

The Degree of Wage Differential as an Indicator of the Balance Between Demand and Labour Supply

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ABSTRACT: The purpose of the article is to use the Gini index to indicate supply gaps in the labour market at sea. In order to determine the size of imbalance in the labour market at sea, a measure of concentration (unevenness) of distribution of a random variable was used. To determine in which positions the largest deficit of employees occurs (and probably will occur in future), positions from the deck and the engine room were selected, both among officers and ratings. Wages received on dry ships and on tankers were analysed separately. The next step was to select nations that to the greatest extent join crews of sea-going vessels (China, Croatia, India, Latvia, Philippines, Poland, Romania, Russia, Ukraine, the United Kingdom). First, the GDP per capita was compared for individual economies, from which seafarers were selected for the analysis. Then, salary levels were compared for each selected position. Differences in the GDP per capita calculated using the Gini coefficient were in line with differences in positions among ratings - mostly among cooks, ordinary seamen, wipers and messmen, regardless in which ship (dry or tanker) they were employed. Among the positions on which nationality had little impact on the amount of remuneration were: chief engineer on tankers and on bulk carriers: master, chief officer and 2nd engineer. Knowledge of the level of market imbalance and market trends may be helpful for crew departments/ crew agencies, while developing a policy of hiring people to work at sea. Additionally, it may indicate areas in which education and training of seafarers should be activated.

1 INTRODUCTION

The labour market at sea is one of the few examples of the market with the structure and principles of functioning similar to the theoretical model of perfect competition. This is possible due to elimination of factors that, to a greater or lesser extent, limit access to the market of employees and employers. In the case of seafarers, their place of residence and nationality do not limit employment opportunities on a ship with regard to the nationality of the employer, the place of registration of a ship or the area, where the ship is operating. This is a result of the lack of barriers to provision of maritime labour services, the lack of

barriers to access seafarers, more effective recruitment methods, uniform requirements for knowledge and skills of crew members (STCW), which eliminated diversity in the quality of education (Skrzyszewska, 2014). It makes the labour market at sea an element of the global labour market (Wu & Morris, 2006). However, despite the global access to both employers and labour resources (which could facilitate elimination of all the phenomena of market imbalance) - the labour market at sea is unbalanced due to insufficient elasticity of demand and supply, which are exposed to many determinants. This, in turn, reduces the possibility of achieving balance on

this market in a short term (Skrzeszewska & Beran, 2016).

One of the reasons is that the demand for work at sea is a secondary demand generated by the demand for maritime services. This, in turn, is a derivative of global economic activity (Oxford Economics, 2016), where sudden demand or supply crises strongly affect conditions of the market of maritime transport services, and hence the maritime labour market.

Changes in demand for work at sea have many sources, among which the most important are: an increase in the size of the global fleet, changes in the regulations governing the length of work at sea (MLC, 2006), a personnel policy of shipowners and crewing ship managers/agencies (e.g. replacement ratio, preferences with regard to the origin of crews of officers and ratings) (Skrzeszewska, 2014). Manning costs are one of the largest categories in the ship's operating costs (Drewry Research, 2015). That is why, a lot is being done to reduce the number of people employed at sea by innovation - automation and robotisation of processes related to the operation of a ship, as well as there are works carried out on autonomous units. This is reflected in the quality of life of seafarers and in the requirements regarding their competences and skills. Reduced crews mean lower costs for the owner, but from the point of view of seafarers - a smaller crew is associated with more duties and the need for higher competences and skills than it was necessary previously on a given position (Exarchopoulos, Zhang, Pryce-Roberts, & Zhao, 2018). This is one of the reasons why at present a career at sea finishes faster than a career on the shore.

2 IMBALANCE IN THE LABOUR MARKET FOR SEAFARERS

The process of globalisation, acceleration of which took place at the beginning of the political transformation of non-democratic states, caused internationalisation of economic activity on an unprecedented scale. Shipping activities were both a catalyst for globalisation and at the same time its beneficiary. A particularly important event for development of shipping was creation of the global labour market, thanks to which seafarers working so far only on ships belonging to the national carriers and registered under the national flag could start looking for jobs on ships without any restrictions (Clayton, 2017; Patchiappane & Rengamani, 2018; Tusson, 2018; Wu & Morris, 2006). Nevertheless, organisations and institutions conducting research on the labour market at sea began to forecast shortages of labour supply in the first decades of the 21st century. The inability to estimate the real number of professionally active (working at sea) seafarers causes huge discrepancies in forecasts of individual centres.

According to the BIMCO / ISF, the gap of demand and supply of seafarers in 2015 reached almost 33 thousand people (including 16.5 thousand officers), but by 2020 the shortage of officers will have reached 92 thousand people, which means the supply gap of 11.7%. In 2025, the shortage of officers will increase to 147.5 thousand people (gap: 18.3%). With respect to

ratings, the estimated surplus is 119 thousand people ((BIMCO & ISF, 2015).

Oxford Economics estimates that the number of officers will increase from 790,000 in 2015, up to almost 1.1 million in 2026, an almost 40% increase in labour supply in this group of seafarers. Smaller increases are forecast for ratings: an increase from 754,000 in 2015 to 865 000 in 2026, an increase of just under 15% (Oxford Economics, 2016). When comparing the size of labour resources at sea calculated by Oxford Economics with the estimated demand for officers and ratings by BIMCO, the market imbalance with respect to officers will be a market deficit of 147.5 thousand seamen. In the case of ratings, there will be a market surplus of 49 thousand people (BIMCO & ISF, 2015; Oxford Economics, 2016).

Japan Maritime Center claims that the gap between demand and supply of work at sea (without distinguishing officers and rating) will increase from less than 5,000 in 2015 up to 14 thousand in 2020 (Japan Maritime Center, 2013).

According to Drewry, manpower deficiencies in the sea labour market relate only to officers. Ratings are available and there is a surplus of their supply over the demand. The situation is different for officers, whose lack on the market is more visible (20,900 in 2015). Due to changes in the size of the fleet (quantitative and qualitative) and organisation of ship operation, the deficit of officers will be soon reduced (up to 15,000 in 2019 and 7,700 in 2020) (Drewry Research, 2015).

Japan International Transport Institute reports that by 2020, the number of officers will increase by 7.2% compared to 2010 (in absolute numbers an increase of 32,153 people), the number of ratings by 7.2% (46,881 people) (Japan International Transport Institute & The Nippon Foundation, 2010). Referring to the data forecast by the BIMCO – the lack of seafarers in total on the market (officers and rating) will be more than 13,000 (8.5% compared to the forecast supply) (BIMCO & ISF, 2015; Japan International Transport Institute & The Nippon Foundation, 2010).

In the face of such large discrepancies in assessment of the current market and forecasts for the future, the following question arises - which of the presented estimates are the closest to the real changes taking place in the global maritime labour market? Is it possible to assess the actual changes on this market since only the demand side can be estimated based on the real data? Thanks to the structure of the labour market at sea, the operation of which is regulated by the market mechanisms - the answers to the above questions can be provided by an analysis and assessment of the degree of differentiation of income obtained by seafarers of different nations holding the same positions.

3 RESEARCH METHODOLOGY

The income inequality indicator expresses a degree of diversification of the income level, among others, of people in a given population (Jędrzejczak & Pekasiewicz, 2018; World Bank Institute, 2005).

Among the measures of income inequality, the following are distinguished as the most important: the Gini coefficient of inequality (Ceriani & Verme, 2012), the Zenga index of inequality (Zenga, 2007), the Theil indexes (Theil, 1967), Atkinson's inequality measures (Atkinson, 1970) (see more: (Greselin & Zitikis, 2018; Lerman & Yitzhaki, 1984). In order to study inequality in salaries of seafarers of different nationalities, the Gini coefficient was used as it is the most popular measure. Graphically, the value of the coefficient is expressed by the ratio of the area contained between the equality line and the Lorenz curve, to the area of the triangle under the diagonal (Włodarczyk, 2013). The Gini index is popular, because of the ease of interpretation, among others. It illustrates the average absolute difference between incomes of randomly selected entities in relation to the average income. Thanks to the normalised size - the value of the Gini coefficient allows making comparisons over time, comparisons between units in a given population, and comparisons between countries. The value of the index ranges between 0 and 1, where 0 means no differences between the compared units, and the higher the value, the more important is diversity (Lee, Lee, & Lee, 2017; Lerman & Yitzhaki, 1984).

Methods of assessing the level of income inequality using the Gini index was used to check a degree of inequality between wages paid in the same positions - seafarers from different nations. The point of reference was a degree of inequality of average incomes in the countries, from which seafarers came. To estimate this - distribution of income inequalities of nations, whose representatives created the supply side on the maritime labour market to the greatest extent, was examined. The GDP *per capita* of selected countries was used for this purpose.

The data used for calculations are secondary data from two sources: UNCTAD resources (GDP *per capita*) and from "Manning 2015. Annual Report", published by Drewry Maritime Research (seafarers' wages). Income inequality indicators were calculated using the Gretl program - an open source econometric package (GNU GPL v3).

4 RESEARCH RESULTS

The number of observed nationalities, which were taken into account while estimating inequality of salaries of seafarers in the same positions, was 10. They came from: China, Croatia, India, Latvia, Philippines, Poland, Romania, Russia, Ukraine, and the United Kingdom. The choice of these nations was dictated by participation of seafarers from these countries in the supply of work at sea in total.

Table 1. GDP *per capita* (2015) in the countries with the largest number of seafarers in the world's resources of seafarers.

Country	GDP <i>per capita</i> US dollars	Country	GDP <i>per capita</i> US dollars
China	8 069	Poland	12 566
Croatia	11 579	Romania	8 958
India	1 613	Russia	9 329
Latvia	13 666	Ukraine	2 124
Philippines	2 878	UK	43 929

Source: UNCTAD.

According to Drewry more than half (53.5%) of all the seamen come from 10 above-mentioned countries (Drewry Research, 2015). In the first step, the level of diversification of the GDP *per capita* (Table 1) was assessed between these countries.

For 10 observations (GDP *per capita* in 2015 for 10 selected countries, based on the UNCTAD data), the Gini coefficient from the sample was 0.454. This means that the average absolute difference between the GDP *per capita* of a randomly selected pair of countries considered is over 45% of the average income (Figure 1). The high Gini index means wide variation in the level of economic development of individual countries.

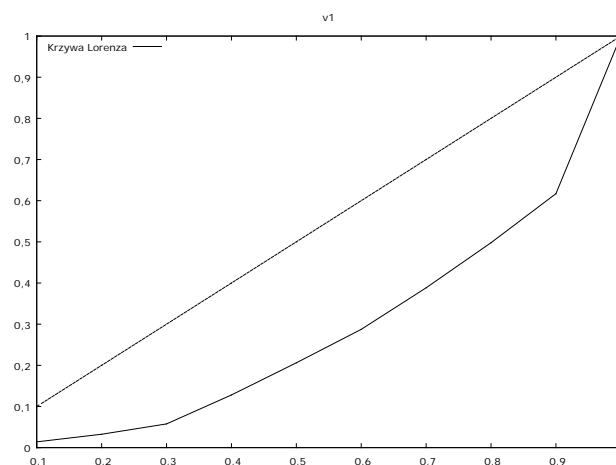


Figure 1. Lorenz curve reflecting a degree of diversification of GDP *per capita* between countries - the largest suppliers of ships' crews.

The second stage of the study consisted in estimating the Gini index in relation to wages of seafarers of various nations employed in the same position, based on the data contained from the "Manning 2015 Drewry Report" (pp. 42-71). Monthly wages include: basic wage, vacation and guaranteed overtime in US dollars. The enormous diversity of ships on which seafarers are employed and, consequently, a large number of differentiated payrolls required grouping all offshore jobs into large collections, so that wages could be compared. Due to the type of a ship, ships for transporting dry cargo (Dry cargo) and ships for transporting liquid cargo (Tankers) were separated. To take into account the fact that the amount of remuneration in the same positions differs, among other things, due to the size of a ship, the degree of its specialization, the value of transported cargo - remuneration for each position (group of positions with a similar level of

competencies required) was presented not as the specified amount, but as the amount between the minimum and maximum levels of remuneration for a given type of a ship (Dry cargo/ Tanker) and the nationality of a person holding the position.

Based on the data aggregated in such a way, Gini coefficients were calculated (using the Gretl program) for individual positions and groups of positions (Table 2).

On the basis of the obtained indicators, it can be concluded that differences in seafarers' wages, depending on the nation, are not as big as in the case of the GDP *per capita* differences.

Table 2. Degree of seafarers' wages differentiation based on the Gini index.

Rank	Wage	Gini coefficient		Level of responsibility
		Dry cargo	Tankers	
Master	min	0.072	0.083	management
	max	0.112	0.090	
Chief Engineer	min	0.082	0.083	management
	max	0.091	0.077	
Chief Officer/ 2nd Engineer	min	0.056	0.097	management
	max	0.080	0.087	
2nd Officer/ 3rd Engineer	min	0.162	0.116	operational
	max	0.133	0.127	
3rd Officer/ 4th Engineer	min	0.125	0.102	operational
	max	0.114	0.125	
Electrician	min	0.118	0.104	operational
	max	0.114	0.091	
Bosun/ Fitter/ Pumpman	min	0.243	0.231	support
	max	0.229	0.203	
Chief Cook	min	0.261	0.303	support
	max	0.252	0.226	
AB/ Motorman/ 2nd Cook	min	0.252	0.244	support
	max	0.217	0.215	
OS/ Wiper/ Messman	min	0.266	0.245	support
	max	0.236	0.214	

Source: own elaboration based on "Manning 2015 Drewry Report" data, calculated by Gretl.

On the basis of the obtained indicators, it can be concluded that differences in seafarers' wages, depending on the nation, are not as big as in the case of the GDP *per capita* differences. This means that the global maritime labour market is an attractive workplace for seafarers, especially from economically weaker countries.

Analysing the highest value index (0.303 - for Chief Cooks earning lower rates on tankers), it means that the average absolute difference between the wages of a randomly selected pair of Chief Cooks accounts for about 30% of the average wage in this position and is less than for differences in the GDP *per capita*.

All the obtained indicators that were analysed can be divided into three groups: indicators with values below 0.1: referring to four highest officer positions - from the management level (Figure 2). Another group of indicators in the range (0.1; 0.2) refers to positions of junior officers, which means the crew of the operational level of competence. The last group of

indicators with a value above 0.2 applies to positions on the support level (Figure 3).

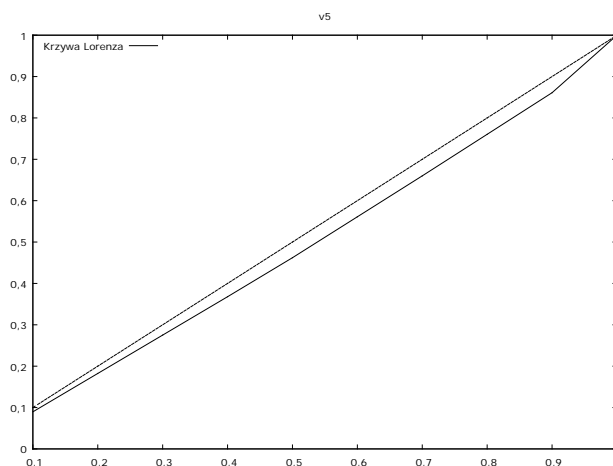


Figure 2. Lorenz curve reflecting a degree of diversification of senior officers' wages (Chief Officers/ 2nd Engineers). Source: own elaboration based on Drewry, calculated by Gretl

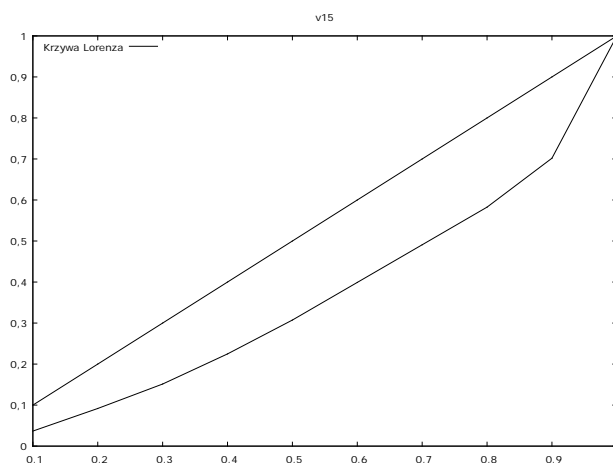


Figure 3. Lorenz curve reflecting a degree of diversification of ratings' wages (Chief Cooks). Source: own elaboration based on Drewry, calculated by Gretl

Lack of restrictions to access the labour market at sea, which to some extent limits employment opportunities in the case of work on land, causes that market imbalance is eliminated by the amount of earnings. It is obviously a reflection of competences and skills, but its amount also depends on employees' pay expectations. These, in turn, are a reflection of the average standard of living in the country of employment.

Analysing the value of the obtained indicators it can be noticed that their value decreases with an increase of competence and the scope of responsibility, regardless of the type of a ship or the level of earnings (higher/ lower) on a given position. This means that differences in wages depending on the nation are decreasing, which in turn means that it is difficult to employ crew members with high and highest competences. In the case of the highest positions, so-called top four, variation in earnings depending on the nation is practically non-existent.

5 CONCLUSIONS

The obtained results indicate an oversupply of ratings, whose earnings are at the minimum level set by the ITF. Officers in junior positions and senior officers - differences in earnings depending on the nation are reflected in differences in the GDP *per capita* (younger), while in relation to seniors officers - variation due to nation is insignificant, which means that employers are forced to pay more than salary expectations specific to a given nation. It also follows that in the case of senior officers there is a surplus of demand over labour supply on the labour market. Observing changes between inequalities in the income of seafarers in the same positions, the category "different nations" is a tool that can be used to create the personnel policy (building loyalty links between the employee and the employer), as well as to set directions for development of educational services in maritime education and training institutions (on various levels of education).

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