

Correlation Between Carbon Emission Treaty and Inequality

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Abstract: The paper discusses the relationship between the imposition of international carbon emission treaties and economic inequality. The paper draws a positive correlation between carbon emission treaties and economic inequality, the matter is most pronounced in developing countries. The substantiation, realization, and understanding of the relationship is crucial in the modern context. Following the pace of globalization, a thorough comprehension of the concept of inequality is quintessential to the resolve of international conflicts and/or affairs. As countries grow increasingly correlated, it is in the stakeholder's common interest that historical legacies can be objectively evaluated and thus have the inter-nation historical discrepancies recognized and thereby worked upon; thus, the carbon emission historical discrepancy and the treaties that further inequality across the globe is of utmost importance to be researched, and discussed upon.

Keywords: carbon emission, economic inequality, developing countries, developed countries, China, pollution

1. Introduction

In this study we derive correlations between carbon emission treaty topics and human development index. We elicit potential connections to carbon emission topics of carbon emission treaties and inequality of a diverse kind - notably economic and human development index. We elicit potential connections to carbon emission quantity from several distinguished aspects between developed and developing nations - demographic (population), technology, and historical carbon emission production discrepancy. We then relate the carbon emission figure to the accounting method of carbon emission treaties, thereby highlighting carbon emission treaties' role in proliferating the existing inequality.

2. Literature Review

The 3.1 billion people who make up 50% of the world's poorest population generate just 7% of the cumulative emissions that are harming the planet. Meanwhile, the 63 million people who make up the world's richest 1% generate more than double that amount, or 15% of the total.

—— Joseph Opoku Gakpo

Global warming has amassed immense recognition over the past century. As a side product of industrial production, carbon emission is invariably associated with economic development. The correlation between carbon emission and economic growth has been substantiated as the trend for

major economic powerhouses such as China, Japan, and the USA [1]. Non-renewable energy consumption, from which carbon emission derives, has also displayed a statistically significant positive correlation with economic development, using BRICS countries as sample [2]. This is about inequality between different classes. The world's poor and marginalized people are suffering the most from climate change impacts, though they contribute the least to the carbon emissions that are driving global warming, this is furthered by the imposition of carbon treaties as the lesser endowed have their growing potential artificially inhibited.

3. Pollution and Population

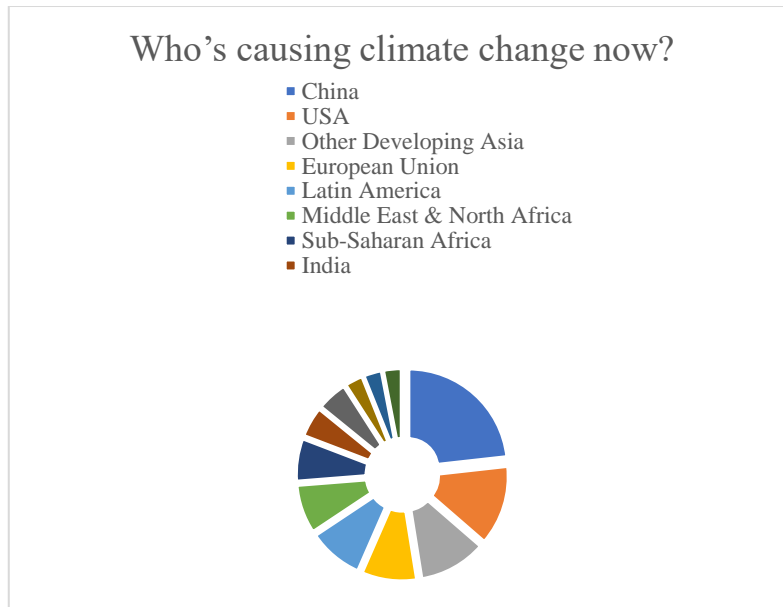


Figure 1: The annual carbon emission from developed and developing countries [3].

Figure 2 is the inequality between the per capita carbon emissions of developing countries and developed countries. Taking China as an example, it can be seen that developing countries account for a large proportion of the total carbon emissions, but the per capita carbon emissions can be enjoyed.

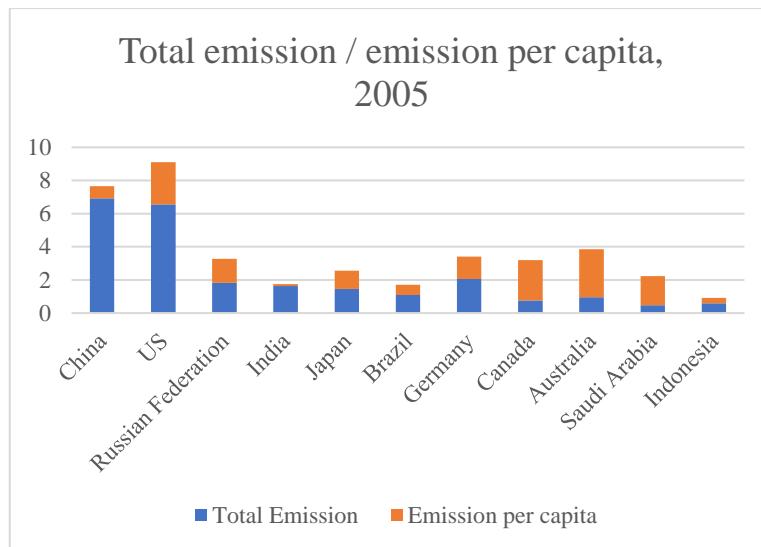


Figure 2: Total emissions and emissions per person.

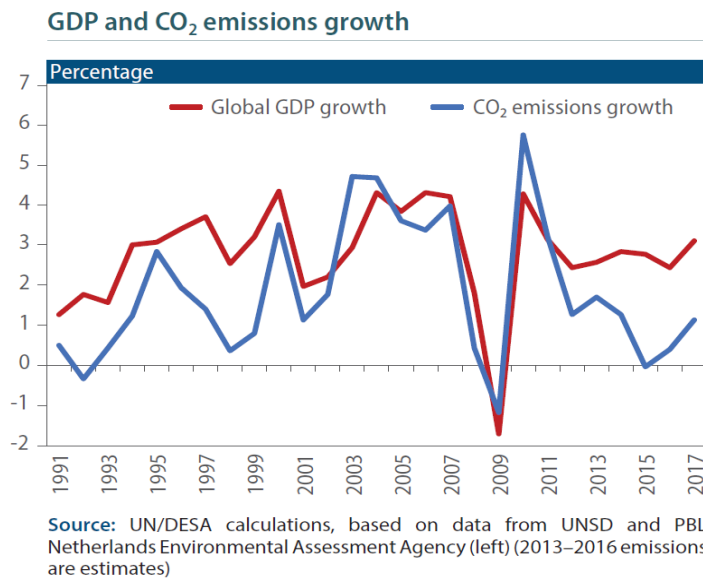


Figure 3: The relationship between economics growth and carbon emissions (source) [4].

Evidence came from the research shows that energy use has a positive impact on the carbon dioxide emissions for all the panels. Indeed, the effect of GDP per capita on carbon is positive and statistically significant at the global level, in Europe and North Asia, as well as in the Middle East, North Africa and Sub-Saharan Africa.

4. Technological Discrepancy

In modern society, technology has penetrated all areas of the national economy and even human society, profoundly changing people's production methods and lifestyles. Technological change is the most important factor that determines the rate of economic growth. It plays a more important role than capital formation. It is the technological change which can bring about continued increase in output per head of the population. Thus, it is the prime mover of economic growth.

Historically, technology has been an important factor in economic growth as the introduction of new technology into manufacturing processes increases productivity, enabling each labour hour to produce a greater output. This increases national output and national income where the producers have access to international markets for their products. The industrial revolution in the United Kingdom, for example, was built on groundbreaking inventions in industries such as textiles and iron and steel, leading to developments in transport such as railways and increasing national income to create the largest economy in the world in the 19th century.

Table 1 gives the percentage increase in labor productivity in several countries during the period 1970-1989. By bringing about an increase in productivity of resources, the progress in technology makes it possible to produce more output with the same resources or the same amount of output with less resources. Progress in technology causes improvement in technology through the provision of better machines, better methods and enhanced skills. This is the age of technology. The developing countries are obsessed by the desire to make rapid progress in technology to catch up with the present-day developed countries. Frantic efforts are being made to install improved technology in agriculture, industries, health, sanitation and education, in fact in all walks of human life. Indeed, the newly emerging nations have come to regard technology as a bastion of national autonomy and as a status symbol in the international community.

Table 1: Percentage increase in Labor Productivity, 1970-1989.

| Country | Increase % |
|----------------|------------|
| United States | 2.9 |
| Canada | 2.5 |
| Denmark | 3.3 |
| France | 4.1 |
| Italy | 4.9 |
| Japan | 6.0 |
| Netherlands | 4.9 |
| Sweden | 2.9 |
| United Kingdom | 3.8 |
| Germany | 3.2 |

Existing studies have shown that there is a huge correlation between technological development and economic growth, but it is not possible to pursue economic growth without paying attention to the environmental issues arising from development, as shown in Figure 4, total carbon dioxide emissions rose from less than 500 million tons at the beginning of the 20th century to 3.5 billion tons in 2017, with far-reaching effects on the environment, for example, as shown in Figure 2, the sea level rose from -2 meters to 8 meters in 1880 and 10 meters in the last 120 years.

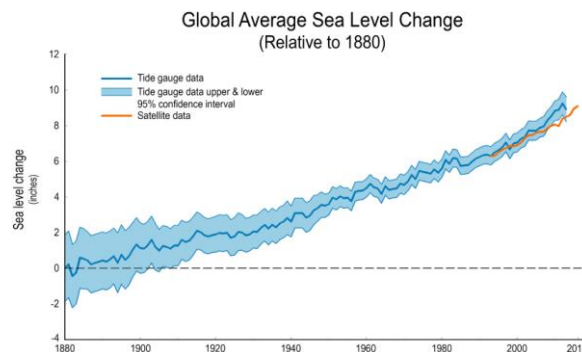


Figure 4: Average Sea Level Change, 1880 – 2016.

However, social development and economic growth are not in conflict with the protection of the environment. The emergence of new energy technologies provides us with a new path - the use of renewable energy technologies to maximize economic development while protecting the environment. From 2011 to 2021, the share of renewable energy in the global electricity supply grows from 20% to 28%. More than 20% of the energy supply in many countries in the world already comes from renewable energy, and more than half of the electricity in some countries comes from renewable energy [5]. In a few countries, all electricity comes from renewable energy. It is expected that the national renewable energy market will continue to grow strongly in 2020 and beyond. Studies have shown that the global transition to 100 per cent renewable energy is feasible for all sectors and economically feasible - electricity, heat, transport and desalination. Renewable energy exists in a wide geographical area, while fossil fuels are concentrated in a few countries.

The application of renewable energy and energy efficiency technologies is producing significant energy security, climate change mitigation and economic benefits. However, renewable energy is being hampered by hundreds of billions of dollars in fossil fuel subsidies. Renewable energy sources such as solar and wind have received strong support in international opinion polls. But the

International Energy Agency says in 2021 that more efforts are needed to increase renewable energy in order to reach net zero carbon emissions, and calls for an annual increase in electricity generation of about 12 percent by 2030.

However, in the 21st century, because of the different levels of scientific and technological development, there is still a large gap between the level of renewable energy science and technology in developing countries and that in developed countries. Under the condition of economic globalization, the industrial development mode is decomposed according to the industrial chain and distributed globally according to the comparative advantage. Therefore, developed countries and developing countries enter the new energy industry almost simultaneously, but developing countries only undertake the low technology content part of the link, while developed countries control the core technology and occupy the new energy market. As shown in this chart below, the table of the World Patent Organization statistics about new energy sources added to the patent shows that in 2010-2019. As can be seen from the chart, most of the new patents on new energy technologies come from developed countries, with only China being among developing countries.

As shown in table 2 below, the table of the World Patent Organization statistics about new energy sources added to the patent shows that in 2010-2019. From the chart, most of the patents on new energy technologies come from developed countries, and only China is on the list among developing countries. But in most developing countries, new energy technologies generate the vast majority of their total electricity production. Costa Rica, for example, accounts for more than 90% of the country's total energy production from renewable sources [6]. These figures, due to this technological divide generated by the monopoly of new energy technologies in developed countries lead to an increase in carbon emissions in developing countries and make them dependent on technologies from developed countries. As can be seen from the graph below, thanks to developed new energy technologies, most developed countries have lower carbon emissions per capita than developed countries, except for the United States.

Table 2: The renewable energy patent figure of top 10 countries 2010 - 2019.

| Top Origins | Total Renewable | Solar | Fuel Cell | Wind Energy | Geothermal |
|-------------------|-----------------|-------|-----------|-------------|------------|
| Japan | 9,394 | 5,360 | 3,292 | 702 | 40 |
| U.S. | 6,300 | 3,876 | 1,391 | 927 | 106 |
| Germany | 3,684 | 1,534 | 813 | 1,309 | 28 |
| Republic of Korea | 2,695 | 1,803 | 506 | 360 | 26 |
| China | 2,659 | 1,892 | 189 | 55 | 23 |
| Denmark | 1,495 | 52 | 81 | 1,358 | 4 |
| U.K. | 709 | 208 | 271 | 218 | 12 |
| Spain | 678 | 341 | 29 | 300 | 8 |
| Italy | 509 | 316 | 57 | 123 | 13 |

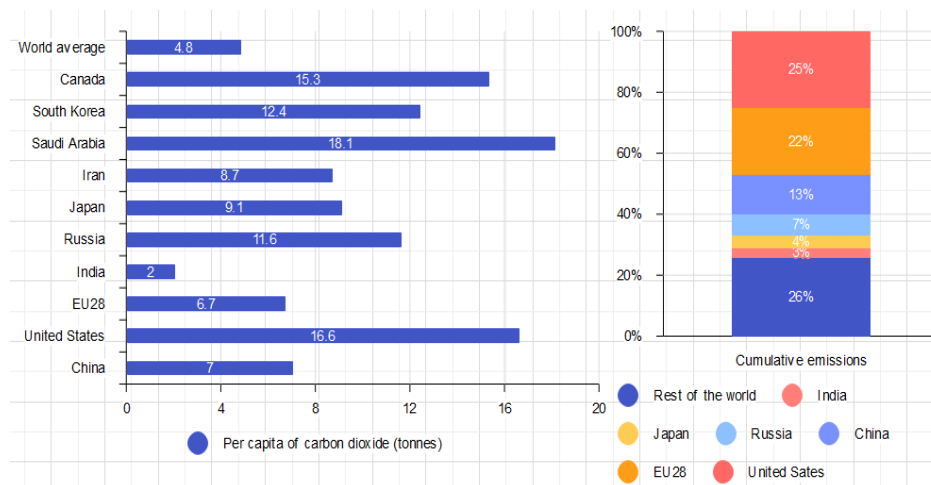


Figure 5: Carbon emission of specific countries.

5. Carbon Emission - Historical Advantages

Inequality is also embodied in the historical advantages of developed countries. First of all, we can be sure that the developed countries developed earlier decades ago. This means that when the developed countries are faced with questions about development and environmental pollution, climate pollution is not a hot topic. The situation faced by developed countries in the 20th century is far different from that of developing countries in the 21st century. Because climate pollution and climate problems only become prominent after the accumulation of time, the developed countries in the 20th century will not be hindered and condemned by excessive carbon emissions in the process of development. Nowadays, the developing countries in the 21st century are under strict control in their development because of the different backgrounds of the times. The other reason which shows that developed countries have historical advantages is the positive correlation between energy consumption and economic growth. Different countries sometimes have peak carbon emissions in different periods, which depends on the unique development progress of each of them. Many developed countries have reached the peak of carbon emissions, and they won't have many concerns about the next carbon emission restrictions. On the contrary, due to the needs of economic development and population growth, the peak of carbon emissions in many developing countries comes later, which means that they have to face the challenge of the international community to strictly limit their carbon emissions.

Firstly, we can be sure that the cumulative carbon emissions of the United States and the European Union account for about half of the global total. However, even though China is the country with the largest carbon emissions at present, its carbon dioxide emissions only account for 11% of the global total [7]. Developed countries have already enjoyed the development opportunities brought by time, but they still choose to use fossil fuels with the highest efficiency and the largest carbon emissions to meet industrial needs. From here, we can conclude that huge carbon emissions are closely related to the country's application of efficient fossil fuels. And efficient fossil fuels bring rapid economic growth to a country. So we can conclude that when a country wants to significantly reduce its carbon dioxide emissions, it must slow down its economy. Developed countries are still reluctant to slow down their economies and reduce carbon emissions on the premise of huge advantages. Instead, they pour the responsibility on developing countries, which makes inequality manifest in the international community. The long-term carbon emission of developed countries has made the goal of carbon reduction the common responsibility of the world, which has led to the climate crisis of the times.

From another angle, developed countries have a higher human development index. Therefore, it is not particularly difficult for them to save energy and reduce emissions, which is a carbon emission transition process. They have enough human resources and financial resources to develop new energy and clean energy, and more scientific and technological research and development can also make them relatively stress-free through the carbon emission transition process. However, in order to achieve rapid economic development, poverty eradication and wide integration into the global value chain, the transition of carbon emissions in developing countries is even more difficult. Developing countries need more time and cost to achieve the transition of carbon emissions.

6. Carbon Emission - Inequality

The low comprehensive transition rate fundamentally contradicts the time constraint of carbon emission reduction. As the climate change phenomenon grows more irreversibly dire as the cumulative carbon emission is raised, the call for an accelerated carbon peak and eventually carbon equality forces developing nations to re-shift their focus. From a domestic aspect, developing nations have a relatively low renewable energy usage rate, the major polluter, China, holds a figure of 12% in terms of renewable energy plotted against aggregate energy use [8]. The number lags far behind the USA's percentage of 23% [9], which is considered moderately moderate given certain European countries like Norway had attained 98% renewable energy source [10]. Thus, developing countries have a great progression to catch up, which is limited by the resources available and time itself as aforementioned. Given the size of developing nations, mere imports of renewable energy power stations would not suffice the heavy demand for carbon emission reduction; whilst autonomous research, upon little or no empirical basis, could take multiple years, as proven by the World Patent organization (that only one developing country, China, the economic powerhouse, was able to produce as much renewable energy patent as the developed countries); the autonomous approach would be extended if the penetration rate is to be considered on a national scale, or at least to the level which supports countries like China to reach their carbon peak in 2030 despite eras of such rapid economic growth, once again, given the attributes of an exponentially larger population - the world bank identifies 81 developed countries as "highly developed countries", 64 countries exceed the threshold of an HDI index of 0.8, UN identifies those as countries with "high human development", they have a population of near 1.6 billion; whilst developing countries tally up to roughly 150, with a population count of above 6 billion. In short, the developed nations essentially have an exponentially lower population figure, while having a high GDP per capita average and technological coverage, the transition from non-renewable energy sources to renewable energy sources would take less of a toll on the latter.

Developing countries, upon having lower average productivity and economic development, also must limit their energy consumption - the primary element derived from carbon emission which had proven to have a bi-directional relationship with economic growth - not only for external, trading concerns but also with internal consideration to public health. A middling position is taken by developing countries, nevertheless, given the developing nation's tendency of high population, to contribute to the carbon emission treaty by controlling the aggregate emission count, the carbon emission per capita must be monitored - at an unusually low rate: South Asia, the home of several large developing countries like China and India, averages a number of 1.52 metric tons per capita, whilst North America averages about 14.25 tons and Euro area estimates to be about 6.11 tons [11]. The carbon emissions are primarily attributed to industrial uses - 24.2% to be exact. Industries collectively are a stark influencer of the HDI - it is the manufacturing of consumer and capital goods, and the source of raw materials that enables trade cycles among countries. Other contributors include transportation - 16.2%, Energy use in buildings - 17.5%, agriculture and livestock / manure - 9.9% [12]. There might be slight variations regarding the weighting of the contributors given national

differences, nevertheless the energy consumption structure of developing countries would be highly similar to those of a developed country. The factors would demonstrate complex and significant influences, to say with reduction, transportation would be the single most crucial element in terms of international trade, which grows to prime importance due to globalization; Energy used in buildings primarily concerns thermal monitoring and electronics which attributes to arguably the HDI and productivity of the individuals; Whilst agriculture and husbandry directly impacts the HDI as it directly determines the life expectancy and literacy rate given adequate nutrition's impact on an individual's cognitive and physical ability.

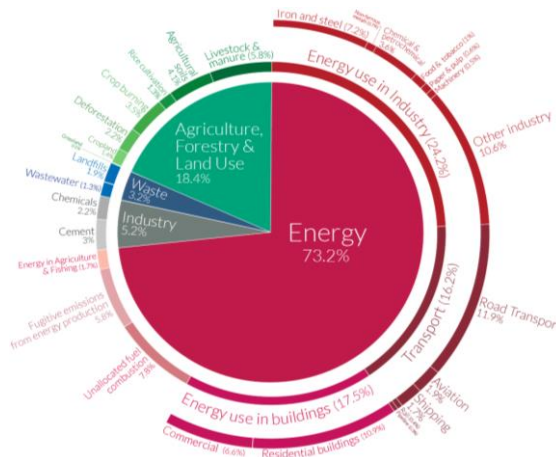


Figure 6: The global greenhouse gasses emissions by sector (source) [11].

Ultimately such discrepancy furthers the existing inequality. Developed nations, having peaked their carbon emission previously, attract little international attention. Whilst developing countries are obliged to make heavy compromises in the energy industry, hindering their economic output and affecting the livelihoods of their citizens - low infrastructure development, raised prices of living, etc. As aforementioned such a discrepancy has well come into shape, the presence of the carbon emission treaty aggravates such inequality: the treaties take into account solely the aggregate carbon emission count, thereby forgoing the possible implications carbon emission per capita could have upon the inequalities measured - developing countries' high economic growth often reduced to low GDP increase per capita. a disproportionate amount of regulations onto regions that simultaneously produce an expected higher count of carbon emission.

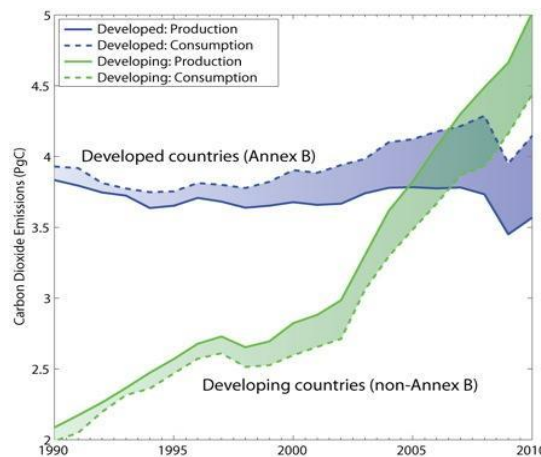


Figure 7: Annual carbon dioxide emissions trend between developed and developing countries, 1990 – 2010.

7. Conclusion

Throughout the research, it is found that there is a causal relationship between the derivatives of the carbon emission reduction treaties and primarily economic and Human development inequality. It is the logic that carbon emission, especially in the form of non-renewable energy consumption, displays a proven and existing bi-directional relationship with economic development, which then extends into a multifarious influence on various types of inequality. The presence of the historical advantages, which is neglected throughout the process of the calculation of carbon emission responsibility, pivots unequal pressure of carbon emission reduction towards the side of the developing countries. This, in combination with the factual technological ineptness of the developing country, double downs on the inequality that expresses itself via the route of carbon emission treaties. As they indirectly limit the economic development of countries with an existing general weak level of human and capital basis.

Certain limitations of this research would be the lack of extensive data, the pinpoint of research was inevitably directed towards China, a developing country of international relevance, therefore could be less applicable upon certain developing countries that may have a different economic structure and such. Gazing into the future, potential studies may analyze climate change treaties' effectiveness and consequences of violation, therefore it allows a more comprehensive view regarding a country's efficient take on this dilemma.

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