



Analysis and Evaluation of Employment in the Maritime Transport System of the Republic of Croatia

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ARTICLE INFO

Received March 06, 2019
Revised from March 23, 2019
Accepted May 20, 2019
Available online June 15, 2019

JEL classification:

J21, C22

DOI: 10.14254/1800-5845/2019.15-2.14

Keywords:

maritime transport,
employment,
regression and correlation analysis,
Croatia

ABSTRACT

The basic objective of this study is to examine the state of employment and employment trends in the maritime transport system of the European Union and the Republic of Croatia. The purpose of this article is to estimate the number of employed in the maritime transport system of the Republic of Croatia by 2025. It will look into interdependence of the number of employees in the national maritime transport system and the number of passenger and cargo ships, static and dynamic indicators of labour and the movement of GDP. The method of descriptive statistics and statistical methods of correlation and regression analysis were used to examine norms and regularities in relations between the mentioned stochastic phenomena. The obtained findings contribute to a scientifically based perspective regarding direct contribution of maritime transport to total employment within the transport sector and the national economy, as well as the factors determining the number of employed persons in maritime transport. The main finding of this paper points to the fact that the number of employees in the national maritime transport system is positively and statistically significantly correlated with labor market indicators in freight transport.

INTRODUCTION

Europe is one of the leading maritime centres in the world: with 329 key seaports along its coastline, and controlling around one third of the world's merchant fleet. Ports are vital gateways, linking European transport corridors to the rest of the world. As 75% of European external trade transits

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through EU ports, the shipping sector plays a major role in connecting the European market with its trade partners (<https://ec.europa.eu/transport>). Sea transport has always been the dominant support of global trade (Rodrigue, 2017). The global maritime shipping industry is serviced by about 100,000 commercial vessels.

With a dynamic short-sea shipping sector, the European maritime sector contributes to the development of a competitive and resource efficient transport system in the EU. Today, shipping accounts for around a third of intra-EU exchanges, and annually 400 million passengers embark and disembark at EU ports (<https://ec.europa.eu/transport>). Overall, maritime industries are an important source of employment and income for the European economy. On a global supply estimated worldwide at 1 371 000 seafarers, EU plus Norway represents about 18,50% of the total workforce, 23% of the officers and near 15% of the ratings (European Commission, 2011). Although European Union is an entity for employment, there is a strong imbalance of situation for seafarers between Western and Eastern Member States. From ISF/BIMCO data, the total number of seafarers in Western Europe countries (EU plus Norway) is 146 231 (81 652 officers and 64 579 ratings) and the number from East Europe 107 988 (62 315 officers and 45 673 ratings).

The total number of seafarers in Croatia is 18 658 (11 704 officers and 6 954 ratings). The country was ranked eighth in the number of officers and sixth in ratings within the EU. Currently, there are about 22 thousand seafarers in Croatia (www.mmpi.hr). Croatian seafarers are trained in eight naval maritime schools, four maritime university colleges and 22 specialized maritime colleges. Thus, the educational system of the Republic of Croatia directly caters the global maritime labour market where Croatian seaman is an "export product" in extreme demand. Croatian seafarers are still competitive on the world seafarer market with their education and training, competence and expertise, as well as with labor price (Marinov, Maglicic and Buksa, 2005).

In 2016 there were only 3 429 people employed in the Croatian national maritime transport system, or 4.4 times less than during the pre-transitional period. Left without large shipping companies such as Jugolinija/Croatia Line and Lošinj Navigation, the Croatian maritime transport system became wholly dependent on human capital, and that capital needs to be put to service as soon as possible and to the fullest extent to affirm Croatia as a maritime country.

Research results in this study are organized in five logically related parts. After introduction, the problem of research is presented in the second part, followed by analysis of employment in the maritime transport of the Republic of Croatia and EU-28+Norway. The third part encompasses secondary data that was used as the subject of analysis, and the presentation of scientific methodology used. After the results of the research and discussion in the fourth part of the study, the conclusion is reached in the fifth.

1. THEORETICAL BACKGROUND AND RESEARCH PROBLEM

The Republic of Croatia has entered a vicious circle of unemployment and dislocation (Jurčić, 2017). The trend of emigration is increasing, which turns human capital into scarce resource and limiting factor of domestic production growth. The number of employed persons in the Republic of Croatia in 2015 has decreased by about 200,000 compared to 2008 (Pupavac, 2017). In the same period, there was also a negative relation of immigration with respect to emigration. The average number of emigrants in 2015 and 2016 has exceeded 30,000.

Negative economic trends had a negative effect on Croatian transport sector. Reduced volume of transport operations measured by static and dynamic indicators, as a result of economic crisis, negatively affected employment trends in the transport sector as well. The average number of employees in the transport sector in 2014 decreased by 12.25% compared to 2008. In comparison, the total employment decreased by 13.7% in the same period, and the real gross domestic product by 12.02% (Pupavac and Baković, 2017). The number of employees in the maritime transport system of the Republic of Croatia decreased by as much as 21.1% in the same period. This relatively large

decrease in the number of employees in the maritime transport system of the Republic of Croatia is a consequence of problems in the national economic system, but also of the great global financial crisis and the difficult period in world shipping.

Negative economic trends and reduction in real income and purchasing power had a negative effect on Croatian transport sector. Decrease in passenger transportation in all forms of transport is a continuation of the negative trend started in 2009. In 2014, there were 38.7% less passengers carried compared to 2008. An increase in the number of passengers carried was recorded only by maritime and coastal transport, which in 2014 carried 1.3 percent more passengers than in 2008. This shift is a result of increased number of tourist arrivals and the fact that maritime and coastal transport cannot be replaced by other types of transport and are therefore less sensitive to change. In addition to passengers, in 2014 there was also a decrease in the amount of goods carried (36,4%) compared to 2008. The amount of transported goods has decreased in all types of transportation. The biggest drop of 40.3% was registered in road transport, the most important mode of transport in goods transportation, but also the most important when it comes to employment. Maritime transport, as the second greatest goods transporter, had 34% lower volume of goods carried than in 2008. The decrease in goods transport is mostly related to negative trends in processing industry and trade (Pupavac and Draskovic, 2015).

Reduced volume of both passenger and goods transport as a consequence of economic crisis has negatively affected employment trends in the transport sector, thus confirming that the demand for transport services is a derived demand, i.e. economic growth induces higher demand for transport services and vice versa (Pupavac & Zelenika, 2004). In the period from 2008 to 2014 there were 9 944 jobs lost within the transport system of the Republic of Croatia, of which 873 or 8.78% within maritime traffic (cf. table 1).

Table 1. Employees in Croatian transport system and maritime traffic, 2008-2014.

<i>Year</i>	<i>Maritime traffic</i>	<i>Index</i>	<i>Croatian transport system</i>	<i>Index</i>
2008.	4154	100	81220	100
2009.	3862	92,97	80733	99,4
2010.	3870	93,16	76486	94,2
2011.	3830	92,20	75827	93,4
2012.	4018	96,72	76085	93,7
2013.	3397	81,77	74882	92,2
2014.	3281	78,98	71276	87,7

Source: The Statistical Yearbook of the Republic of Croatia 2015, (online data at www.dzs.hr , PC-Axis) (access: 5/12/2018)

Based on data from Table 1, it is evident that the number of employees in Croatian transport system decreased by 12.3% in 2014 compared to 2008, while the number of employees in maritime traffic decreased by 21.02%. The relative share of the number of maritime traffic employees in the total number of people employed in transport has been in steady decline for the last three decades. For example, in 1988 it was 11.85%, in 1998 it was 7.05%, in 2008 it was 5.11% and in 2014 it was only 4.6%. This information is particularly worrying given the fact that the number of employees in Croatian transport system has shown a tendency of steady decline since 1987 (see Figure 1).

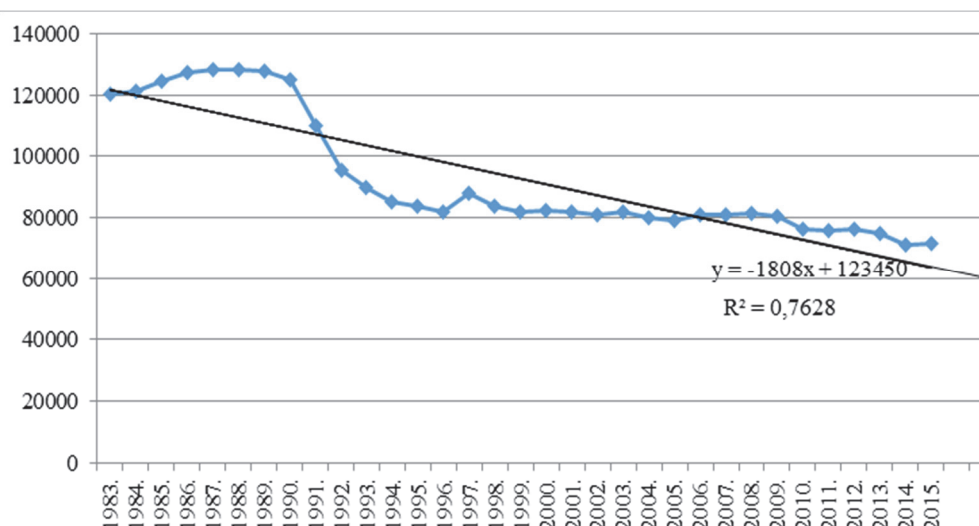


Figure 1. Employment trends in transport system of the Republic of Croatia, 1983-2015.

Source: The Statistical Yearbook of the Republic of Croatia 2015, (online data at www.dzs.hr, PC-Axis) (accessed: 5/12/2018)

In 1987, Croatian transport system employed a record-breaking 128 400 workers (Pupavac, 2009), while the number of maritime traffic employees was 15,000. This means that there was one maritime traffic worker per 8,56 employees in the transport system. In the forthcoming period, this ratio will increasingly deteriorate to the detriment of maritime traffic employees (see Fig. 2).

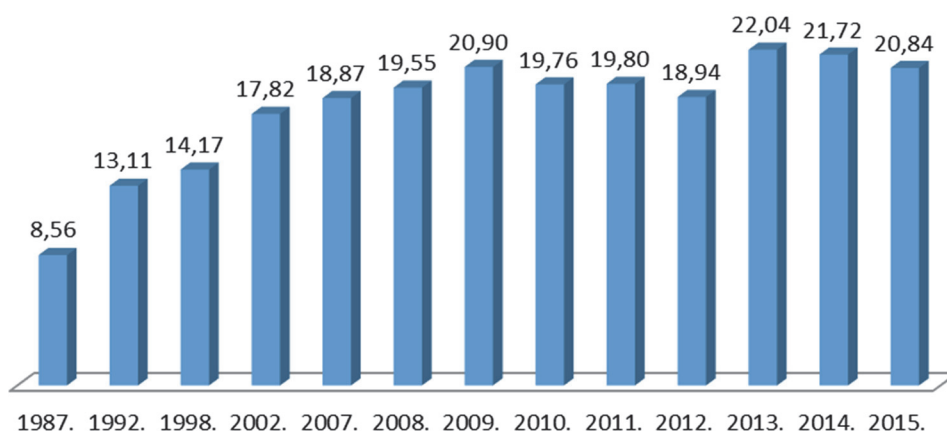


Figure 2. Maritime traffic employees and transport system employees ratio, 1987-2015.

Source: authors' calculation

The EU-28 maritime transport system in 2014 employed 181 017 workers or 1.7% of the total number of employees in the EU-28 transport system. Only five European Union countries - Czechoslovakia, Luxembourg, Hungary, Austria and Slovakia - do not keep records of the number of employees in maritime traffic, since these countries do not have sea access anyway. Below is a brief overview of employment in the EU-23 maritime traffic based on the method of descriptive statistics (cf. table 2).

Table 2. Descriptive statistics on employment in maritime transport in EU-23, 2014

<i>Column1</i>	
Mean	7,87
Standard Error	2,15
Median	2,14
Standard Deviation	10,31
Sample Variance	106,22
Kurtosis	6,44
Skewness	2,24
Range	44,31
Minimum	0,17
Maximum	44,49
Sum	181,00
Count	23,00
Confidence Level(95,0%)	4,46

Based on data from Table 2, it is evident that average employment per member country is 7,870 people. Large variation range and standard deviation (SD = 10.31) show great dispersions. The largest number of people is employed by the maritime transport system of Italy - 44 490, while the least people are employed by Slovenia - 174. Italy is followed by Denmark with 21 292 employees in the maritime system, Germany with 16 642, UK with 16 130 and Greece with 13 997 . Thus according to the number of maritime transport workers, the Republic of Croatia is below the EU-23 average.

Employment trends within the Croatian maritime transport system over the past three decades is shown in Figure 3.

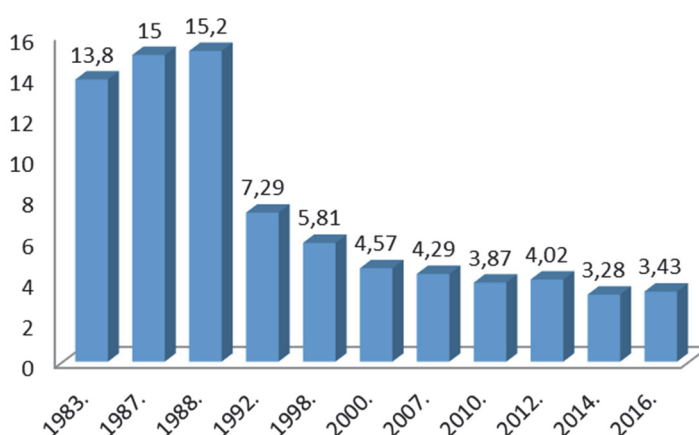


Figure 3. Employment trends in maritime transport system of the Republic of Croatia (000)

Source: prepared by the authors according to Statistical Yearbook of the Republic of Croatia, different years

However, Croatia is among the top EU countries if the share of seafarers in the total population is observed (cf. Figure 4).

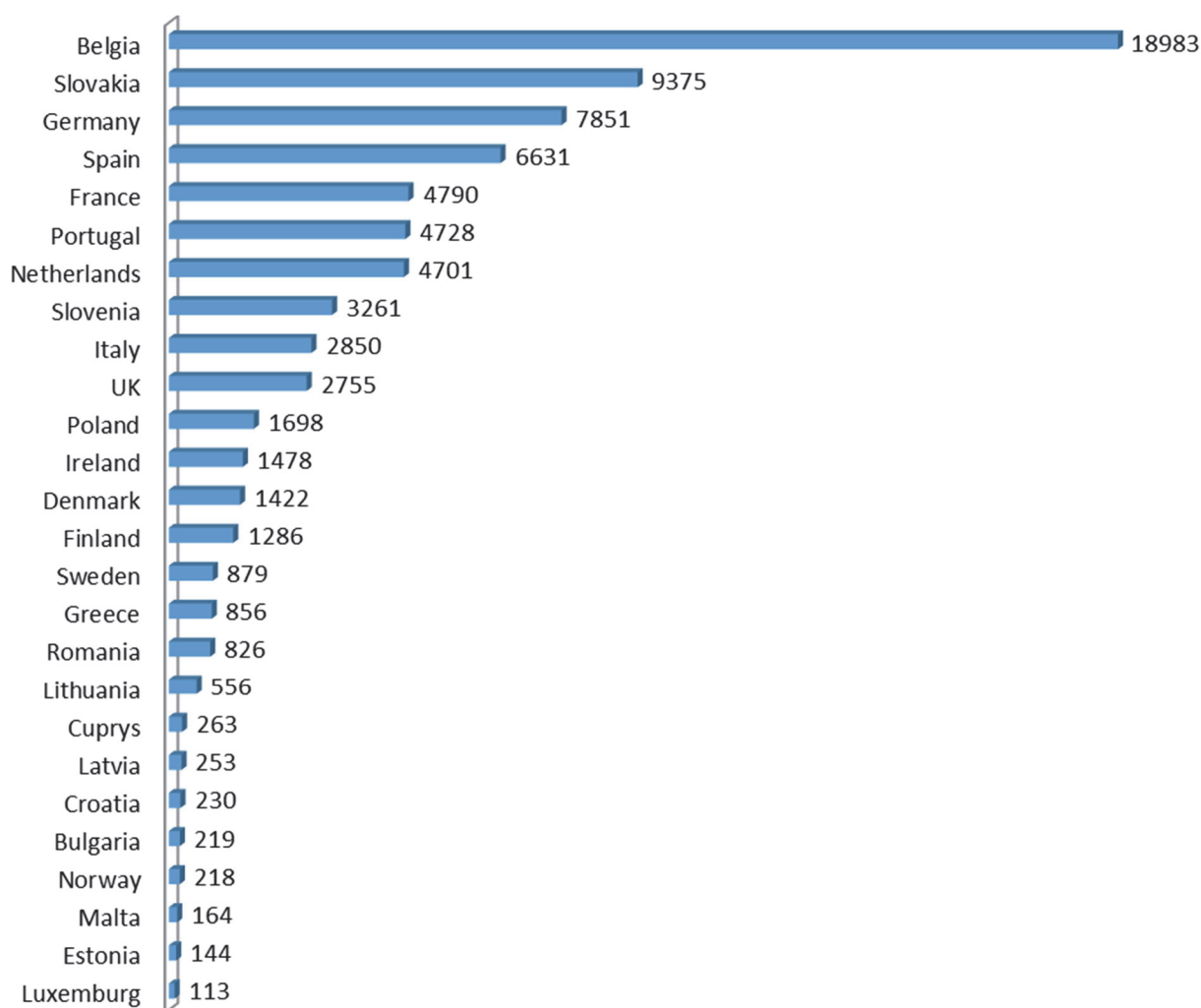


Figure 4. Number of inhabitants per one seafarer in EU countries.

Source: prepared by the authors

Based on Figure 4, it is evident that there are only 253 inhabitants per one seafarer in Croatia, whereas, for example, in Belgium, there are 18 983. In the observed EU-23 countries there is an average of one seafarer per 1 767 inhabitants. When the share of seafarers in the total number of inhabitants is considered, Luxembourg is the leading country with only 113 inhabitants per one seafarer, although it has no sea access. However, in 2010, there were 106 ships sailing under their flag. During the same year, the largest number of ships was sailing under the flag of Malta - 1552, then of Norway with 1381 ships, Greece with 1305, Italy with 990 and United Kingdom with 944. Accordingly, based on the data from the table 3 we made the correlation analysis between the number of seafarers in individual EU countries, the gross domestic product per capita and the number of vessels flying their flag (cf. table 4).

Table 3. Number of seafarers, GDP/p.c. and number of ships, EU-25+Norway

	Seafarers	GDP/p.c.	Number of ships
Belgia	590	32700	99
Bulgaria	33269	4800	67
Cuprys	3421	21000	855
Denmark	3938	42600	409
Estonia	9000	10700	35
Finland	4200	33300	176
France	13696	29900	299
Germany	10253	30500	663
Greece	12963	19600	1305
Ireland	3112	35000	49
Italy	20950	25700	990
Latvia	7892	8600	33
Lithuania	5395	8900	58
Luxemburg	4436	78600	106
Malta	2436	15200	1552
Netherlands	3574	35400	827
Norway	23382	77500	1381
Poland	22669	9200	72
Portugal	2221	16200	64
Romania	24343	5800	34
Slovakia	576	12100	0
Slovenia	644	17400	0
Spain	7043	22800	116
Sweden	10923	37300	356
UK	231193	27500	944
Croatia	18658	10152	194

Source: prepared by the authors according to European Commission (2011), Study on EU Seafarers Employment and Regional GDP per capita in the EU in 2010: eight capital regions in the ten first places

Table 4. Correlations between the number of seafarers, GDP/p.c. and number of ships, EU-25+Norway

<i>Correlations (Spreadsheet1) Marked correlations are significant at $p < ,05000$ N=26 (Casewise deletion of missing data)</i>					
	Means	Std.Dev.	S	GDP/p.c.	NS
Seafarers	18491,42	44275,49	1,000000	-0,005885	0,239260
GDP/p.c.	25709,69	18869,66	-0,005885	1,000000	0,293969
Number of Ships	410,92	484,31	0,239260	0,293969	1,000000

Based on data from Table 4, there is evidently no correlation between the number of seafarers in certain European countries and their GDP / p.c. ($r = -0.005$; $p < 0.05$), i.e. there is a poor correlation between the number of seafarers in certain European countries and the number of ships under their flag ($r = 0.29$, $p < 0.05$). Accordingly, it seems more appropriate to investigate dependence of the number of seafarers on GDP trends individually at the national level.

2. DATA AND RESEARCH METHODOLOGY

Data about employment in maritime transport (NE), waterway fleet in seawater and coastal transport (passenger ships-PS and cargo ships-CS), seawater and coastal transport of passenger (passenger carried-PC and passenger miles-PM) and goods (goods carried-GC and tonne-miles-TM) are taken from the Croatian Bureau of Statistics, while data regarding the GDP in constant prices is the result of author's calculations (cf. table 5).

Table 5. Movement of employment in sea transport, passenger ships, cargo ships, passengers carried, passenger miles, goods carried, tonne-miles and GDP

	NE	PM in mln	PS	TM in mln	CS	PC in 000	GC in 000t	GDP Constant price in HRK
2007	4290	265	91	74230	67	12723	32420	323522,76
2008	4154	265	88	77199	68	12861	30768	331155,41
2009	3862	263	88	74160	64	12550	31371	308305,68
2010	3870	266	85	87878	68	12506	31948	301214,65
2011	3830	315	80	83929	67	12926	30348	301214,65
2012	4018	325	91	67861	64	12474	25636	295190,36
2013	3397	331	85	68727	46	12770	24744	292238,45
2014	3281	335	84	58158	45	13029	20335	290777,26
2015	3427	337	84	65995	43	13082	21376	295430,00
2016	3429	352	86	61071	41	13525	20951	303997,47

Source: The Statistical Yearbook of the Republic of Croatia 2017.

In order to determine the factors that directly and essentially influence employment in the national maritime transport system, first a correlation analysis will be carried out. After that, with the help of regression analysis, it will be attempted to formulate a suitable mathematical model that can be used for objective estimate of the number of employees in the maritime transport system by 2025.

In order to make an objective forecast regarding the number of employees in maritime transport in Croatia, a theoretical model should be defined first. This study investigates the dependance of the number of employees in maritime transport (NE) as the dependent variable and passenger ships, cargo ships, passengers carried, passenger miles, goods carried, tonne-miles and gross domestic product (GDP) as independent variables.

Accordingly, a model to estimate the number of employees in maritime transport can be written as a function

$$NE = f(PS, CS, PC, GC, PM, TM, GDP) \quad (1)$$

Supposing that the number of employees in maritime transport depends on passenger ships,

cargo ships, passengers carried, passenger miles, goods carried, tonne-miles and gross domestic product, its linear form would be as following:

$$NE = b_0 + b_1PS + b_2CS + b_3PC + b_4GC + b_5PM + b_6TM + b_7GDP \quad (2)$$

b_i – ($i=0,1,2,3,4,5,6,7$) = model parameters.

3. RESEARCH RESULTS AND DISCUSSION

Based on data given in Table 5, correlation analysis was conducted (cf. Table 6). It shows a strong and positive interdependence between the number of employed in the maritime transport and number of cargo ships ($r=0,90$; $p<0,05$), goods carried ($r=0,84$; $p<0,05$), GDP ($r=0,75$; $p<0,05$) and strong and negative interdependence between the number of employed in maritime transport and passenger miles ($r=-0,78$; $r<0,05$). Connections between the number of employees in maritime traffic and the number of passenger ships ($r = 0.59$, $r < 0.05$) and realized tonne miles ($r = 0.61$; $r < 0.05$) are positive and of medium strength, and the one between the number of employed in maritime transport and the number of passengers carried ($r = -0.57$; $r < 0.05$) is negative and of medium strength. The existence of a negative correlation between the number of employees in maritime transport and indicators of labour in passenger traffic can be explained by an insufficient utilization of the existing capacities, especially off season.

Table 6. Interdependence of the number of employed in maritime transport and passenger ships, cargo ships, passengers carried, passenger miles, goods carried, tonne-miles and gross domestic product

Marked correlations are significant at $p < ,05000$ $N=10$ (Casewise deletion of missing data)										
	Means	Std.Dev.	PM	PS	TM	CS	PC	GC	GDP	NE
PM	305,4	36,20	1,000000	-0,394281	-0,705984	-0,823708	0,637303	-0,911112	-0,715065	-0,783274
PS	86,2	3,39	-0,394281	1,000000	-0,135498	0,311583	-0,403330	0,255385	0,466138	0,596145
TM	71920,8	9463,18	-0,705984	-0,135498	1,000000	0,815831	-0,546044	0,870327	0,373536	0,614622
CS	57,3	11,81	-0,823708	0,311583	0,815831	1,000000	-0,712282	0,926820	0,569298	0,903897
PC	12844,6	319,61	0,637303	-0,403330	-0,546044	-0,712282	1,000000	-0,656556	-0,072981	-0,574450
GC	26989,7	4921,19	-0,911112	0,255385	0,870327	0,926820	-0,656556	1,000000	0,638232	0,842620
GDP	304304,7	13399,47	-0,715065	0,466138	0,373536	0,569298	-0,072981	0,638232	1,000000	0,759329
NE	3755,8	351,44	-0,783274	0,596145	0,614622	0,903897	-0,574450	0,842620	0,759329	1,000000

Since there was a strong or relatively strong interdependence between the number of employed in maritime transport and independent variables, regression analysis was also conducted using data from Table 5. Calculations conducted to determine the value of parameters of the function in the form (2) yielded no conclusive regression models. After many trial and errors procedures, a simpler model has been developed to estimate the future number of employees in the maritime transport of the Republic of Croatia.

$$NE = f(CS) \quad (3)$$

$$NE = f(GC) \quad (4)$$

Regression analysis between the number of employees in maritime transport and number of cargo ships (CS) and goods carried (GC) has resulted with the following models of linear regression:

$$NE = 2215,045 + 26,889CS \quad (R=0,90; F(1,8)=35,723; p<0,01) \quad (5)$$

$$NE = 2131,707 + 0,060GC \quad (R=0,84; F(1,8)=19,587; p<0,01) \quad (6)$$

As there is a positive and firm link between the number of cargo ships and tonnes of goods carried ($r = 0.92$, $p < 0.05$), it seems more appropriate to choose only one model for predicting the number of employees in the national maritime system. This is also supported by the fact that between 2007 and 2016 the number of ships in freight maritime transport decreased by 38.8%, while freight maritime transport measured in tonnes of goods carried decreased by 35.4%.

We have decided to relate the number of employees in maritime transport to tonnes of goods carried, so in order to establish the most accurate trends, the following is an overview of tonnes of goods carried in the Republic of Croatia from 1996 to 2016 (cf. Fig. 5).

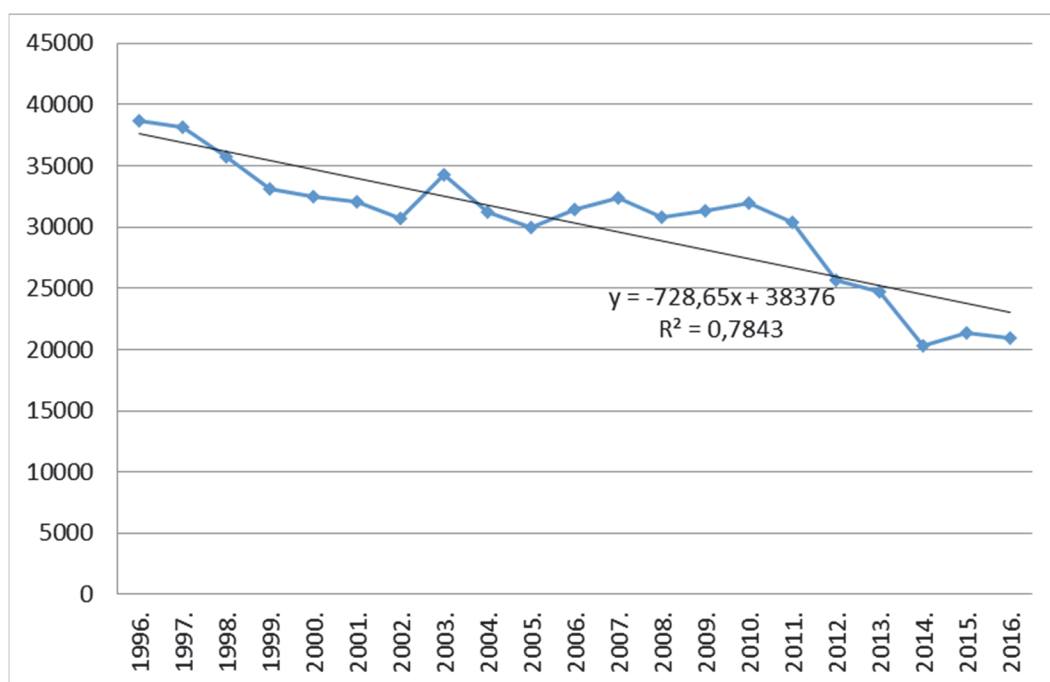


Figure 5. Goods carried in sea water and coastal transport (000t).

If the observed negative trend were to continue in the future, the number of transported tonnes of goods in maritime transport in 2025 would be only 16.5 million tonnes, or 21.07% less than in 2016. Such a reduction in the volume of cargo in maritime transport would result in the loss of another 303 jobs, i.e. a significant reduction of employment in maritime transport by 8.83% compared to 2016 (cf. table 6).

Table 7. Pessimistic estimates for employment in the maritime transport of the Republic of Croatia 2025

<i>Predicting Values for variable: NE</i>			
	<i>b-Weight</i>	<i>Value</i>	<i>b-Weight-*Value</i>
G	0,60175	16536,40	995,070
Intercept			2131,707
Predicted			3126,777
-95,0%CL			2767,826
+95%CL			3485,729

However, as the Croatian economy shows signs of recovery, i.e. positive growth rates have been achieved since 2015, it is expected that the observed trend in the maritime transport of goods will be reversed. The Strategy of the Transport Development of the Republic of Croatia 2017-2030 seems to support this. It defines the following specific objectives for maritime transport (Strategy, 197):

- To encourage development and enhance the competitiveness of the port of Rijeka as the main Croatian seaport;
 - To reduce the impact of maritime transport on the environment (fleet development, prevention and mitigation measures for pollution by naval facilities, environmental protection);
 - To increase the distribution of freight transport on oversea Adriatic and coastal routes in favour of maritime transport,
 - To increase reliability of maritime transport (public transport and supply chains) in aggravating weather conditions;
 - To improve the efficiency and cost-effectiveness of the maritime transport system;
 - To improve maritime transport security,
 - To improve the integration of ports into the local transport system (passenger and freight).
- According to defined goals and planned measures towards achieving them, it is expected that all indicators of labour in maritime transport will be increased.

The initial assumption for predicting the number of employees in the national maritime transport system is that by 2025, tonnes of goods carried in maritime transport will reach the average level of tonnes of goods carried for the period from 1996 to 2016 (cf. Table 8).

Table 8. Descriptive statistics for goods carried, 1996-2016

Mean	30361,24
Standard Error	1114,043
Median	31371
Standard Deviation	5105,188
Sample Variance	26062948
Kurtosis	0,013715
Skewness	-0,64488
Range	18309
Minimum	20335
Maximum	38644
Sum	637586
Count	21

If this estimate would have been realized, it would result in an increase in the number of employed in the maritime transport system for around 530 people (cf. table 9).

Table 9. Optimistic estimates for employment in the maritime transport of the Republic of Croatia in 2025

<i>Predicting Values for variable: NE</i>			
	<i>b-Weight</i>	<i>Value</i>	<i>b-Weight-</i>
<i>*Value</i>			
G	0,60175	30361,40	1826,983
Intercept			2131,707
Predicted			3958,691
-95,0%CL			3778,129
+95%CL			4139,252

There is a 95% reliability that the number of employees in Croatian maritime transport in 2025 would move within the range of 3778 - 4139 employees.

CONCLUSION

The main finding of this study is that the number of people employed in the maritime transport in the Republic of Croatia is steadily falling, and so the maritime transport seems to be heading in the same direction as the entire transport system where some 57,000 jobs were lost in the last three decades. Maritime transport has lost 11.7 thousand workplaces in the past three decades, or 20.6% of total workplaces in transport. The ratio between the total number of those employed in transport and the number of employed in maritime transport is steadily worsening to the detriment of maritime transport. The Republic of Croatia is below the EU average considering the number of maritime transport workers. Among the EU countries with records of employment in maritime transport, Italy has the largest number of employees, and Slovenia the smallest. However, if the number of seafarers is observed, then the situation is significantly different. With one seafarer per 263 inhabitants, the Republic of Croatia is at the very top of the EU. As for the number of seafarers in individual EU countries and their GDP/p.c., no statistically significant relationship was established. Such analyzes should better be conducted at individual national levels.

The correlation analysis between employment trends in Croatian maritime traffic on one hand and GDP trends, the number of passenger and cargo ships and the static and dynamic indicators of transport work for the period 2007-2016 on the other hand, confirmed the existence of a solid and positive relation only between employment trends in maritime transport and the number of cargo ships, goods carried and GDP. To estimate the number of employees in the maritime transport system in 2025, a simple linear regression model was chosen where the number of employees in the maritime transport system is related to tonnes of goods carried. Further continuation of the observed negative trends will result in reduction in maritime transport employment.

Since this scenario is unrealistic for a country that is so maritime inclined, the starting point for this study is a scientifically based assumption that the observed trend would be reversed, and that tonnes of goods carried in maritime transport of the Republic of Croatia by 2025 will reach at least the average tonnes of goods carried for the period from 1996 to 2016. In this case, the number of employed in the maritime transport system of the Republic of Croatia by 2025 would increase by 15.4% compared to 2016. In support of this estimate are the following facts: the end of a difficult

period in world shipping, the recovery of Croatian economy, and the adoption of the Transport Development Strategy of the Republic of Croatia for the period 2017-2030.

The main limitation of this study stems from the fact that employment in maritime transport is seen as a dependent variable of only one independent variable - goods carried. In future researches the model for estimating the number of employees in maritime transport should include the greater number of variables.

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