

THE INEQUALITY-POLLUTION NEXUS IN EUROPEAN COUNTRIES: TRENDS, CAUSES AND CONSEQUENCES

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Abstract

One of the global challenges is excessive emissions of pollutants that affect climate change, the causes of which are the intensification of economic development and technological breakthroughs. In turn, globalization, economic and technological development, a significant difference in the incomes of managers and hired workers, tax policy, and trade unions decline have caused an increase in income inequality. In most European countries, the gap between rich and poor is at its highest level since 30 years. Our research aims to cluster countries by inequality level, analyze differentiation, and identify the relationship between the level of inequality in countries and their carbon footprint. The sample included 38 European countries for the period 2010–2020. The countries were clustered by economic development level and income inequality level based on such indicators as GDP per capita; Gini index; income quintile share ratio S80/S20 for disposable income; income share held by highest 10%; income share held by lowest 10%. We identified a significant difference between countries in the inequality level and, more importantly, in the level of carbon footprint left by the richest group of people.

Key words: climate change, cluster analysis, income inequality, pollution

JEL Code: J30, O12, O33

Introduction

Nowadays income inequality is defined as a threat of a global scale, which tends to grow. According to Oxfam's Survival of the Richest report (2023), since 2020, the richest 1% have seized nearly two-thirds of all new wealth, almost twice as much as the bottom 99% of the global population combined. The top 1% gained 74 times more wealth than the bottom half. The COVID-19 pandemic, along with the recent spike in food and fuel prices, has deepened inequality. During the height of the pandemic, income losses among the poorest

40% were twice as severe as those experienced by the richest 20%, causing global income inequality to rise for the first time in decades, according to the World Bank.

The gap between the rich and the poor is expanding, with the wealthiest individuals accumulating a disproportionate share of wealth. This concentration of wealth can lead to social and economic instability, as it limits opportunities for upward mobility and exacerbates poverty. Also, high levels of inequality can erode trust in institutions and contribute to social unrest. When people perceive that the economic system is unfairly benefiting a small elite while leaving the majority behind, it can lead to increased tension and conflict within societies.

Wages for the majority of workers have stagnated or grown only marginally, while the cost of living has increased. This makes it harder for people to afford basic necessities like housing, healthcare, and education, further deepening inequality.

High levels of inequality can hinder economic growth. When a large portion of the population is unable to invest in education, healthcare, and entrepreneurship due to lack of resources, it can stifle innovation and reduce overall productivity.

Wealth concentration allows the rich to exert more influence over political processes, often leading to policies that favor the wealthy at the expense of the broader population. This can undermine democracy and lead to policies that perpetuate or even worsen inequality.

Therefore, the problem of income inequality and its impact on various socio-economic indicators is extremely acute now.

Our research aims to cluster countries by inequality level, analyse differentiation and identify the relationship between the level of inequality in countries and their carbon footprint.

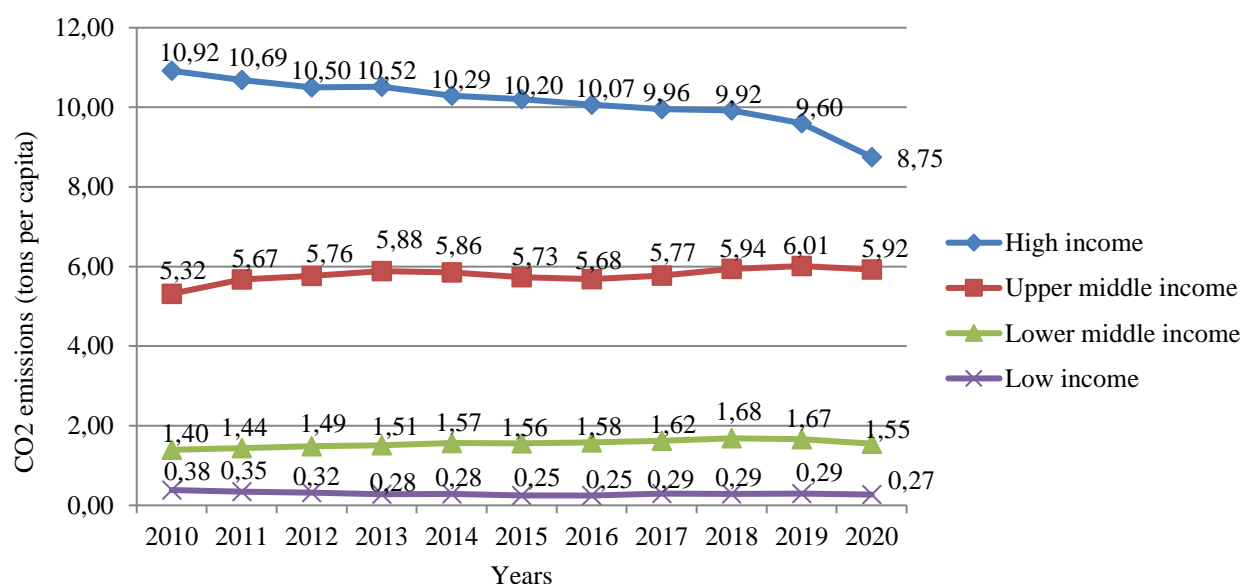
1 Methodology and Data

We clustered countries by economic development level and income inequality level based on such indicators as GDP per capita; Gini index; income quintile share ratio S80/S20 for disposable income; income share held by highest 10%; income share held by lowest 10%. The sample included 38 European countries for the period 2010–2020. Data was taken from such official websites as World Bank, Our World in Data, OECD data.

2 Results

The problems of economic development and deepening income inequality at the present stage are closely correlated with environmental pollution. The relationship between income inequality and environmental pollution is studied by scientists such as Bruckner B., Fan M., Feng K., Gao X., Hubacek K., Rai S., Rawat A., Shan Y., Zhong H. and many others. The Figure 1 shows that the higher income of the country, the higher the level of CO₂ emissions. Low income countries emit 0,38 tons CO₂ per capita in 2010, but high income 10,92 tons. In 2020 low income countries emit 0,27 tons CO₂ per capita and high income 8,75 tons.

Fig. 1: CO₂ emissions per capita in high, upper middle, lower middle and low income countries



Source: own processing based on (The World Bank, 2023).

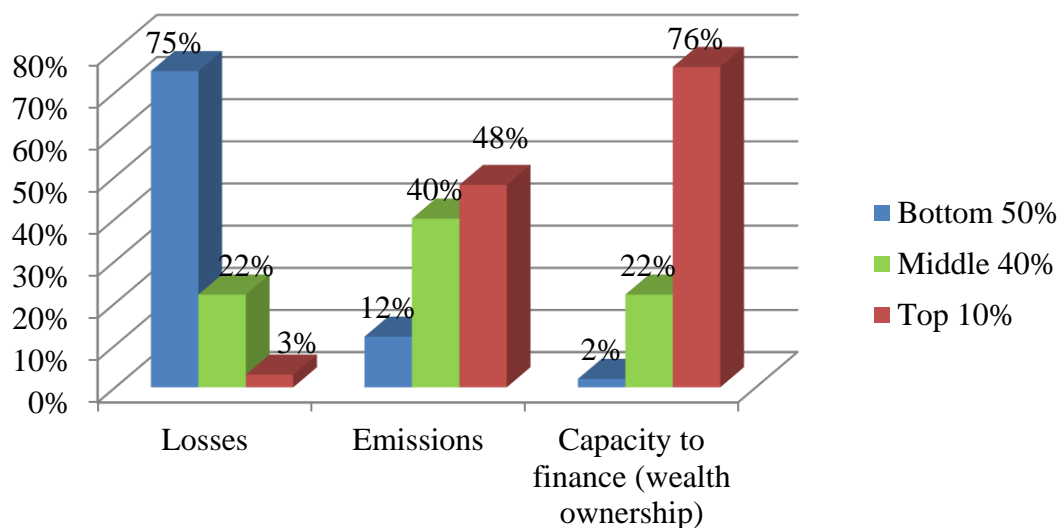
The rich people have more air travel and have yachts resulting in significant greenhouse gas emissions. The world's richest 10% were responsible for a half of global greenhouse gas emissions. Just the richest 1% of people emit 17% of emissions, almost twice as much as the poorest 50% emit only 12% in 2019 (World Inequality Report, 2022). The richest 10% of the world consumes 20 times more energy than the poorest 10%. The richest 10% of people buy 56% of auto fuel, 70% cars, 76% tours. But it is the poor who will be the first to face the consequences of climate change, although they are the least responsible (Oxfam and Stockholm Environment Institute "The carbon inequality era", "Confronting carbon inequality", 2020).

It's important to recognize that high emitters exist in low- and middle-income countries, just as low emitters can be found in wealthy nations. For example, in Europe, the

bottom 50% of the population emits about five tonnes of carbon per person annually, while in East Asia it's around three tonnes, and in North America, about 10 tonnes. In stark contrast, the top 10% of emitters in these regions are responsible for much higher emissions – 29 tonnes in Europe, 39 in East Asia, and 73 in North America.

Notably, the poorest half of the population in wealthy countries is already at or near the 2030 climate targets set by their governments, when measured on a per capita basis. This is not true for the top half of the population, highlighting significant inequalities in emissions. These disparities suggest that climate policies should focus more on wealthy polluters. However, current measures, like carbon taxes, often disproportionately affect low- and middle-income groups while leaving the consumption patterns of the wealthiest largely untouched (World Inequality Report, 2022). A comparison of the global bottom 50%, middle 40%, and top 10% in terms of emissions, financial capacity, and climate action responsibility underscores the striking climate inequalities (Figure 2). The top 10% of emitters account for nearly half of all global carbon emissions, meaning that the emissions from the bottom 90% of the global population are only slightly higher than those from the top 10%.

Fig. 2: Global carbon inequality, share of world total



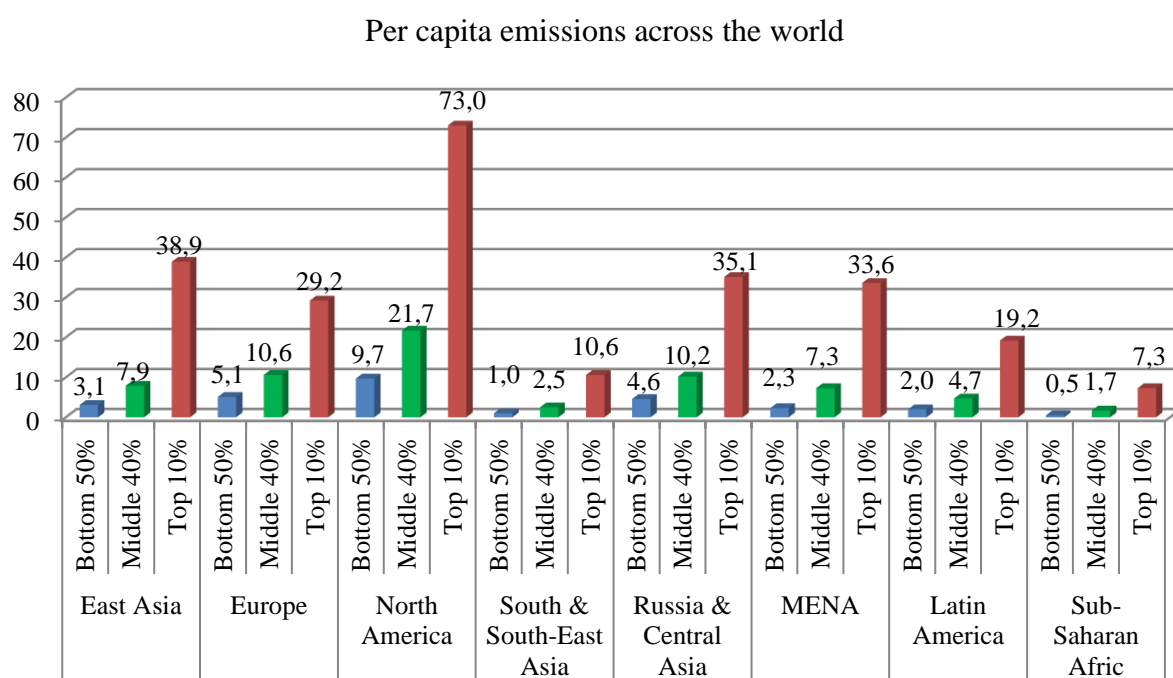
Source: own processing based on Climate Inequality Report 2023 (Chancel, 2023)

According to Chancel (2023), the top 1% of the global population is responsible for more than one-sixth of global emissions, with per capita emissions over 16 times higher than the global average in 2019. This means that the total carbon emissions generated by the top 1% far exceed those of the entire bottom half of the global population. In other words, the

consumption and investment choices of a small fraction of the population are causing significantly more environmental damage than those of the entire bottom half of the world's population combined (Figure 3).

Rich people can influence national decision-making in favour of their interests (lobbying) and to the detriment of the environment. They receive income from investments in production and are interested in growing consumption. As a result, the environmental state is deteriorating. The wealthiest groups have higher incomes than expenditures, and their savings and investments lead to significant additional environmental impacts. For example, Canada, which has an inequality coefficient of 9,4, emits 14,2 tons of CO₂ per person per year, while Sweden, which has a lower inequality coefficient (6,2), emits 5,5 tons of carbon dioxide per person.

Fig. 3: Per capita emissions across the world



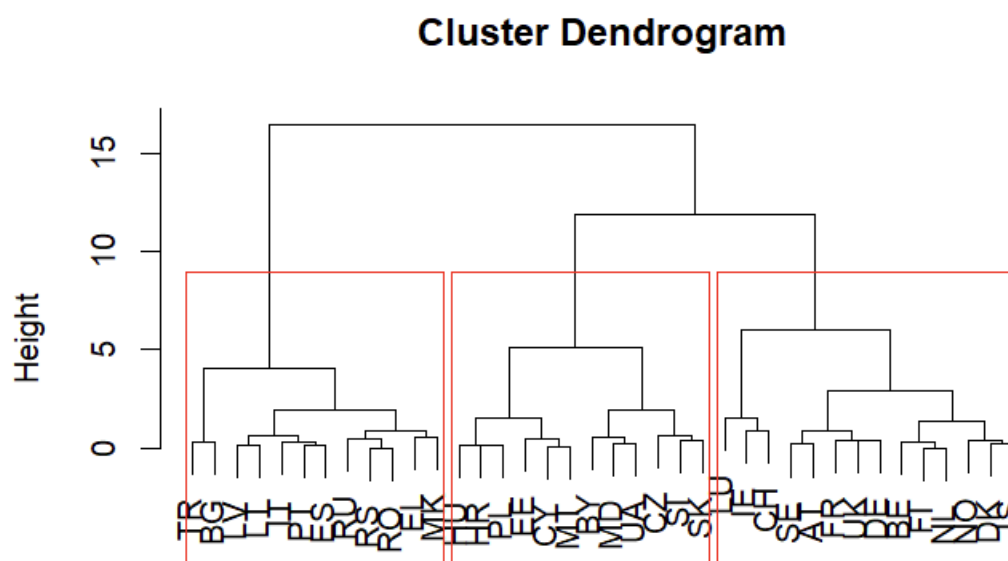
Source: own processing based on (World Inequality Report, 2022).

The higher the income inequality level, the more resources are consumed in the country and the more waste is generated. For example, in Sweden, with an inequality coefficient of 6,2, the annual amount of waste per person is 513 kilograms. In Switzerland, with an inequality coefficient of 7, there are already 728 kilograms of waste per person. In

Singapore, where the inequality coefficient is 18, the waste rises to 1072 kilograms per person per year.

As part of the study, we clustered countries by economic development level and income inequality level. The obtained cluster dendrogram of countries in 2020 is presented in Figure 4.

Fig. 4: Cluster dendrogram of countries in 2020



Source: own processing

The countries included in each of the clusters are presented in Table 1.

Tab. 1: The countries included in each cluster in 2020

Cluster number	Country	Cluster representative
Cluster 1	DK, FI, IS, IE, NO, SE, UK, AT, BE, FR, DE, LU, NL, CH	FR
Cluster 2	EE, HR, CY, MT, SI, BY, CZ, HU, MD, PL, SK, UA	PL
Cluster 3	LV, LT, EL, IT, MK, PT, RS, ES, TR, BG, RO, RU	TR

Source: own processing

So, countries with a high level of economic development and the lowest level of income inequality belong to cluster number 1. Countries with a low level of economic development and the highest level of income inequality belong to cluster number 3.

As a result of calculations, it was obtained that the representative of cluster №1 is France (sum of distances equals 47,59). A more detailed picture of income inequality in France is presented in Table 2.

In France, the bottom 50% of earners make €PPP 16.500 (€17.430), while the top 10% earn on average seven times more (€PPP 117.000 or €123.610). This income gap between the bottom 50% and the top 10% is narrower than in some other European countries, such as Germany (where the gap is 10 times), and is similar to that of the UK (8,8 times).

Tab. 2: Inequality outlook of France

Income group	Income		Wealth	
	Avg. income (PPP EUR)	Share of total (%)	Avg. income (PPP EUR)	Share of total (%)
Full population	36.300	100	228.000	100
Bottom 50%	16.500	22,7	22.300	4,9
Middle 40%	40.900	45,1	203.100	35,6
Top 10%	116.900	32,2	1.355.800	59,5
Top 1%	357.000	9,8	6.162.900	27,0
Top 10% to Bot. 50% Income gap			1 to 7	
Female labour share			41%	
GHG footprint			8,7 tCO ₂ / pers.	
Transparency index			15 / 20	

Source: own processing based on (World Inequality Report, 2022).

For Poland, which belongs to the second cluster and is its representative, the inequality outlook is shown in Table 3.

Tab. 3: Inequality outlook of Poland

Income group	Income		Wealth	
	Avg. income (PPP EUR)	Share of total (%)	Avg. income (PPP EUR)	Share of total (%)
Full population	26.600	100	49.400	100
Bottom 50%	10.400	19,5	-700	-0,7
Middle 40%	28.500	42,8	48.000	38,9
Top 10%	100.400	37,8	305.300	61,8
Top 1%	395.800	14,9	1.497.300	30,3
Top 10% to Bot. 50% Income gap			1 to 10	
Female labour share			40%	
GHG footprint			9,4 tCO ₂ / pers.	
Transparency index			8,5 / 20	

Source: own processing (based on World Inequality Report, 2022).

In Poland, the bottom 50% of earners receive 19,5% of the total income, while the top 10% earn nearly 38%, which is about 10 times more. Income inequality in Poland is relatively high for a European country; the share of income held by the top 10% is similar to that in Germany but significantly higher than in other neighboring countries. When it comes to household wealth, Poland ranks low compared to Western European countries and is average within Eastern Europe. The wealthiest 10% hold 62% of the total wealth, while the middle

40% own 39%. In stark contrast, the bottom 50% have a negative average wealth (-1% of the total), meaning this group has more debts than assets.

Inequality outlook of Turkey, which belongs to the third cluster, is shown in Table 4.

Tab. 4: Inequality outlook of Turkey

Income group	Income		Wealth	
	Avg. income (PPP EUR)	Share of total (%)	Avg. income (PPP EUR)	Share of total (%)
Full population	27.400	100	39.100	100
Bottom 50%	6.500	11,9	2.900	3,7
Middle 40%	23.100	33,6	28.200	28,9
Top 10%	149.400	54,5	263.800	67,5
Top 1%	516.700	18,8	1.442.500	36,9
Top 10% to Bot. 50% Income gap			1 to 23	
Female labour share			23%	
GHG footprint			6,3 tCO ₂ / pers.	
Transparency index			3 / 20	

Source: own processing (based on World Inequality Report, 2022).

In Turkey, the top 10% of earners make, on average, 23 times more than the bottom 50%. The top 10% accounts for 54,5% of the total income, while the bottom 50% receives just 12%. In 2021, the distribution of national wealth was similarly skewed, with the bottom 50% holding 4%, the middle 40% holding 29%, and the top 10% holding 68% of the total wealth. We also examined the average CO₂ emissions across different income groups and compared the emission levels in various countries within each cluster, considering the inequality levels in these countries. The average CO₂ emissions for different population groups, including carbon embedded in both consumption and investment portfolios are presented in Table 5.

Tab. 5: Carbon table, avg. GHG footprint (tCO₂e/capita)

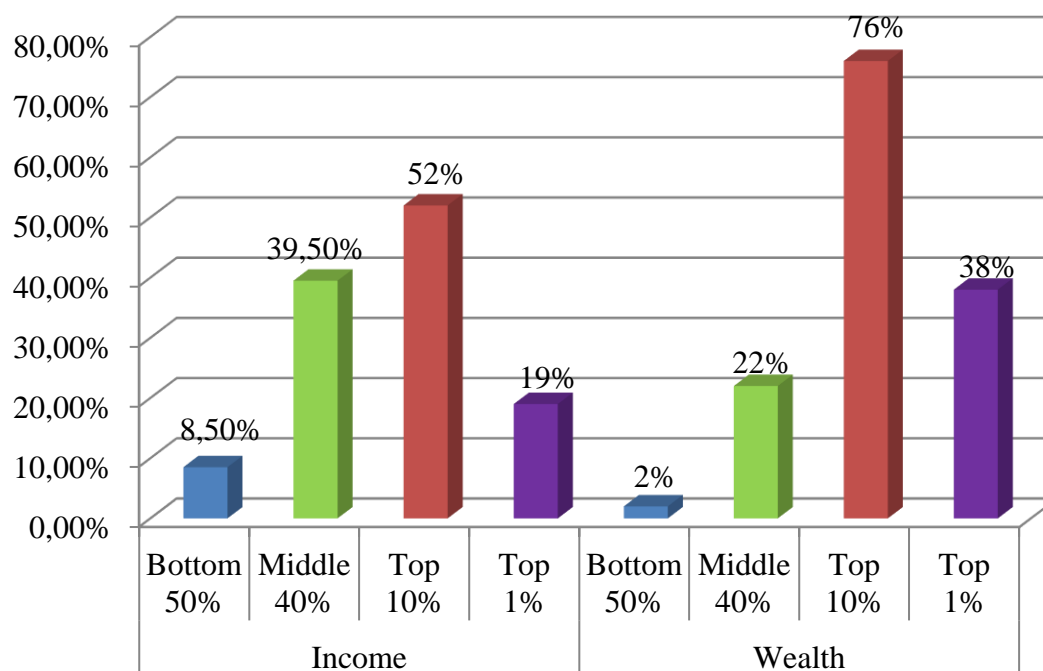
Income group	1 cluster			2 cluster	3 cluster	
	France	United Kingdom	Germany	Poland	Russia	Turkey
Full population	8,7	9,9	11,3	9,4	12,3	6,3
Top 1%	77,5	76,6	117,8	91,8	186,1	75,0
Top 10%	24,7	27,7	34,1	27,2	41,7	22,6
Middle 40%	9,3	10,9	12,2	10,2	11,7	6,3
Bottom 50%	5,0	5,6	5,9	5,3	6,8	3,1

Source: own processing based on (World Inequality Report, 2022).

Conducted analysis of statistical data on income inequality and wealth inequality levels shows a significant difference between income and wealth inequality. For example, in

France, the richest 1% owns 9,8% of income, but 27% of wealth. In Poland, this ratio is 14,9% and 30,3% respectively. In Turkey, 18,8% and 36,9%, in Russia 21,5 and 47,7 respectively. The comparison of global income and wealth inequality is presented in Figure 5.

Fig. 5: Global income and wealth inequality



Source: own processing based on (World Inequality Report, 2022).

Comparing even the countries that belong to cluster 3 (Russia and Turkey) we can see that in Turkey 1% of the richest people own 18,8% of income, and in Russia 21,5%. In Turkey, the richest 10% of people own 54,5% of all income, and in Russia 46,4%, that is, not a very significant differentiation in income inequality in Russia and Turkey. However, if we analyse the emissions of these population groups, we will see that in Russia the richest 1% of the population emits 186,1 tCO₂e/capita, and in Turkey 75 tCO₂e/capita. Similarly for the first cluster, in the United Kingdom the top 1% of the rich emits 76,6, and in Germany 117,8 tCO₂e/capita, which is 53,7% more.

Conclusion

We clustered countries by level of economic development and level of income inequality, as a result of which 38 European countries in 2020 were divided into three clusters depending on the size of the income gap. We identified a significant difference between countries in the inequality level and, more importantly, in the level of carbon footprint left by the richest group of people. As part of further research, we want to model and predict the quantitative

impact of income level on environmental quality based on an analysis of the level of greenhouse gas emissions and the level of economic development of countries and the income inequality level.

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