is twice as big as in Croatia.

Imports coverage by exports in Croatia is around and below 50 percent, which is considerably less than in all other observed countries where this indicator averaged between 72.0% in Bulgaria and 98.5% in the Czech Republic. In addition, in the same period Croatia achieved the highest average trade deficit.

The structure of Croatian exports to the EU15, as the most important export market, has gone through certain changes in the last ten years. This mainly refers to the falling share of the so-called traditional products (labour and resource intensive products - here defined as clothing and footwear, leather, textiles, wood and paper⁴). The share of clothing decreased the most, which can be attributed to the growing competition of cheap textile products from China. However, traditional products continue to account for roughly one fourth of total Croatian exports. They also constitute a large share of exports of Romania and Bulgaria. On the other hand, advanced countries of Central and Eastern Europe exported much less of these products, which make up between 5.2% of total exports of Hungary and 10.5% of exports of Slovakia. These shares are much closer to the structure of EU15 imports.

Unlike exports of traditional products, the relative importance of chemical products in Croatian exports is higher than in all other selected countries, while machinery⁵ and transport equipment have a much smaller share in Croatian exports compared to the exports of more advanced countries of Central and Eastern Europe and to total extra EU15 imports. In fact,

⁴ SITC codes 24, 25, 61, 65, 63, 64, 84 and 85. The same approach is used in Cabral (2004).

⁵ Includes power generating machinery and equipment, machinery specialized for particular industries, metalworking machinery, general industrial machinery and equipment n.e.s., office machines and automatic data processing machines, telecommunications and sound-recording and reproducing apparatus and equipment and electrical machinery, apparatus and appliances n.e.s.

more than half of total exports to EU15 from more advanced countries of Central and Eastern Europe, with the exception of Slovenia, refer to machinery and transport equipment. In Croatia this share is less than 30%.

Table 1: EU15 imports according to countries of origin, in %

SITC		2000-2004			2005-2008		
		HR	EU15*	SI	HR	EU15*	SI
0	Food and live animals	5,2	5,0	0,8	7,0	4,7	3,0
1	Beverages and tobacco	0,4	0,4	0,2	0,4	0,4	0,1
24+25	Crude materials - cork, wood and paper	6,1	1,3	1,2	5,5	0,9	1,1
21-23+26-29	Other crude materials, except food and fuels	4,3	3,4	1,3	5,4	3,4	2,4
3	Mineral fuels and lubricants	4,8	16,1	1,6	4,0	23,2	1,4
4	Animal and vegetable oils and fats	0,2	0,3	0,0	0,1	0,4	0,1
5	Chemicals and related products	10,1	8,1	5,0	8,6	8,0	5,5
61+65	Products made of leather and textile	3,7	2,2	3,8	3,5	1,7	2,3
63+64	Products made of cork, wood and paper	4,0	1,3	4,7	3,5	1,0	3,5
62+66-69	Other manufactures, classified chiefly by material	9,3	8,4	16,9	11,2	10,0	19,9
70-77	Machinery	16,0	26,9	22,5	20,9	23,8	21,9
78	Road vehicles	1,8	5,4	18,1	2,5	5,5	22,3
79	Other transport equipment	3,7	4,1	3,5	4,0	2,9	1,7
84	Clothing	16,7	4,9	4,4	9,9	4,1	1,8
85	Footwear	5,3	1,0	0,6	3,5	0,9	0,5
81-83+87-89	Miscellaneous manufactured goods, except clothing and footwear	7,9	8,6	14,5	9,5	7,8	12,1
9	Other products, n.e.s.	0,5	2,6	0,8	0,5	1,3	0,4
Total		100,0	100,0	100,0	100,0	100,0	100,0

* Refers to extra EU15 imports. HR - Croatia, SI - Slovenia

Source: Eurostat

Given the strong competition in the EU market, Croatian exporters began to turn to less demanding markets in developing countries where the competition is still weaker than in the EU. This is reflected in the geographical structure of Croatian exports. In the 2000-2008 period the share of developed countries decreased, mainly due to the reduced share of exports to Germany, Italy and Slovenia. Exports to developing countries intensified, especially to neighbouring countries (Bosnia and Herzegovina, Montenegro and Serbia).

Many factors led to the disappointing results of Croatian merchandise exports. For example, Mikic (2002) lists a number of reasons on the supply side, such as lack of investment in the creation of advanced products, low level of competition in innovation and investment in research and development, barriers to the entry of new firms into the market, the lack of a more "demanding" domestic market, shallow industrial clusters and inadequate role of the state. Teodorovic and Buturac (2006) believe that the successful restructuring of industrial production and changing comparative advantage in international trade towards higher value added products were mostly restrained by slow implementation of reforms, bureaucratic obstacles, problems with the judiciary, unregulated land registry and slow and incomplete privatization. Škuflić (2005) also points to the delay in the process of Croatian accession to the EU because in the early 1990s EU provided associate membership for ten countries of Central and Eastern Europe. This significantly improved the trade of these

countries with the EU, while at the same time Croatia has not had a clear European perspective which adversely affected the growth and restructuring of its trade with the EU.

3 Structural features of Croatian exporters

The main source of the firm-level data is a database of the Financial agency (FINA). Manufacturing companies over the 2002-2007 period are included in the sample. Observations on companies that had less than 10 employees (because of questionable data quality⁶), companies that in a given year operated less than six months and companies for which in the particular year there were no data on fixed assets, sales and revenues were excluded from the sample. In this way the sample was reduced by approximately one quarter of companies that made up about half of the exporters. However, companies retained in the sample account for about 90 percent of the total number of employees and over 90 percent of sales and exports achieved by all manufacturing companies included in the database. It can be concluded that the sample is largely representative. This is further confirmed by the fact that exporters included in the sample represent about 80 percent of manufacturing exports according to data published by the Central Bureau of Statistics.

Of the total number of companies in the sample, approximately one third operated only on the domestic market and about two thirds of the companies exported, on a more or less regular basis, to foreign countries. Less than one third of the total number of companies exported occasionally. Approximately one fifth of the companies exported every year (regular exporters). Only 10% of the companies began to export and the remaining part of the companies stopped exporting in this period⁷.

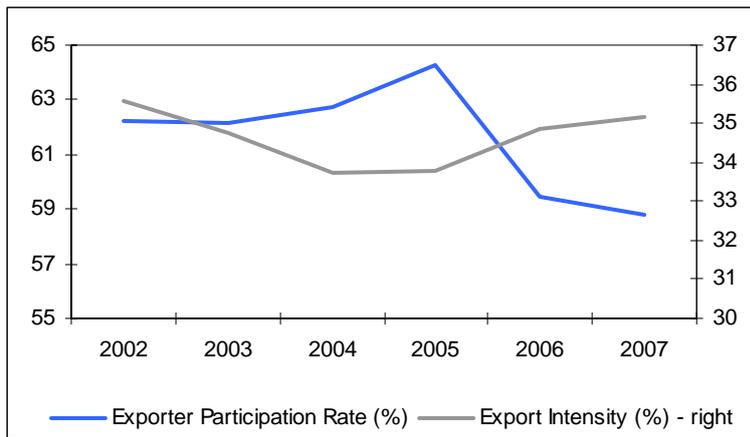
3.1 Exporter participation and export intensity

Over the 2002-2007 period the number of exporters grew more slowly than the total number of active manufacturing enterprises, which resulted in a slight decrease in the exporter participation rate, measured by the ratio of the number of exporters and the number of total companies in the sample, from 62.2% in 2002 to 58.8% in 2007. Export intensity, measured by the arithmetic mean of exports to total sales ratio for exporters, also declined slightly in the first part of the analyzed period. It subsequently recorded an increase and in 2007 it was approximately at the same level as in 2002. Average export intensity over the 2002-2007 period was 35%.

⁶ The same approach is used by Marić (2008).

⁷ The exporter status is determined as follows: non-exporting firms did not export in any of the years; regular exporters exported in all of the years; new exporters did not export in at least two consecutive years and then started and continued to export in the remaining period (at least for the last two years); ex exporters exported in at least two consecutive years and then stopped exporting in the entire remaining period; occasional exporters are companies that in some years exported and in some years did not export.

Figure 2: Exporter participation rate and export intensity



Notes: Exporter participation is the ratio between the number of exporters and the total number of enterprises. Export intensity is the average share of exports in total sales of exporters.

Source: own calculations based on FINA database

Compared to other countries, the exporter participation rate in Croatia is approximately the same as in Austria, West Germany, Italy, Ireland and the UK, but it is much smaller than in, for example, Slovenia (according to the results cited in ISGEP, 2008). Quite high propensity of Croatian companies to export is not surprising given the small domestic market, which is why companies have an incentive and need to sell their products on foreign markets. By comparison, Bernard et al. (2007) reported that the same indicator in the manufacturing industry in the United States in 2002 amounted to 18 percent.

The exporter participation rate and export intensity vary substantially in individual sectors of manufacturing. Above average exporter participation is found in the manufacture of chemicals and chemical products, manufacture of coke, refined petroleum and nuclear fuel, manufacture of leather and leather products and manufacture of machinery and equipment. By contrast, the exporter participation rate in the manufacture of food products, beverages and tobacco, manufacture of other non-metallic mineral products and manufacture of transport equipment is less than average.

Export intensity is highest in the manufacture of leather and leather products, manufacture of textiles and textile products and manufacture of transport equipment. On the other hand, a much smaller portion of total sales goes to exports in the manufacture of pulp, paper and paper products and the manufacture of coke, refined petroleum products and nuclear fuel.

Table 2: Exporter participation rate and export intensity according to manufacturing industries (in %)

Code	Manufacturing industry	Exporter participation rate		Export intensity-firms	
		2002	2007	2002	2007
DA	Manufacture of food products, beverages and tobacco	34	32	21	25
DB	Manufacture of textiles and textile products	69	67	52	50
DC	Manufacture of leather and leather products	88	82	60	56
DD	Manufacture of wood and wood products	70	67	48	47
DE	Manufacture of pulp, paper and paper products, publishing and printing	55	62	15	9
DF	Manufacture of coke, refined petroleum products and nuclear fuel	100	83	15	19
DG	Manufacture of chemicals, chemical products and man-made fibres	88	89	25	30
DH	Manufacture of rubber and plastic products	70	68	28	27
DI	Manufacture of other non-metallic mineral products	60	50	25	25
DJ	Manufacture of metals and metal products	63	59	37	40
DK	Manufacture of machinery and equipment n.e.c.	81	82	39	42
DL	Manufacture of electrical and optical equipment	74	65	30	33
DM	Manufacture of transport equipment	54	54	49	51
DN	Manufacturing n.e.c.	69	64	43	33
D	Total manufacturing	62	59	36	35

Notes: Exporter participation rate is defined as the share of exporters in total number of firms in the sample. The export intensity is defined as the average export intensity (the ratio of exports and sales) of all firms in a particular sector.

Source: own calculations based on FINA database

3.2 Exporters according to firm size, ownership and technology intensity

Majority of Croatian manufacturing exporters are small firms⁸. Their share increased from roughly half the total number of exporters at the beginning of the period to almost 70 percent at the end of the period under study. In contrast, the share of medium and large exporters decreased: the share of medium firms from one third to one quarter and the share of large firms from 17 to 8 percent. However, large firms account for the majority of total exports and have the highest export intensity, which was on average around 40 percent.

According to ownership structure, privately owned enterprises (especially those private from the start up of the firm) dominate. Nearly 90 percent of all companies are privately owned. On average annually around 60 percent of all privately owned enterprises export to foreign markets (exporter participation) and about one third of their total sales refer to exports (export intensity). These firms account for roughly half of total manufacturing exports.

⁸ Official classification of entrepreneurs according to firm size is based on several criteria, including employment. In general, small firms have less than 50 employees, medium firms have between 50 and 250 employees and large firms have more than 250 employees.

Most of the exporters (around 80 percent) belong to low and medium-low technology⁹ industries, exporters in medium-high technology industries account for about 17 percent of all exporters and only the remaining 4 percent are exporters in the high technology industries. Given the small number of exporters in the high technology sectors and their below-average export intensity, it is not surprising that these entrepreneurs realize only about 10 percent of total exports, and this share has been decreasing slightly during the analyzed period. Exporters engaged in medium-high technology industries achieved only about one fifth of total exports, about 30 percent of exports was achieved by firms in low technology industries and most of the exports (the remaining 40 per cent) refer to firms in medium-low technology industries.

3.3 Exporters vs. Non-exporters

Exporters are (on average) significantly larger than non-exporters: they have greater assets and capital and employ more people, they invest more and make more sales in the domestic market, they earn higher profits, import more and pay higher wages. The dominance of exporters over non-exporters is confirmed also when selected indicators are expressed as a share of exporters and non-exporters in their total value. Only about 5 percent of total assets, capital and investment that entrepreneurs have reported in their annual financial statements refer to companies that operate only on domestic market, although, as previously shown, they make up about one third of the total number of companies. They employ only 8 percent of all employees, roughly the same as their share in total sales in the domestic market and slightly less in the mass of paid net salaries. These entrepreneurs reported a loss at the beginning of the study period but later on their profitability improved. However, they achieve only about 5 percent of total profits earned.

Table 3: Comparison of exporters and non-exporters

	2002-2004			2005-2007		
	Non-exporting firms	Exporters Regular	Exporters Occasional	Non-exporting firms	Exporters Regular	Exporters Occasional
Assets	5,5	71,3	23,2	5,3	68,8	25,9
Capital	4,9	75,6	19,5	5,0	74,2	20,8
Employment	7,9	65,3	26,9	9,2	62,7	28,1
Imports	1,0	85,4	13,6	0,9	81,0	18,2
Investment	4,3	74,7	21,0	5,1	71,3	23,6
Sales on domestic market	8,3	69,2	22,5	8,2	67,5	24,3
Profit	-0,7	77,1	23,6	5,0	68,9	26,1
Net wages	6,4	70,7	22,9	7,2	67,8	25,0

Notes: Numbers in the table represent the average share of exporters and non-exporters in the total value of the indicator (in percent). Occasional exporters include new exporters and ex exporters.

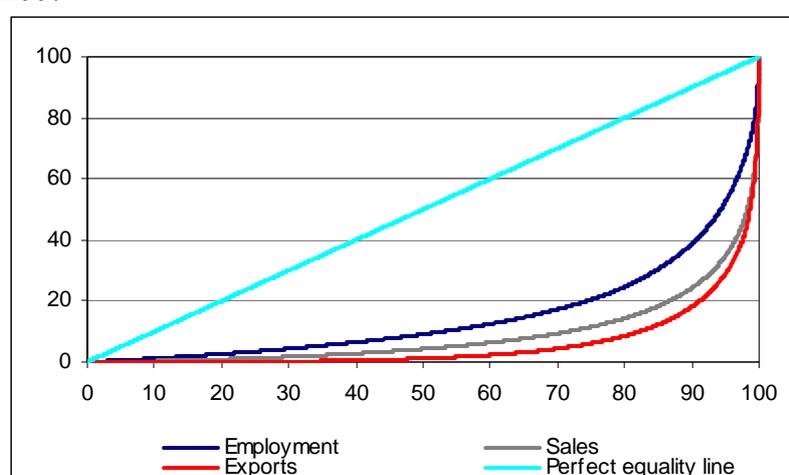
Source: own calculations based on FINA database

9 High-technology industries are: aerospace (NCA 35.3), computers and office machinery (30), electronics-communications (32) and pharmaceuticals (24.4). Medium-high technology industries are: scientific instruments (33), motor vehicles (34), electrical machinery (31), chemicals (24.1-24.3), other transport equipment (35.2, 35.4-35.5) and non-electrical machinery (29). Medium-low technology industries are: rubber and plastic products (25), shipbuilding (35.1), other manufacturing (36), manufacture of other non-metallic mineral products (26), manufacture of metals and metal products (27-28) and petroleum refining (23). Low technology industries are: paper printing (21-22), textiles and clothing (17-19), food, beverages and tobacco (15-16) and wood (20).

3.4 Concentration indicators

In the next section indicators of export concentration are analyzed, including their comparison with concentration indicators for sales and employment, which are crucial variables in the econometric testing of the links between productivity and exports. The Lorenz curve shows that exports are concentrated in a smaller number of companies compared to employment and sales, which is consistent with findings in other papers, e.g. Castellani et al. (2008) who examined the concentration of Italian manufacturing firms. The Lorenz curve for 2007 shows, *inter alia*, that 10% of the largest firms achieved about 80% of total exports, or about 75% of sales and about 60% of total employment. Compared to the beginning of the analyzed period there were no significant changes in the degree of concentration.

Figure 3: Lorenz curve for employment, sales and exports of Croatian manufacturing firms in 2007



Source: own calculations based on FINA database

Values of the Gini coefficient for exports, employment and sales in 2002 and 2007 confirm that in the observed period there were no significant changes in their concentration. Concentration is most pronounced for exports. This is true not only at the aggregate level but at the level of individual sectors as well. Greater concentration of exports in comparison with sales and employment may be the result of concentration between different sectors (exports is concentrated in a small number of sectors) or concentration within the sector (the small number of companies within the industry realizes the bulk of exports), as explained by Castellani et al. (2008). The first case is in line with traditional trade theories that predict that the country specializes in the export of certain sectors, while other sectors import. In contrast, new trade theory based on firm heterogeneity predicts that trade liberalization will favour the most productive firms within each industry. This is examined by using the features of the Theil index.

Decomposition of the total Theil index on between-sector and within-sector elements shows that the second element explains the bulk of the total concentration of the observed variables. The between-sector element is the most important for sales, although it explains just over one third of the total concentration. In the 2002-2007 period there were only minor changes in the contribution of individual elements. The contribution of the between-sector element increased only for exports, while it declined for employment and sales.

Table 4: Concentration indicators

	Gini		Theil total		Theil % between sectors		Theil % within sectors	
	2002	2007	2002	2007	2002	2007	2002	2007
Exports	0,87	0,88	2,31	2,39	27,21	31,41	72,79	68,59
Employment	0,71	0,70	1,23	1,19	19,15	13,30	80,85	86,70
Sales	0,81	0,82	2,03	2,17	37,81	35,25	62,19	64,75

Source: own calculations based on FINA database

4 Review of empirical literature

The empirical literature in the field of international trade based on firm-level data is very extensive. One of the seminal papers is the one by Bernard and Jensen (1995). They showed that only a small fraction of U.S. manufacturing firms exported and that those firms were more productive, larger and more likely to survive in the market compared to non-exporters. Their work has spurred a number of studies examining the differences between exporters and non-exporters even within the same industry based on detailed databases at the firm level. Published papers indicate that differences between exporters and non-exporters are significant. Exporters are usually larger, more productive, pay higher wages, have higher capital equipment, etc. In addition, there is evidence on persistence of export activities in the sense that firms rarely change their status between exporters and non-exporters which is usually explained by significant sunk costs of exports (Roberts and Tybout, 1997).

Researchers have paid special attention to examining the positive link between productivity and exports. This link is usually explained by two basic hypotheses that are not mutually exclusive. According to the self-selection hypothesis only more productive firms start exporting to other countries because of significant barriers and additional initial costs of starting to export which less productive enterprises can not afford (for example, costs of establishing new distribution and marketing channels). Thus exporters are more productive than non-exporters before they start exporting, e.g. the productivity of future exporters is *ex ante* higher. According to the learning-by-exporting hypothesis firms increase their productivity after entering the foreign markets; among other things because they are exposed to stronger competition in international markets, have the opportunity to learn from foreign customers and competitors and to use economies of scale. In other words, the productivity of new exporters is *ex-post* higher compared to non-exporters.

A considerable number of empirical studies confirm the existence of the first hypothesis, but the results for the second hypothesis are ambiguous. Bernard and Jensen (1999) showed on the sample of U.S. manufacturing companies in the 1984-1992 period that exporters have higher total factor productivity (TFP) and that more productive firms are more likely to become exporters, but they did not confirm that exports improve TFP growth. Therefore they believe that policy makers should primarily support potential exporters rather than existing exporters. Arnold and Hussinger (2005), using a sample of German manufacturing companies, showed that exporters have above-average productivity as well as that higher productivity increases the probability of exporting. The results of testing the causality between productivity and exports confirmed that the link goes from productivity to exports but not vice versa. Castellani (2002) showed that the learning effects of exporting are important for the Italian companies with very high exposure to foreign markets, but this does not apply to firms with lower export intensity.

Different results obtained by researchers may be due to methodological differences. Therefore it is important to mention the results of the International Study Group on Exports

and Productivity (ISGEP, 2008). Experts from 14 countries examined the exports-productivity link based on the same methodology. Their results confirm that exporters are more productive than non-exporters and that more productive firms self select into exports but they did not find evidence supporting the learning-by-exporting hypothesis. They also showed that the exporter productivity premium is higher in countries with lower exporter participation rates, with more restrictive trade policies and lower GDP per capita, lower government efficiency and lower-quality regulations, as well as in countries that export to more distant markets.

After data on commodity and geographic structure of exports became available on the firm level, these issues were examined in more detail as well. Damijan et al. (2007) showed that Slovenian exporters to the EU are more productive than those exporting to neighbouring countries, that there is a positive link between productivity and the number of markets a firm starts to export to and that firms enter new export markets gradually (on average one every two years), while they start by exporting to countries with low fixed costs. Eaton et al. (2004) showed that most French exporters exported to a small number of markets, while a small number of exporters sells to nearly all markets. They confirmed the negative relationship between the number of firms selling to more markets and the number of foreign markets where they do business. Also, they showed that the variation of geographical structure of French exports is mainly observed at the extensive margin (i.e., the number of companies selling there) instead of at the intensive margin (i.e., sales of companies that already export there).

More recent empirical papers also consider firms' import activities. Andersson et al. (2008) showed that Swedish firms that both export and import are more productive than firms that only export or only import. This is explained by the fact that firms that both export and import are deeply involved in the international division of labour and that in their production processes they use inputs based on the latest knowledge and technology. In addition, the authors suggest that firms with low productivity trade with markets characterized by low productivity limits. Muuls and Pisu (2007) confirm for Belgium that both exports and imports are highly concentrated in a small number of firms, with an upward trend in concentration. The number of manufacturing firms that trade with foreign countries decreases as the number of countries of export destination or countries of import origin, as well as the number of traded products, increases. Regarding productivity indicators, they show that firms that both export and import are most productive, followed by firms that only import and only export, and finally by firms that do not trade with the rest of the world. Based on these findings, authors conclude that there are fixed costs related not only to exporting but also to importing, that the self-selection process is present both for export and import markets and that the exporter productivity premium may be overestimated because calculations usually do not take into account firms' import activities.

5 Methodology for testing the link between exports and productivity

Testing the link between productivity and exports in Croatian manufacturing is based on three main hypotheses according to existing empirical literature. First, the productivity premium of exporters is assessed by testing whether exporters are more productive than non-exporters. Then the causality between productivity and exports is tested by examining the self-selection hypothesis and learning-by-exporting hypothesis.

Assessment of exporter productivity premium is based on an OLS regression on panel data, where the firm productivity level is explained by its export status and control variables. Relying largely on ISGEP (2008), the regression equation can be written as:

$$(1) \ln LP_{it} = \alpha + \beta EDUM_{it} + cCONTROL_{it} + e_{it}$$

where i denotes a firm, t the year, LP labour productivity, $EDUM$ is a dummy variable for the exporter status taking the value 1 if the firm exports in year t and the value 0 otherwise, $CONTROL$ is a vector of control variables and e

is the random error. In this model the estimated coefficient β represents the exporter productivity premium. To facilitate the interpretation it is usually expressed as $100*(\exp(\beta)-1)$ and represents the average percentage difference in productivity between exporters and non-exporters. The sample for regression estimation excludes observations for firms with top 1% and bottom 1% productivity levels. Regressions are estimated without and with fixed effects. By controlling for firm-specific fixed effects the impact of specific characteristics of individual firms (such as the quality of management) is taken into account.

Labour productivity is defined in two ways. The first measure of productivity (LPI) is the ratio of sales and the number of employees based on hours worked. The second measure of productivity ($LP2$) is the ratio of value added and employment. The control variables include dummy variables for each year and industrial activity at the two-letter level. The impact of firm size is controlled for by the log of firm's fixed assets or by dummy variables for company size according to the official classification. Dummy variables for each year are used to capture the impact of macroeconomic developments that influence the behaviour of all firms, such as business cycle conditions, trade liberalization, etc. Industrial dummy variables control for specific conditions at the industry level, such as market competition, use of similar technology, etc. Firm size is important, *inter alia*, because it affects company's ability of taking advantage of economies of scale.

After the assessment of exporter productivity premium, examining the causality link between productivity and exports follows. First, the *ex ante* exporter productivity premium hypothesis is tested. According to this hypothesis today's new exporters were more productive than today's non-exporters in the period a few years earlier when none of them exported. To test whether only more productive firms start exporting, the sample includes firms which did not export in the 2002-2007 period (non-exporters) and firms that started exporting (new exporters). The following model is estimated (relying on ISGEP, 2008):

$$(2) \ln LP_{it-1(2,3)} = \alpha + \beta EDUM_{it} + cCONTROL_{it-1(2,3)} + e_{it}$$

The control variable takes into account firm size as measured primarily by its assets. Depending on the year in which a firm started exporting (2004, 2005, 2006), the question is whether one, two or three years prior this there was a statistically significant difference in productivity between the new exporters and non-exporters.

The exporter *ex post* premium productivity hypothesis, indicating that exports encourage productivity growth, is tested by comparing productivity growth of new exporters and non-exporters one, two and three years after they started exporting. The empirical model is as follows (relying on ISGEP, 2008):

$$(3) \ln LP_{it+1(2,3)} - \ln LP_{it} = \alpha + \beta EDUM_{it} + cCONTROL_{it} + e_{it}$$

6 Data description

The main variables used in the econometric analysis are: exports, sales, value added, employment, assets and wages. As for sales, only current revenues from selling products, goods and services in domestic and foreign market are taken into account. They are deflated by a price index for industrial products at the division level of NACE. Financial revenues are excluded from the analysis because, as stated by Marić (2008), in some firms they may constitute a significant part of total income, while in others they may be negligible. In addition, current revenues better reflect the nature of the case study. The number of employees is based on hours worked instead of on the number of employees at the end of the period in order to exclude the possible influence of fluctuations of employees at the end of the year compared to the rest of the year, for example due to the nature of the business, as well as the effect of possible hiring more people with shorter working hours. The second measure of productivity is based on value added which is estimated by subtracting the value of energy costs and raw materials from sales. Value added is also deflated by prices of industrial products.

Table 5: Transition matrix

t	$t+1$	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	average
N	N	73,7	78,4	79,2	76,4	80,2	77,6
	E	26,3	21,6	20,8	23,6	19,8	22,4
E	N	18,0	16,9	15,5	15,1	16,2	16,3
	E	82,0	83,1	84,5	84,9	83,8	83,7

Notes: Values show percentages. N stands for non-exporter and E for exporter. Accordingly, the N-E link represents firms that enter export markets, E-N link represents firms that exit the export markets, I-I link represent firms that continue to export and N-N link represents firms that continue not to export.

Source: own calculations based on FINA database

As an introduction to the empirical analysis, the importance of firm entry to and exit from export markets and export persistence is discussed by using a transition matrix. For a given pair of years it shows: (a) out of the total number of firms that exported at time t , how many of them exported or did not export in time $t+1$, (b) out of the total number of firms that did not export at time t , how many of them exported or did not export in time $t+1$. The table shows the rates of entry into export markets and exit from export markets and the degree of persistence of export/non-export activities.

Data presented in the transition matrix indicates a high degree of persistence of firm behaviour. This is a key element in confirming the importance of sunk costs, but it is not enough to conclude that sunk costs of exporting are significant because the decision to export or not depends on many factors specific to a firm or sector to which it belongs to, requiring an in-depth structural analysis of this issue. On average about 78 percent of firms that did not export in previous year continued to do business only in domestic market. This percentage is higher for exporters: on average about 84 percent exporters continue to export in the following year.

In terms of firm size, the persistence of exporter status is mostly evident in large firms that to a large extent after starting to export continue to do so in the following year as well. Although the persistence of exporter status is quite high for small and medium firms as well, it is however noticeably lower than for large firms. In contrast, the persistence of non-exporter status is mostly significant for small firms and the least significant for large firms. It is also interesting to note that large firms rarely change their status from exporter to non-exporter but they more often become exporter from non-exporter.

Table 6: Transition matrix according to firm size, 2002-2007 average

<i>t</i>	<i>t+1</i>	Small	Medium	Big	Total
N	N	79,1	69,1	64,5	77,6
	E	20,9	30,9	35,5	22,4
E	N	21,2	11,9	5,3	16,3
	E	78,8	88,1	94,7	83,7

Note: Firm size is fixed in the initial year of doing business because otherwise transition rates could be greater than 100% since some companies move from one firm size to another. Size is determined according to the official classification.

Source: own calculations based on FINA database

7 Results

Regardless of whether the first or the second measure of labour productivity is used, whether fixed effects are taken into account or not and how firm size is controlled for (assets or dummy variable), results presented in Table 7 indicate that the exporter productivity premium in Croatia is statistically significant. These results are in line with expectations based on descriptive analysis of the data and empirical results of similar assessments for other countries. Numerous papers dealing with the assessment of the link between productivity and exports generally confirm the existence of the productivity premium of exporters and in this respect the results obtained here do not represent an exception. The estimated premium lies in the range between 14.8 and 4.2 per cent. Including firm fixed effects reduces the premium substantially: the average premium in models without controlling for fixed effects is 12.9 percent and in models with fixed effects it is 4.4 percent.

Table 7: Estimated exporter productivity premium

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
EDUM	0,1295	0,1088	0,1378	0,1081	0,0435	0,0415	0,0451	0,0419
Transf. coeff.*	13,8	11,5	14,8	11,4	4,4	4,2	4,6	4,3
t-statistic	9,6280	8,0557	9,3462	7,2877	4,2500	4,0850	3,7251	3,4794
P-value	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0002	0,0005
Notes:								
Labour productivity	LP1	LP1	LP2	LP2	LP1	LP1	LP2	LP2
Fixed effects	-	-	-	-	+	+	+	+
Size: assets	+	-	+	-	+	-	+	-
Size: dummy	-	+	-	+	-	+	-	+

Notes: The number of observations is 14,921. All models include year dummy variables and industry dummy variables as controls. * The transformed coefficient was calculated as $100 * (\exp(\beta) - 1)$. The first measure of productivity (*LPI*) is the ratio of real sales and employment; the second one (*LP2*) is the ratio of real value added and employment.

Source: own calculations

The results obtained do not differ significantly from similar studies for other countries, but suggest that the exporter premium in Croatia is somewhat lower than in other countries. For example, ISGEP (2008) reports that the average exporter productivity premium in 14 countries is 7 percent when individual fixed effects are controlled for or 22.4 percent if not controlled¹⁰.

¹⁰ The results are not fully comparable. Control variables used in ISGEP (2008) include employment and wages and the sample includes firms with more than 20 employees.

To check the robustness of the estimated aggregate exporter productivity premium, several additional regressions are estimated. The results are given in Table 8. In model 1 the sample includes only companies with more than 20 employees, in order to further reduce the possibility of including data of questionable quality as well as to ensure better comparability with the previously mentioned results from ISGEP (2008). In model 2 the sample excludes small exporters, defined as exporters whose export intensity is (a) less than 10% or (b) exporters whose value of exports is less than 100 thousand kunas. In model 3 the sample excludes occasional exporters.

Compared to the first estimates, only further exclusion of small firms results in the reduction of exporter premium. In contrast, although expected, exclusion of small exporters increases the estimated productivity premiums, regardless of whether the small exporters are defined according to their absolute or relative value of exports. In addition, the productivity premium of exporters is higher if occasional exporters are excluded from the sample.

Table 8: Robustness checks of estimated exporter productivity premium

	EDUM	Transf. coeff.*	t-statistic	P-value	Observations
Model 1	0,0249	2,5	1,8118	0,0701	9.092
Model 2a	0,0642	6,6	3,3738	0,0007	11.453
Model 2b	0,0702	7,3	5,5030	0,0000	13.785
Model 3	0,0533	5,5	2,8753	0,0040	11.672

Notes: The dependent variable is labour productivity defined as the ratio of sales and employment. Firm fixed effects are controlled for. Model 1 excludes all firms with fewer than 20 employees; model 2 excludes small exporters defined as those whose (a) export intensity is less than 10% or (b) whose absolute value of exports is less than 100 thousand kuna. Model 3 excludes the occasional exporters.

Source: own calculations

In addition to considering overall differences in the productivity of exporters and non-exporters, the exporter productivity premium is estimated at the level of individual groups of enterprises depending on their size, type of ownership, technology level of industry, manufacturing sector and exporter status (regular exporters, new exporters, ex exporters and occasional exporters). Main results are presented in Table 9.

According to firm size, estimated exporter productivity premium is statistically insignificant for medium and large firms, but positive and significant for small firms. This can be explained by the fact that fixed costs of entering export markets are probably more important for smaller than larger firms. Concerning the type of ownership, the estimated export premium has proved to be statistically significant only for privately owned enterprises, while for enterprises in state and mixed ownership it is statistically insignificant, which is probably due to the small number of observations. The same goes for the premium estimated according to technology level of industries they belong to. Namely, the estimated export premium is insignificant only for companies in high-technology sectors where the number of firms included in the sample is smallest. For other groups the exporter premium is positive and statistically significant. It is the highest for firms in medium-high technology sectors. The exporter premiums were also estimated at the level of individual manufacturing sectors but the results were divergent with a considerable number of statistically insignificant and several negative coefficients.

Table 9: Estimated exporter productivity premium according to structural features of firms

	Coefficient	Transf. coeff.*	t-statistic	p-value	Observations
Size					
Small	0,0455	4,7	4,0699	0,0000	10.220
Medium	0,0293	3,0	1,1015	0,2708	3.290
Blg	0,0592	6,1	1,1278	0,2597	1.411
Ownership					
State	0,0114	1,1	0,1477	0,8828	312
Private	0,0413	4,2	3,9387	0,0001	13.282
Mixed	0,0015	0,2	0,0311	0,9752	1.293
Technology intensity					
High-technology	-0,0263	-2,6	-0,4896	0,6248	430
Medium-high-technology	0,1205	12,8	2,9487	0,0032	2.046
Medium-low-technology	0,0436	4,5	2,4864	0,0129	5.449
Low-technology	0,0377	3,8	2,7126	0,0067	6.853
Exporter status					
Regular	0,0532	5,5	1,3203	0,1868	9.603
New	0,1306	14,0	4,4895	0,0000	5.283
Ex	-0,0361	-3,5	-1,1635	0,2447	4.884
Occasional	0,0371	3,8	3,0822	0,0021	7.298

Notes: The dependent variable is labour productivity defined as the ratio of sales and employment. Firm size is measured by their assets. Firm fixed-effects are controlled for.

Source: own calculations

Prior to considering *ex ante* and *ex post* productivity premiums it is interesting to look at the results of estimated exporter premiums according to exporter status. Notably, it seems that the exporter premium is not statistically significant when productivity of non-exporters and regular exporters is compared. The same goes for stopper exporters, i.e. firms that stopped exporting in the observed period, although the sign of estimated coefficient is negative as expected. In contrast, occasional exporters have a premium only slightly lower than the one estimated for aggregate data. The exporter premium is especially pronounced for new exporters and it is substantially higher than the aggregate estimate.

Unlike a general assessment of exporter premiums which used data available for all exporters and non-exporters in the manufacturing, the sample of exporters used for testing the *ex ante* premium includes only companies that began exporting in the observed period. Given that the whole analyzed period is only six years and that new exporters are defined as firms which did not export for at least two consecutive years and then began to export and have not stopped exporting in the remaining years (at least two consecutive years), it is understandable that the sample decreases significantly. This should be taken into account in the interpretation of the results.

Table 10: Comparison of productivity of non-exporters and new exporters one, two and three years prior to starting to export

Beginning year	Comparison year	Number of observations	Number of beginners	Estimated coefficient	Transf. coefficient	t-statistic	P-value
2004	2003	628	25	-0,0585	-5,7	-0,3905	0,6963
	2002	588	13	0,21139	23,5	1,0149	0,3105
2005	2004	597	19	0,2755	31,7	1,6176	0,1036
	2003	615	12	0,1381	14,8	0,6449	0,5192
2006	2002	586	11	0,2105	23,4	0,9279	0,3538
	2005	595	28	0,1158	12,3	0,8252	0,4096
	2004	601	23	0,1499	16,2	0,9482	0,3434
	2003	615	12	-0,1664	-15,3	-0,7681	0,4427

Notes: The dependent variable is labour productivity defined as the ratio of sales and employment. Firm size is measured by their assets.

Source: own calculations

The results show that the productivity premium of new exporters is not statistically significant in any of estimated models; moreover it is in some cases even negative¹¹. This may be due to a fairly small number of new exporters used in the evaluation. A similar problem is present in the estimation for other countries as well¹². To circumvent this problem productivity premium of new exporters is estimated in the beginning year of exports when the number of new exporters is substantially higher. The results shown in Table 11 indicate that in the year the firm starts to export, with the exception of 2006, exporters were more than 20 percent more productive than non-exporters.

Table 11: New exporter productivity premium in the beginning year of exports

Beginning year	Number of observations	Number of beginners	Estimated coefficient	Transf. coefficient	t-statistic	P-value
2004	680	102	0,2511	28,5	3,1075	0,0020
2005	650	83	0,2071	23,0	2,3876	0,0172
2006	1012	202	0,0264	2,7	0,4763	0,6340

Notes: The dependent variable is labour productivity defined as the ratio of sales and employment. Firm size is measured by their assets.

Source: own calculations

The *ex post* exporter productivity premium is tested by comparing the productivity growth of new exporters and non-exporters one, two and three years after they began exporting. Several years are taken into account because the positive effects of starting to export may not be visible immediately. The results of estimated cross-sectional regressions (see Table 12) are ambiguous: from a total of six regressions only two coefficients are statistically significant and two are negative. However, since these results suggest that possible positive effects of starting to export may be present but not evident due to the small number of new exporters, this issue is further examined, first by repeating cross-sectional regressions where the dependent variable is the productivity level (instead of productivity growth) and then by estimating regressions on panel data (both for productivity growth and productivity level).

¹¹ New exporter productivity premium is not statistically significant when equations are estimated on panel data either.

¹² Median number of new exporters in estimated regressions is 12 and median share of new exporters in total number of observations is 3. ISGEP (2008) states that the same indicators for, for example, Slovenia are 4 and 9, Austria 16 and 3, for Ireland 18 and 8, for Spain 16 and 11, for Italy 144 and 11, for France 173 and 12 and for West Germany 187 and 3. Statistically significant results were obtained only for countries with sufficiently large number of new exporters.

Table 12: Comparison of productivity growth of new exporters and non-exporters one, two and three years after starting to export

Beginning year	Comparison year	Number of observations	Estimated coefficient	Transf. coefficient	t-statistic	P-value
2004	2005	1170	0,0559	5,7	2,5888	0,0098
	2006	509	0,1256	13,4	3,2847	0,0011
	2007	434	0,0467	4,8	1,0617	0,2889
2005	2006	1320	-0,0029	-0,3	-0,1262	0,8996
	2007	483	-0,0121	-1,2	-0,2817	0,7783

Notes: The dependent variable is labour productivity defined as the ratio of sales and employment. Firm size is measured by their assets. Source: own calculations

The positive *ex post* exporter productivity premium is further confirmed by comparing productivity levels of new exporters and non-exporters one, two and three years after they started exporting (see Table 13). Most of the estimated coefficients are statistically significant and they all have the expected sign. It should also be noted that the exporter premium is in each given year substantially higher for new exporters than the overall exporter productivity premium, which also included regular and occasional exporters.

Table 13: Comparison of productivity levels of new exporters and non-exporters one, two and three years after starting to export

Beginning year	Comparison year	Number of observations	Estimated coefficient	Transf. coefficient	t-statistic	P-value
2004	2005	673	0,3322	39,4	4,2857	0,0000
	2006	916	0,3101	36,4	4,3695	0,0000
	2007	1021	0,2428	27,5	3,3847	0,0007
2005	2006	897	0,1563	16,9	1,9803	0,0480
	2007	1002	0,1027	10,8	1,2930	0,1963
2006	2007	1121	0,0691	7,2	1,2784	0,2014

Notes: The dependent variable is labour productivity defined as the ratio of sales and employment. Firm size is measured by their assets.

Source: own calculations

Testing the *ex post* exporter premiums on panel data leads to similar conclusions, both for the productivity growth and for the level of productivity. After starting to export productivity of new exporters grew faster compared to non-exporters. The difference in productivity growth is more pronounced in the second year after starting to export than in the first year. In addition, one year and two years after starting to export new exporters had substantially higher levels of productivity compared to non-exporters.

Table 14: Comparison of productivity growth and productivity levels of new exporters and non-exporters one and two years after starting to export, panel data

	Comparison year	Number of observations	Estimated coefficient	Transf. coefficient	t-statistic	P-value
LP1 growth	t+1	2206	0,0462	4,7	3,2421	0,0012
	t+2	992	0,0670	6,9	2,3519	0,0189
LP1 level	t+1	2691	0,1584	17,2	4,1208	0,0000
	t+2	1918	0,2184	24,4	4,1239	0,0000

Notes: The dependent variable is labour productivity defined as the ratio of sales and employment. Firm size is measured by their assets.

Source: own calculations

8 Concluding remarks

Microeconomic analysis of the export activities of Croatian manufacturing firms shows small firms are dominant among exporters. However, the bulk of total exports is achieved by large firms whose export intensity is above-average. Compared to non-exporting firms, exporters are on average significantly larger: they have greater assets and capital, employ more people, undertake more investment, make more sales on the domestic market, earn higher profits, import more and pay higher salaries. Croatian exports are concentrated in a small number of large companies, which is primarily the result of the within-sector concentration in line with the new new trade theory based on the firm heterogeneity and to a lesser degree the result of sectoral specialization according to traditional trade theory. The concentration of exports is more pronounced compared to employment and sales.

Estimation results on the exporter productivity premium are quite robust, confirming that exporters are more productive than non-exporters, even after controlling for factors such as firm size and firm-specific fixed effects. After controlling for fixed effects, exporters are on average only about 4 percent more productive than non-exporters. This advantage is somewhat higher when small exporters and occasional exporters are excluded from the sample.

Evidence on the self-selection and learning-by-exporting hypotheses are ambiguous. On the one hand, it can not be confirmed that new exporters are more productive than non-exporters before they start to export. In contrast, it seems that after they start exporting new exporters achieve faster productivity growth than non-exporters, indicating possible positive spillover effects of exports on the productivity of domestic firms.

Finally, since this is the first study analyzing the link between productivity and exports in Croatia, there are many possibilities for its improvement and further research. Also, the first results should be taken with a certain degree of caution. Some possibilities for further research include: analysis of a longer time period, taking into account import activities of companies and their foreign direct investment, improving methods of hypotheses-testing (e.g., the use of the matching method for the evaluation of the *ex-post* export premium), estimation of total factor productivity at the firm level, comparison of results obtained for manufacturing with those of the services sector, etc.

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