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# Education and Reducing Income Inequalities – The Importance of Education in Maritime Studies

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## ABSTRACT

Contemporary studies of economic inequality and poverty emphasise that their key causes are in the area of tax policy, labour force policy, and employment, and the causes that are being pointed out lately are education and educational attainment level of the population. The aim of the paper is to confirm the theoretically defined link between education and income inequality reduction and to point out that economic policy makers cannot solve the problem of inequality in society without a significant influence on public education, primarily through increased availability and quality of public education. In the second part of the paper, the Gini coefficient, the education index, and the coefficient of human inequality are used on the example of 130 countries to establish a correlation between education and income inequality reduction. The model shows a strong link between income inequality reduction (measured by the Gini coefficient) and increase in the educational attainment level of the population, increase in income, but also improvement of the health care system. It was found that, for each unit reduction of the coefficient of human inequality (IHDI), the Gini coefficient decreases by 9.7 points. In addition to research limitations and the proposal of future research, the conclusion proposes the opportunities and measures for increasing the educational attainment level of the population in order to reduce income inequality. Emphasis is also placed on the importance of tertiary maritime education.

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## 1 Introduction

Global inequality in the world was growing at the beginning of the 21st century, both in underdeveloped and developed countries. Rising inequality has become evident in the richest economies in the past few decades, both in those historically characterised by relatively high income inequality, as well as in those that traditionally had less inequality, such as Denmark, Germany, and Sweden. In developing countries, a large number of people are getting out of the poverty zone, thus forming the new middle class, but income inequality has been increasing, although the reasons are not always the same as in developed countries. [16]

Awareness of the questionability of actual social and economic development in the world in which income distribution differences are constantly increasing has be-

come more evident and requires concrete action. Namely, in accordance with the modern concepts, the realisation of social and economic development implies the development of three simultaneous processes: (1) realisation of economic growth measured by the level of gross domestic product per capita; (2) reduction of unemployment, i.e. employment growth; (3) reduction of poverty and income inequality.

Contemporary research of economic inequality and poverty emphasise that their key causes are in the area of tax policy, labour force and employment policy, and the emphasis has recently been placed on education and educational attainment level of the population. The results of previous research indicate that the role of education in reducing income inequality is very important, because the possibility of choosing one's occupation, access to better jobs, and salary level all depend on educational attainment level.

Analysing the contents of the UN Millennium Goals, it is possible to note the significance attributed to the increase in educational attainment level as one of the most powerful means of fighting poverty and great income inequality of the population. The aim of the achievement of these goals is, among other things, availability of primary education to all, i.e. ensuring that children around the world have the possibility to complete primary education and increase the literacy rate of the population aged 15 to 24. Agenda 2030, that defines global objectives for sustainable development of the world, set a higher goal – quality education.

The objective of the paper is to confirm the theoretically defined link between education and income inequality reduction, thus pointing out that economic policy makers cannot solve the problem of inequality in a society without a significant influence on public education, primarily through increased availability and quality of public education.

## 2 Literature review

Contemporary research of economic inequality and poverty increasingly emphasises that their key causes are in the area of tax policy, labour force and employment policy, especially education and educational attainment level of the population. Numerous economists believe that future tendencies of inequality and poverty, i.e. the possibilities of their reduction, will significantly depend on reducing the differences in the availability of education to all income categories of the population.

In the recent economic literature, there is an increasing number of papers covering the issues of education and economic inequality. Some of them cover the degree of correlation between income and educational attainment level of the population and prove through quantitative analysis that income distribution depends on education. This, in fact, substantiates and deepens the earlier understanding of the correlation between earnings (income) of an individual and their educational attainment level. Back in 1964, Gary Becker and Barry Chiswick had specified the costs of investing in human capital as a share in the profit that would have been achieved without investment. [5] About ten years later, Jacob Mincer stated: „If only the costs of attending school for an extra year were the opportunity costs of the student’s time and if proportional increase in earnings caused by additional education was constant over the course of a lifetime, the earnings flow would be linearly correlated with individual years of education, and the decline in this correlation could be interpreted through the rate of return on investment in education”. [21]

On the basis of a panel data analysis covering a wide range of countries for the period between 1960 and 1990, De Gregorio provided empirical evidence on the correlation between education and income distribution. The

results of the analysis show that educational factors – a higher education level and a more equitable income distribution – play a significant role in achieving greater equality in income distribution. [11]

Numerous authors studied the rates of return on investment in education, especially higher education (Becker, Hanoch, Mattila, Freeman, Mc Connell, and Brue). In the 1980s, Mc Connell and Brue calculated the rates of return on investment in higher education, i.e. the movement of premiums in higher education for the period from 1963 to 1986. Premiums were expressed as a percentage difference in weekly earnings of workers with tertiary education and those with secondary education. Over this period of time, these differences varied depending on the labour force supply and demand. The smallest difference was in 1963 when highly educated workers earned weekly 47% more than employees who completed secondary education, and the difference was the greatest in 1986, as much as 67%. [19] Krueger and Lindahl estimated that each additional year of education resulted in an increase in earnings of about 10% in the USA and that the rate of return on investment in education varies over time and that it differs in some countries. [17]

At the very beginning of the third millennium, a growing number of research aim to point out the impact of education on employees’ earnings and to evaluate the importance of education as an investment. [10] More recently, it has been pointed out in the studies that greater public education funding can reduce income inequality in a country. [31] It is pointed out that income inequality is reproduced through the education system, and, in more developed countries, through tertiary education in particular. [23] It is considered that the key factors influencing the inclusion in higher education in this process are: the level of parents’ income, occupational groups, and educational attainment level of the parents. Children from a lower socio-economic background are less likely to participate and succeed in at least similar types of higher education. This is important considering the fact that the level of income, labour-based social status or access to power in later life depend on tertiary education.

Using a structural dynamic model, Belzil and Hansen demonstrate that the family background, especially educational attainment level of the parents, contributes with as much as 68% to educational results of the children, and that the sole impact of their abilities is the least significant in the group of the identified impact factors. At the same time, individual differences in salaries are primarily the result of their specific skills, that contribute as much as 73%. [7]

In the studies of European countries, apart from household income, educational attainment level of the parents has been identified as a significant factor influencing participation in tertiary education. Children of highly educated parents are more likely to participate in tertiary education, even if the parents’ income is average. [8]

Willen, Hendel, and Shapiro study the reduction of wages of the least educated population and deepening of economic inequality as a result of increased availability of higher education on the example of the USA. Namely, they conclude that the poorer part of the population becomes even poorer if it remains at the same educational level while at the same time increasing the educational level, and thus increasing the wages of the rest of the population. [32]

The researchers have invested great efforts into analysing long time series for a large number of countries to demonstrate that a fairer distribution of educational opportunities for the population in longer periods has a major impact on fairer distribution of income. [11] It is therefore emphasised that in the higher education sector there is an increasing stratification in the quality of services, so those who are privileged in terms of income enrol into prestigious programmes in the private sector. Such a hierarchical differentiation in the system allows privileged groups to retain their position by creating elite institutions or programmes. [27] By contrast, households with lower income capacity use more public sector services. [1] Assuming that the quality of education is good in the public sector, but better in the private sector, richer households will focus on the private sector. In this case, lower income groups will benefit from free education in the public sector, and the public education sector will thus indirectly affect income redistribution. The authors of this paper believe that poorer quality of public education will in the long term generate new income inequality and it is therefore necessary to continuously improve educational programmes in the public education sector.

The researchers have recently devoted more attention to lifelong education. Technological progress requires constant improvement of employees' knowledge and skills and it has proven more useful for higher-skilled workers. For example, people with much needed skills who work in new information and communication technologies or skills that are specific for the finance sector have achieved significant profits and gain, while low-skilled workers or those with no skills are lagging behind. As a result, the gap between the salaries of highly qualified and low-skilled workers has been increasing. [24] Some authors argue that lifelong education is a necessary condition for individual employment, but at the same time point to the problem of lack of indicators of the positive impact of lifelong education on wages, which is necessary for further research of the overall economic benefits of lifelong education. [12]

In the most developed parts of the world, more and more emphasis is placed on the need to abandon the „mass education society“. Studies conducted in Japan show that, in the period from 1990 to 2010, disparities in the attitudes towards education emerged not only between people, but also between neighbouring regions. They are the result of social and economic disparities. [22] In the context of population mobility, this trend in education

also points to the increasing importance of lifelong education, because the population moves from less developed to more developed areas.

It has become more evident that the young population shows the inclination towards mobility to areas that offer greater educational opportunities. The research carried out in Turkey shows that regions that have better availability of education, higher social capital, more favourable cultural attitudes towards women, higher level of domestic resources, and lower level of educational inequality have a higher degree of intergenerational mobility. [4]

Explaining the causes of a large increase in income inequality and poverty in the former European transition economies (CEE countries), the World Bank in 2000 pointed out the impact of educational premiums as a result of investment in individual education. [33] By investigating the factors of impact on income inequality in transition economies, A. Kaasa specifically identifies the importance of human resource development in a group of demographic factors. [14]

The research of the World Bank conducted for Croatia has shown that almost 80% of the poor in the year 2000 came from households in which the head of the family completed only primary education [34], in 2008 68.7%, and 23.1% more from households in which the head of the family completed only secondary vocational education [35]. This means that there has been growing demand for the educational attainment of employees, because even the secondary education level no longer guarantees the elimination of poverty risk. There are not enough jobs for everyone, in part also because some parts of the population do not possess the necessary knowledge and expertise the employers require. [6] The results of the income distribution research with respect to the level of education show that young people behave very rationally, which means that they look for jobs and levels of education that will facilitate their employment and enable higher income. [30]

African and South American countries have the largest income inequality. Abebe Shimeles, the main economic analyst of the African Development Bank, argues that the role of education in overcoming intergenerational mobility, hence inequality, is documented in many studies, although it is not clear which level of education is the most important for the most effective reduction of inequality. The results of his research show that the Gini coefficient, the usual measure of inequality, decreases with the share of the population that completes secondary or tertiary education [28]. This is a new insight that is fundamentally different from those in the earlier generally accepted studies arguing that rates of return in primary education in Africa are higher than those in secondary and tertiary education. Therefore, focusing on secondary and tertiary education could lead to a long-term reduction of the inequality in Africa. Shimeles notes that the "return rate" of higher education decreases with the increasing share of highly educated population.

The global financial crisis that began in 2008 increased the number of poor people, but also deepened the ever-increasing income gap between the poorest and the richest. Joseph E. Stiglitz points out that this is happening because of the effect of market rules that have positive, but also a multitude of negative effects. [29] Some of the negative effects are the increase in poverty and economic inequality. The market can lead to a large concentration of wealth if there is no role of the government or economic policy makers. In the first few post-recession years at the beginning of the third millennium (from 2002 to 2007), 1% of the richest Americans accounted for more than 65% of total national income, and in 2010, 93%. At the same time, most US citizens lived worse. In the USA, life expectancy is 78 years, but the poor live 10%, i.e. almost 8 years shorter than the richest. Those who come from poor families are sentenced to remaining poor forever. [29] In the opinion of the authors of this paper, the key cause of this situation is the lack of educational opportunities for the poor. This problem will be impossible to solve without an active role of the economic policy makers in the area of public education development: primary, secondary, and tertiary.

The methodology of income inequality measurement and educational attainment level is analysed below aiming to set the grounds for discussion of the relationship between the educational attainment level and income inequality.

### 3 Methodology

Education is a major component of well-being and is used in the measuring of economic development and quality of life, which is a key factor determining whether a country is a developed, developing, or underdeveloped. Thus, the authors analyse in this paper how education affects economic inequality.

Income distribution is related to the population's average schooling and its dispersion. Income inequality increases with education inequality. By contrast, an increase in average schooling has an ambiguous effect in income distribution. [11] Traditional models of human capital theory suggest the following expression for the level of earnings ( $Y$ ) of an individual with  $S$  years of schooling:

$$+ \sum_{j=1}^S \log(1 + r_j) + u \quad (1)$$

wherein  $r_j$  is the rate of return to the  $j^{\text{th}}$  year of schooling and  $u$  reflects other factors that influence earnings, regardless of education. De Georgio et al. indicate that the function can be approximated by:

$$\log Y_s = \log Y_0 + rS + u \quad (2)$$

using a bar over variable to denote its mean, De Georgio et al. denote its mean as:

$$\text{Var}(\log Y_s) = r^2 \text{Var}(S) + S^2 \text{Var}(r) + 2rS \text{Cov}(r, S) + \text{Var}(u) \quad (3)$$

Accordingly, an increase in educational inequality unambiguously leads to greater income inequality, with other variables kept constant.

In accordance with this conclusion, the authors of the paper analyse how education interacts with inequality. In the first step, the authors calculate the **Education Index**. There are two steps in calculating the Education Index. The minimum and maximum values (goalposts) are set in order to transform the indicators expressed in different units into indices between 0 and 1. These goalposts act as the "natural zeros" and "aspirational targets," and are used for standardisation of component indicators. Societies can subsist without formal education, justifying the education minimum of 0 years. The maximum for expected years of schooling, 18, is equivalent to achieving a master's degree in most countries. The maximum for mean years of schooling, 15, is the projected maximum of this indicator for 2025. [36]

Having defined the minimum and maximum values, the dimension indices are calculated as:

$$\text{Dimension index} = \frac{\text{actual value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \quad (4)$$

For the educational dimension, equation (4) is first applied to each of the two indicators, and the arithmetic mean of the two resulting indices is then taken into consideration. Using the arithmetic mean allows perfect substitutability between mean years of schooling and expected years of schooling. Many developing countries have low school attainment among adults, but are eager to achieve universal primary and secondary school enrollment. Because each dimension index is a proxy for capabilities in the corresponding dimension, the transformation function from income to capabilities is likely to be concave. [2]

The formula for the calculation of the Education Index:

$$EI = \frac{MYSI + EYSI}{2} \quad (5)$$

wherein the Mean Years of Schooling Index is:

$$MYSI = \frac{MYS}{15} \quad (6)$$

and the Expected Years of Schooling Index is:

$$EYSI = \frac{EYS}{18} \quad (7)$$

Mean years of schooling is a calculation of the average number of years of education obtained by people aged 25 and older in their lifetime based on educational attainment levels of the population converted into years of schooling based on theoretical duration of each level of education attended. Expected years of schooling is a calculation of the number of years a child is expected to attend school, or university, including the years spent on repetition. It is the sum of age-specific enrollment ratios for primary, secondary, post-secondary non-tertiary, and tertiary

education, and is calculated assuming that the prevailing patterns of age-specific enrollment rates will stay the same throughout the child's life. Expected years of schooling is capped at 18 years. Eighteen is equivalent to achieving a master's degree in most countries.

After analysing education by using the Education Index, the authors of this paper use the **Gini coefficient** as a measure of inequality. In economics, the Gini coefficient, sometimes called Gini index, or Gini ratio, is a measure of statistical dispersion intended to represent the income or wealth distribution of a nation's residents, and it is the most commonly used measurement of inequality. The Gini coefficient measures the inequality among frequency distribution values. A Gini coefficient of zero expresses perfect equality, where all values are the same. A Gini coefficient of 1 (or 100%) expresses maximum inequality among values (e. g., for a large number of people, where only one person has all the income or consumption, and all other have none, the Gini coefficient will be very close to one). [18]

The Gini coefficient is usually defined mathematically based on the Lorenz curve, which plots the proportion of the total income of the population that is cumulatively earned by the bottom  $x$  of the population. The line at 45 degrees thus represents perfect income equality.

An alternative approach is to define the Gini coefficient as half of the relative mean absolute difference, which is mathematically equivalent to the Lorenz curve definition. The mean absolute difference is the average absolute difference of all pairs of items of the population, and the relative mean absolute difference is the mean absolute difference divided by the average, to normalise it in relation to the scale.

The main advantage of the Gini coefficient is that it is a measure of inequality by means of a ratio analysis, rather than a non-representative variable for most of the population, such as income per capita or gross domestic product. It can be used to compare income distribution across different population sectors as well as countries; for example, the Gini coefficient for urban areas differs from that of rural areas in many countries. It is simple enough and can be compared across countries and be easily interpreted. GDP statistics are often criticised as they do not represent changes for the whole population; the Gini coefficient demonstrates how income has changed for the poor and the rich. If the Gini coefficient is rising, as well as GDP, poverty may not be improving for the majority of the population. The Gini coefficient can be used to indicate how the distribution of income has changed within a country over a period of time; it is thus possible to see whether inequality is increasing or decreasing. The Gini coefficient fulfils four important principles: anonymity: it does not matter who the high and low earners are; scale independence: the Gini coefficient does not consider the size of the economy, the way it is measured, or whether it is a rich or a poor country on average; population independence: it does not

matter how large the population of the country is; transfer principle: if income (less than the difference), is transferred from a rich person to a poor person, the resulting distribution is more equal. [38]

The authors also calculate and analyse the **Coefficient of Human Inequality**. It was introduced in the 2014 Human Development Report as an experimental measure. It is a simple average of inequality in health, education, and income. The average is calculated by an unweighted arithmetic mean of estimated inequality in these dimensions. When all inequality is of a similar magnitude, the coefficient of human inequality and the loss in HDI differ negligibly; when inequalities differ in magnitude, the loss in HDI tends to be higher than the coefficient of human inequality. [36]

An unweighted average of inequalities in health, education and income is denoted as the coefficient of human inequality. It averages these inequalities using the arithmetic mean:

$$\begin{aligned} \text{Coefficient of human inequality} &= \\ &= \frac{A_{\text{Health}} + A_{\text{Education}} + A_{\text{Income}}}{3} \end{aligned} \quad (8)$$

When all inequalities in dimensions are of a similar magnitude, the coefficient of human inequality and the loss in HDI value differ negligibly. When inequalities differ in magnitude, the loss in HDI value tends to be higher than the coefficient of human inequality.

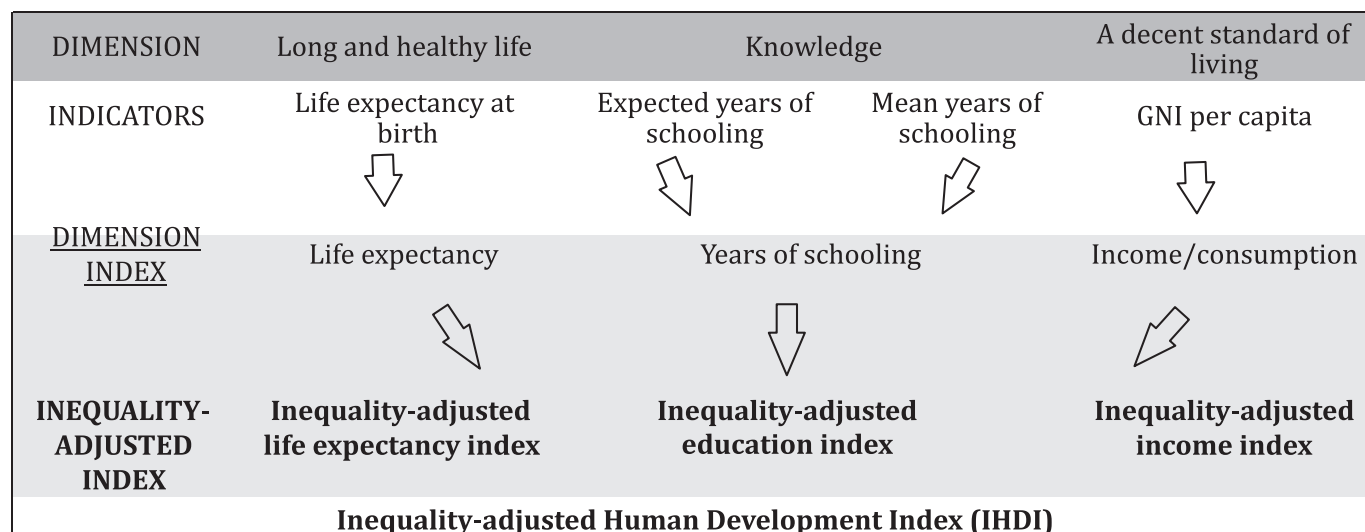
The **IHDI** is based on the Atkinson Index, which satisfies subgroup consistency. This property ensures that improvements (deteriorations) in the distribution of human development within only a certain group of the society imply improvements (deteriorations) in the distribution across the entire society. The main disadvantage is that the IHDI is not association-sensitive, so it does not capture overlapping inequality. To make the measure association sensitive, all the data for each individual must be available from a single survey source, which is currently not possible for a large number of countries. [36]

The difference between the IHDI and HDI is the human development cost of inequality, also termed – the loss of human development due to inequality. The IHDI allows a direct link to inequality in dimensions, it can inform the policy makers of inequality reduction, and leads to a better understanding of inequality across population and its contribution to the overall human development cost.

To reach the conclusions, the authors used regression analysis for statistical modelling.

In the linear regression, the model specification is that the dependent variable is a linear combination of the parameters (but does not need to be linear in the independent variables). In a multiple linear regression, there are several independent variables or functions of independent variables.

$$y_i = \beta_0 + \beta_1 X_i + \beta_2 x_i^2 + \varepsilon_i, i = 1, \dots, n \quad (9)$$



**Figure 1** The Calculation of Inequality-adjusted Human Development Index (IHDI)

Source: Authors' presentation based on [36]

A trend line represents a trend, a long-term movement in time series data after other components have been accounted for. Trend lines are typically straight lines, although some variations use higher degree polynomials depending on the degree of curvature desired in the line.

#### 4 Discussion

In the appendix of the paper (Appendix Table 2), there is a table with input data for analysis. In total, it covers 130 countries with the presented and calculated variables as follows: income in 2017, expected years of schooling in 2017, average years of schooling in 2017, education index in 2017, the Gini coefficient for the period 2012-2017, and the human inequality coefficient for 2017. Where necessary, the same data were used in the calculations and the analysis logarithmed with the natural logarithm ( $\ln$ ). The data in the table are structured according to income level and the countries were classified, according to the World

Bank methodology, into high-, middle-, and low-income countries. For the purposes of this analysis, there was no classification of countries into upper-middle and lower-middle income countries.

Table 1 shows descriptive statistics for the analysed data set.

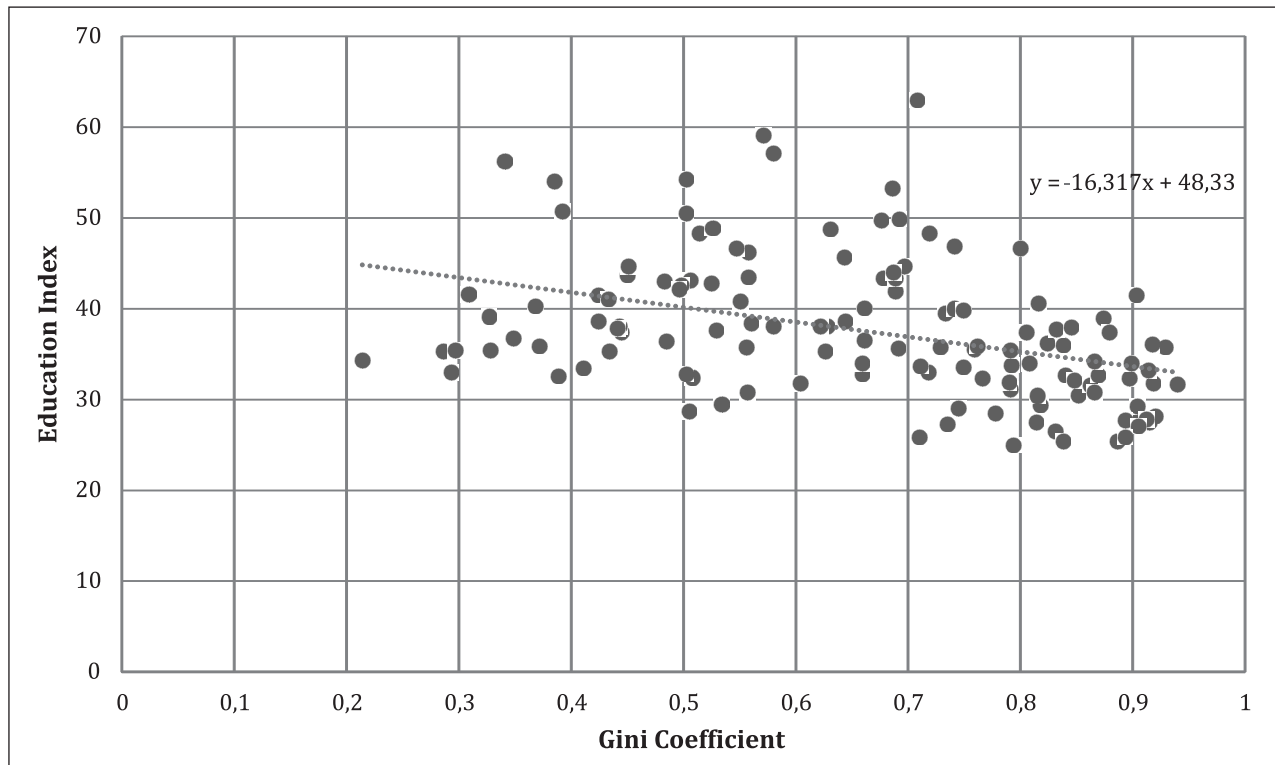
The sample covers 130 countries (*count*). Norway has the largest amount of GNI pc (68012 USD), and Central African Republic the smallest (663 USD). The longest expected years (*EYSI*) of schooling are expected in Australia (22.9 years), and the shortest in South Sudan (4.87 years). The average years of schooling (*MYSI*) are the longest in Germany (14.08), and the shortest in Burkina Faso (1.47 year). The highest income inequality measured by the Gini coefficient is in South Africa, and the lowest in Ukraine. All data are presented for 2017, and the Gini coefficient for the period 2012-2017.

When the education index (*EI*) is calculated for all countries, the most educated population is in Germany,

**Table 1** Descriptive Data Analysis of the Model

	Gross national income (GNI) per capita 2017	Expected years of schooling 2017	Mean years of schooling 2017	Education Index 2017	GINI coeff	Coefficient of human inequality
count	130	130	130	130	130	130
max	68.012,49	22,92	14,08	0,94	63,00	41,80
min	663,15	4,87	1,47	0,21	25,00	3,60
average	16.918,48	13,49	8,65	0,66	37,55	18,97
median	11.520,82	13,79	8,84	0,69	36,05	17,20
standard deviation	15979,24	3,19	3,28	0,19	7,70	9,79

Source: Authors' calculation



**Graph 1** Regression Analysis of the Educational Attainment Level (Education Index) and the Gini Coefficient

**Source:** Authors' calculation

and the most uneducated in Niger. In addition, the calculated coefficient of human inequality shows that the greatest inequality in the society appears in Central African Republic, and the smallest in Japan.

Graph 1 shows a regression analysis of the educational attainment level and income inequality.

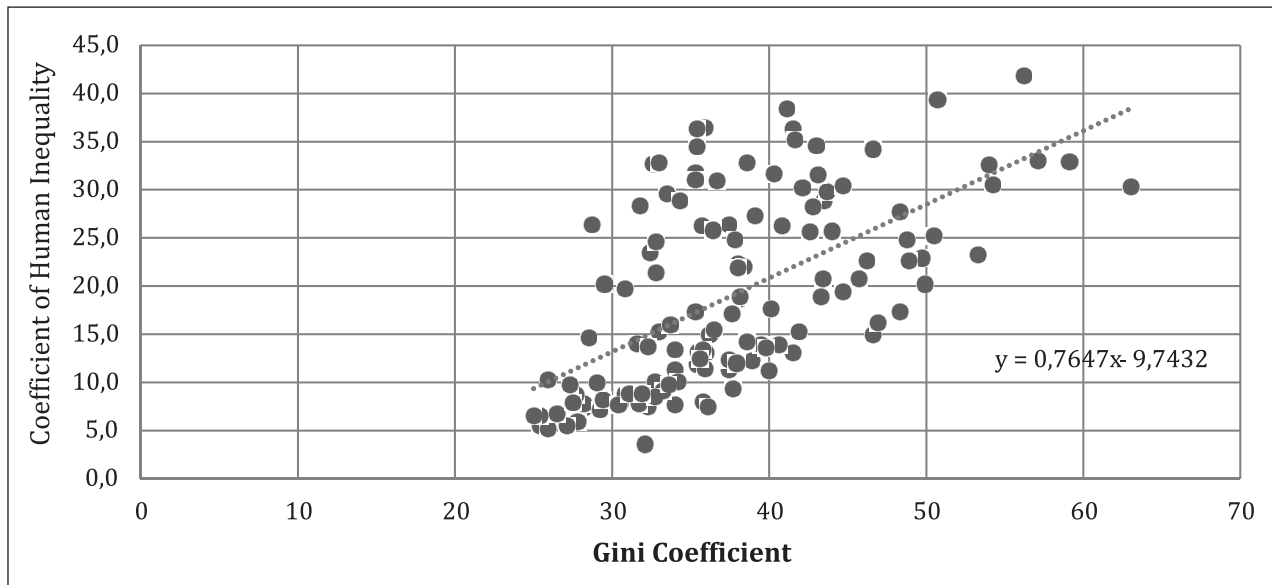
The theoretically set hypothesis that the differences measured by the Gini coefficient are reduced by increasing the educational attainment level of the population is demonstrated by the regression model shown in the chart, and the analysis of the model shows the impact of actual and expected years of schooling on changes in income inequality in the country.

The model (Appendix Table 3) shows that actual (average) years of schooling have a greater impact on inequality reduction (measured by the Gini coefficient) than expected years of schooling. This is logical considering the fact that expected years of schooling have an impact on inequality reduction in the future, i.e. the model proves that in a society in which the population is educated, this education has a greater impact on inequality reduction. This is also an important message for educational policy makers who must influence the increase in educational attainment of the population for the development of the society and to reduce income inequality. This confirms the results of Shimeles' research from 2016.

The OECD studies [24] show that poor young people are under-represented in tertiary education. If enrollments into higher education institutions corresponded to the population structure according to income, twice as many young people from socially vulnerable groups would enroll in higher education. Unfortunately, this is not the case and this confirms that social background is very important. In addition, many young people do not have the opportunity to enroll into elite schools, but rather enroll into short vocational programmes. The answer to the question why potential years of schooling have a lesser impact on income inequality reduction lies also in the fact that the population can move from one country to another in the future, and it is difficult to really determine the extent of their (future) impact on inequality reduction in the society.

When looking at the current structure of the economy, it is particularly important to emphasize that the tertiary sector requires, and in the future will be even more pronounced, the increasing importance of acquiring knowledge in higher education institutions. This applies in particular to maritime studies, which is further characterized by faster technological development than other service industries. [25] This will have the effect of increasing income inequalities between highly educated naval staff and those with less education. In such circumstances, the development of maritime education programs taking place at higher education institutions plays an important role. [3]





**Graph 2** The correlation between the Coefficient of Human Inequality and the Gini coefficient

Source: Authors' calculation

In the next step (Appendix Table 4), the authors aim to determine whether more variables in the model could better explain the impact on income inequality reduction. For this purpose, the model includes the coefficient of human inequality.

The model shows a strong link between income inequality reduction (measured by the Gini coefficient) and increase in the educational attainment level of the population, increase in income, but also improvement of the health care system. It can be established that, for each unit reduction of the coefficient of human inequality, the Gini coefficient decreases by 9.7 points. This is also an important message for economic policy makers who should have an impact through their measures and activities both on life span prolongation and on increase in the educational attainment level of the population, primarily through the development of public education, increasing income and reducing the difference between these indicators in the society. This is why contemporary theorists analyse socio-economic development in the context of a series of efforts of economic policy makers focusing on increasing the standard of living, human capital, important infrastructure, regional competitiveness, social inclusion, health condition of the population, and its literacy. [15] Furthermore, the quality of higher education programs that must be monitored through quality assurance standards is emphasized (ESG<sup>1</sup>).

<sup>1</sup> The Standards and guidelines for quality assurance in the European Higher Education Area (ESG) were adopted by the Ministers responsible for higher education in 2005 following a proposal prepared by the European Association for Quality Assurance in Higher Education (ENQA) in co-operation with the European Students' Union (ESU), the European Association of Institutions in Higher Education (EURASHE) and the European University Association (EUA).

## 5 Conclusion

Research have shown that there is a strong link between education and income inequality. The research limitation is based on the inability to conduct a separate analysis for the poorest world countries. Namely, taking into consideration the huge lack of statistical data for these countries, it is impossible to analyse in detail the link between increase in the educational attainment level of the population and income inequality reduction. However, with a theoretical background of the studied phenomenon, it can be established that the link exists and that it is possible to provide recommendations for increasing the level of education of the population in these countries. A series of research, including this one, have shown that economic policy makers need to implement significant measures in the education sector; it is necessary to strengthen the public sector to make it more accessible (not just in the primary, but also in secondary and tertiary education). Continuous growth in the quality of educational programmes in the public sector is necessary to reduce the differences between public education programmes and prestigious (most often private) educational programmes. Due to technological progress and significant changes in the economic structure, lifelong learning programmes need to be developed to increase employability also in the deprived groups. In addition, it is necessary to enable the enrollment of young people who achieve the best educational results into prestigious programmes, both in the public and the private sector, through a scholarship system and favourable loans. It is also important to include the youngest age groups in the education system considering the fact that education at the earliest age provides better opportunities for success and a way out of poverty.

Investment in education has the effect of deferred action both for an individual and social community. However, the return on investment is much faster from an individual than a social aspect. Investment into generational coverage, to the greatest extent possible, and quality education will only show its impact when pupils and students enter the labour market. To improve the educational structure of the total population and its synergistic effect on the growth of social well-being, it is necessary to provide quality education to generations of pupils and students. Both public and private investments have an important role in this process. Without them, however, there is no long-term economic development and they are thus at the top of the hierarchy of national development priorities in the countries that think about their future. The countries that in the second half of the XX. century succeeded in achieving rapid economic growth and development belonged, according to the studies from the 1960s, to the top groups according to the level of educational attainment, i.e. development of human resources.

In future research, the authors plan to analyse in detail the components of the index of human inequality and the impact of each of these components on income inequality reduction. In future research, with respect to the analysis of the level of educational attainment of the population, the authors also plan to analyse the impact of completion of primary, secondary, and tertiary education on income inequality reduction as well as the quality of maritime higher education programs in the Republic of Croatia measured by the fulfilment of the ESG standards.

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## Appendices

**Table 2** GNI per capita, Expected years of schooling, Mean years of schooling, Education index, GINI coefficient and Coefficient of Human Inequality for selected countries

Country	Gross national income (GNI) per capita 2017	Expected years of schooling 2017	Mean years of schooling 2017	Education index 2017	GINI	Coefficient of Human Inequality
Norway	68012	17,9	12,6	0,915	27,5	7,9
Luxembourg	65016	14,0	12,1	0,792	33,8	10,1
Switzerland	57625	16,2	13,4	0,897	32,3	7,5
United States	54941	16,5	13,4	0,903	41,5	13,1
Ireland	53754	19,6	12,5	0,918	31,8	8,6
Denmark	47918	19,1	12,6	0,92	28,2	7,4
Netherlands	47900	18,0	12,2	0,906	28,2	7,8
Sweden	47766	17,6	12,4	0,904	29,2	7,2
Germany	46136	17,0	14,1	0,94	31,7	7,8
Iceland	45810	19,3	12,4	0,912	27,8	5,9
Austria	45415	16,1	12,1	0,852	30,5	7,8
Australia	43560	22,9	12,9	0,929	35,8	8,0
Canada	43433	16,4	13,3	0,899	34	7,7
Belgium	42156	19,8	11,8	0,893	27,7	8,7
Finland	41002	17,6	12,4	0,905	27,1	5,5
France	39254	16,4	11,5	0,84	32,7	10,1
United Kingdom	39116	17,4	12,9	0,914	33,2	9,1
Japan	38986	15,2	12,8	0,848	32,1	3,6
Korea (Republic of)	35945	16,5	12,1	0,862	31,6	14,0
Italy	35299	16,3	10,2	0,791	35,4	11,9
Malta	34396	15,9	11,3	0,818	29,4	8,2
Spain	34258	17,9	9,8	0,824	36,2	14,9
New Zealand	33970	18,9	12,5	0,917	36,1	7,5
Israel	32711	15,9	13,0	0,874	38,9	12,2
Cyprus	31568	14,6	12,1	0,808	34	11,3
Slovenia	30594	17,2	12,2	0,886	25,4	5,5
Czech Republic	30588	16,9	12,7	0,893	25,9	5,2
Slovakia	29467	15,0	12,5	0,831	26,5	6,7
Estonia	28993	16,1	12,7	0,869	32,7	8,5
Lithuania	28314	16,1	13,0	0,879	37,4	11,3
Portugal	27315	16,3	9,2	0,759	35,5	13,2
Poland	26150	16,4	12,3	0,866	30,8	8,8
Hungary	25393	15,1	11,9	0,815	30,4	7,7
Latvia	25002	15,8	12,8	0,866	34,2	10,1
Turkey	24804	15,2	8,0	0,689	41,9	15,3
Greece	24648	17,3	10,8	0,838	36	13,1
Russian Federation	24233	15,5	12,0	0,832	37,7	9,3
Romania	22646	14,3	11,0	0,762	35,9	11,4
Kazakhstan	22626	15,1	11,8	0,814	27,5	7,9
Croatia	22162	15,0	11,3	0,791	31,1	8,8
Chile	21910	16,4	10,3	0,8	46,6	14,9
Mauritius	20189	15,1	9,3	0,729	35,8	13,4

Country	Gross national income (GNI) per capita 2017	Expected years of schooling 2017	Mean years of schooling 2017	Education index 2017	GINI	Coefficient of Human Inequality
Uruguay	19930	15,9	8,7	0,733	39,5	13,9
Panama	19178	12,7	10,2	0,692	49,9	20,2
Iran (Islamic Republic of)	19130	14,9	9,8	0,741	40	11,2
Bulgaria	18740	14,8	11,8	0,805	37,4	12,3
Argentina	18461	17,4	9,9	0,816	40,6	13,9
Iraq	17789	11,0	6,8	0,534	29,5	20,2
Mexico	16944	14,1	8,6	0,678	43,4	20,8
Montenegro	16779	14,9	11,3	0,79	31,9	8,8
Gabon	16431	12,8	8,2	0,628	38	22,3
Belarus	16323	15,5	12,3	0,838	25,4	6,5
Thailand	15516	14,7	7,6	0,661	36,5	15,5
China	15270	13,8	7,8	0,644	38,6	14,2
Costa Rica	14636	15,4	8,8	0,719	48,3	17,3
Dominican Republic	13921	13,7	7,8	0,643	45,7	20,8
Brazil	13755	15,4	7,8	0,686	53,3	23,2
Maldives	13567	12,6	6,3	0,56	38,4	22,0
Serbia	13019	14,6	11,1	0,778	28,5	14,6
Colombia	12938	14,4	8,3	0,676	49,7	22,9
North Macedonia	12505	13,3	9,6	0,691	35,6	12,4
South Africa	11923	13,3	10,1	0,708	63	30,3
Albania	11886	14,8	10,0	0,745	29	10,0
Peru	11789	13,8	9,2	0,689	43,3	18,9
Bosnia and Herzegovina	11716	14,2	9,7	0,718	33	15,3
Sri Lanka	11326	13,9	10,9	0,749	39,8	13,6
Indonesia	10846	12,8	8,0	0,622	38,1	18,7
Venezuela (Bolivarian Republic of)	10672	14,3	10,3	0,741	46,9	16,2
Egypt	10355	13,1	7,2	0,604	31,8	28,3
Ecuador	10347	14,7	8,7	0,697	44,7	19,4
Tunisia	10275	15,1	7,2	0,659	32,8	21,4
Mongolia	10103	15,5	10,1	0,766	32,3	13,7
Namibia	9387	12,3	6,8	0,571	59,1	32,9
Georgia	9186	15,0	12,8	0,845	37,9	12,0
Philippines	9154	12,6	9,3	0,661	40,1	17,6
Armenia	9144	13,0	11,7	0,749	33,6	9,8
Paraguay	8380	12,7	8,4	0,631	48,8	24,8
Jordan	8288	13,1	10,4	0,711	33,7	16,0
Ukraine	8130	15,0	11,3	0,794	25	6,5
Bhutan	8065	12,3	3,1	0,445	37,4	26,4
Guatemala	7278	10,8	6,5	0,514	48,3	27,7
El Salvador	6868	12,6	6,9	0,58	38	21,9
Timor-Leste	6846	12,8	4,5	0,505	28,7	26,4
Bolivia (Plurinational State of)	6714	14,0	8,9	0,687	44	25,7
India	6353	12,3	6,4	0,556	35,7	26,3
Lao People's Democratic Republic	6070	11,2	5,2	0,485	36,4	25,8

Country	Gross national income (GNI) per capita 2017	Expected years of schooling 2017	Mean years of schooling 2017	Education index 2017	GINI	Coefficient of Human Inequality
Viet Nam	5859	12,7	8,2	0,626	35,3	17,3
Congo	5694	11,4	6,3	0,526	48,9	22,6
Myanmar	5567	10,0	4,9	0,443	38,1	18,9
Moldova (Republic of)	5554	11,6	11,6	0,71	25,9	10,3
Pakistan	5311	8,6	5,2	0,411	33,5	29,6
Nigeria	5231	10,0	6,2	0,483	43	34,6
Nicaragua	5157	12,1	6,7	0,558	46,2	22,6
Honduras	4215	10,2	6,5	0,502	50,5	25,2
Sudan	4119	7,4	3,7	0,328	35,4	34,5
Ghana	4096	11,6	7,1	0,558	43,5	28,8
Bangladesh	3677	11,4	5,8	0,508	32,4	23,4
Mauritania	3592	8,6	4,5	0,389	32,6	32,7
Zambia	3557	12,5	7,0	0,58	57,1	33,0
Côte d'Ivoire	3481	9,0	5,2	0,424	41,5	36,3
Djibouti	3392	6,2	4,1	0,309	41,6	35,2
Tajikistan	3317	11,2	10,4	0,659	34	13,4
Cameroon	3315	12,2	6,3	0,547	46,6	34,2
Kyrgyzstan	3255	13,4	10,9	0,735	27,3	9,8
Lesotho	3255	10,6	6,3	0,502	54,2	30,5
Vanuatu	2995	10,9	6,8	0,529	37,6	17,1
Kenya	2961	12,1	6,5	0,551	40,8	26,3
Sao Tome and Principe	2941	12,5	6,3	0,557	30,8	19,7
Tanzania (United Republic of)	2655	8,9	5,8	0,441	37,8	24,8
Nepal	2471	12,2	4,9	0,502	32,8	24,6
Senegal	2384	9,7	3,0	0,368	40,3	31,7
Mali	1953	7,7	2,3	0,293	33	32,8
Rwanda	1811	11,2	4,1	0,45	43,7	29,8
Ethiopia	1719	8,5	2,7	0,327	39,1	27,3
Haiti	1665	9,3	5,3	0,433	41,1	38,4
Uganda	1658	11,6	6,1	0,525	42,8	28,2
Burkina Faso	1650	8,5	1,5	0,286	35,3	31,8
Guinea-Bissau	1552	10,5	3,0	0,392	50,7	39,4
Gambia	1516	9,2	3,5	0,372	35,9	36,4
Togo	1453	12,4	4,8	0,506	43,1	31,5
Madagascar	1358	10,6	6,1	0,498	42,6	25,6
Yemen	1239	9,0	3,0	0,349	36,7	30,9
Mozambique	1093	9,7	3,5	0,385	54	32,6
Malawi	1064	10,8	4,5	0,451	44,7	30,4
South Sudan	963	4,9	4,8	0,297	35,4	36,3
Niger	906	5,4	2,0	0,214	34,3	28,8
Congo (Democratic Republic of the)	796	9,8	6,8	0,496	42,1	30,2
Burundi	702	11,7	3,0	0,424	38,6	32,8
Liberia	667	10,0	4,7	0,434	35,3	31,0
Central African Republic	663	7,2	4,3	0,341	56,2	41,8

Source: Authors' calculation

**Table 3** Regression analysis for GINI, Expected years of schooling and Mean years of schooling

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0,387781							
R Square	0,150374							
Adjusted R Square	0,138237							
Standard Error	7,003965							
Observations	130							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	2	1215,521	607,7606	12,38924	1,11E-05			
Residual	140	6867,773	49,05552					
Total	142	8083,294						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	46,1727	2,774962	16,63904	5,56E-35	40,68645	51,65895	40,68645	51,65895
Expected years of schooling 2017	-0,08274	0,346314	-0,23893	0,811509	-0,76743	0,601937	-0,76743	0,601937
Mean years of schooling 2017	-0,84659	0,337242	-2,51032	0,0132	-1,51333	-0,17984	-1,51333	-0,17984

Source: Authors' calculation

**Table 4** Regression analysis for GINI and IHD

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0,601732							
R Square	0,362081							
Adjusted R Square	0,357098							
Standard Error	6,173837							
Observations	130							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	2769,243	2769,243	72,65253	3,69E-14			
Residual	128	4878,881	38,11626					
Total	129	7648,124						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	28,56913	1,184958	24,10982	1,99E-49	26,22448	30,91377	26,22448	30,91377
Coefficient of human inequality	0,473491	0,05555	8,523645	3,69E-14	0,363575	0,583407	0,363575	0,583407

Source: Authors' calculation