

Analysis of the related with different

Yisheng
Shixiang

factors of CO₂ emission

economic levels

Sun

Gao

I. Introduction

Carbon dioxide, as a major greenhouse gas, has been an important target of energy conservation and emission reduction. Even though most of the carbon dioxide is absorbed in the natural carbon cycle, since the industrial revolution, the concentration of carbon dioxide in the atmosphere has continued to rise due to human's burning of fossil fuels and other reasons.

So our team wanted to explore whether the factors that affect CO_2 emissions are different in countries with different economic levels.

II. Methods & Data

Firstly, according to the overall comparison of national development (developed, developing), determine whether per capita carbon emissions is truly related to national economic situation.

Then we will analyze the relationship between the change of carbon dioxide emissions of Argentina (a developed country turned into a developing country) and the change of GDP in time dimension. We will plot and analyze the correlation between them.

Then determine whether the impact weight of different independent variables on per capita carbon emissions is the same in countries with different levels of development, and try to fit an equation. There are three main sources of carbon emissions: human

activity, livestock, and ecosystems. In order to simplify the model, we choose to use their main part to represent them.

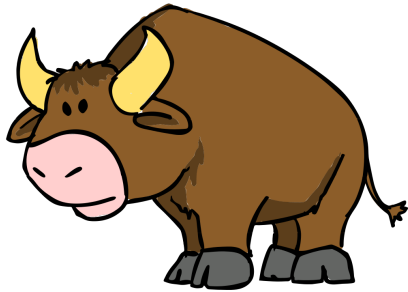
Car ownership per thousand people —————> Human activity

Car is an important representative of human industry. The burning of fossil fuels in the process of car manufacturing and driving is accompanied by a large amount of greenhouse gas emissions, including CO₂. Therefore, we want to explore whether car ownership is related to CO₂ emissions.



From www.cn.dreamstime.com

Cattles ownership per thousand people —————> Livestock



It is reported that a cow weighing about 500 kilograms can emit 800 to 1,000 liters of methane per day, which is equivalent to 4,600 kilograms of carbon dioxide. That's equivalent to the carbon footprint of a car running 24,000 kilometers on 8 liters of fuel per 100 kilometers. Therefore, the number of cattle is also an important research factor.

Forest coverage as a percentage of land area —————> Ecosystem

Forest coverage area has a great influence on carbon dioxide emission purification. As the larger the land area is, the larger the forest area will be, so the use percentage weakens the influence brought by the land area.

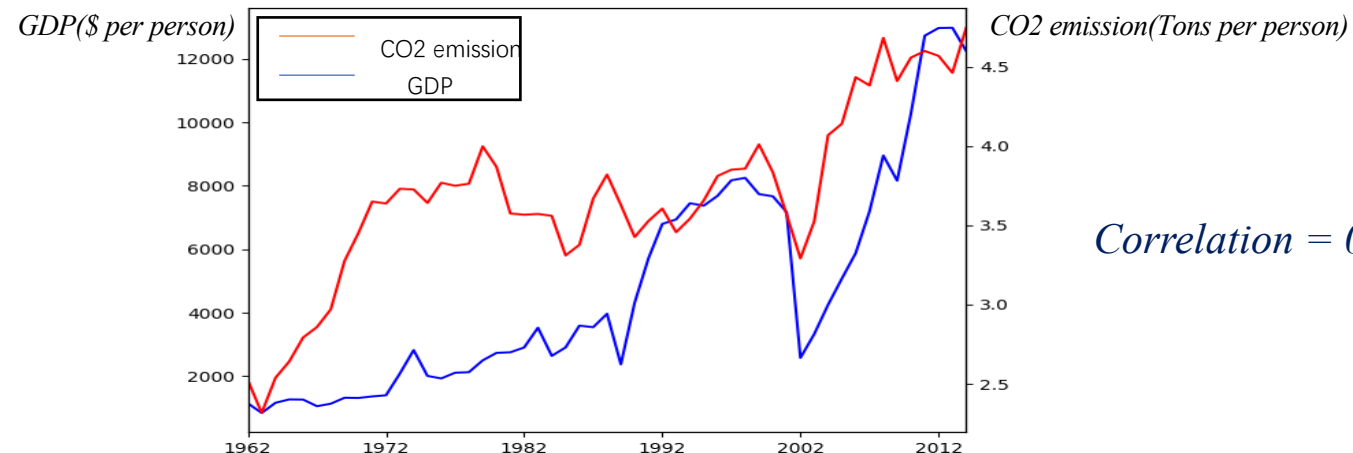


III. Results

The condition of CO2 emissions comparison of countries with different income levels are listed below:

	Sum emissions	Highest emission country	Highest emissions	Lowest emission country	Lowest emissions
High income: OECD	2.588373e+08	United States	1.179918e+08	Iceland	46944.934
High income: nonOECD	1.581112e+07	Saudi Arabia	7.009760e+06	Turks and Caicos Islands	1503.470
Low income	5.485641e+06	Korea, Dem. Rep.	3.104479e+06	Comoros	2068.188
Lower middle income	6.272726e+07	India	2.681828e+07	Kiribati	601.388
Upper middle income	2.100775e+08	China	9.809777e+07	Niue	80.674

Argentina's economic change and CO2 emission curve 1962 ~ 2014:



Correlation = 0.72

The fitting results of three independent factors in countries with different economic levels:

	Country Name	Number_of_cars_per_thousand_people	Forest_Land_Percentage_of_all_land	Heads_per_thousand_people
0	United States	797	33.869659	280.267693
1	Liechtenstein	750	43.125001	161.876801
2	Iceland	745	0.477806	207.748651
3	Luxembourg	739	35.679011	348.043119
4	Australia	717	16.198664	1246.196266
5	New Zealand	712	38.554555	2257.826906
6	Malta	693	1.093750	35.024093
7	Italy	679	31.424492	100.207044
8	Guam	677	46.296296	0.869743
9	Puerto Rico	635	55.540024	107.500296
10	Greece	624	31.216447	62.336968

Merged Data Frame

	co2_per_thousand
co2_per_thousand	1.000000
Number_of_cars_per_thousand_people	0.282887
Forest_Land_Percentage_of_all_land	0.057406
Heads_per_thousand_people	0.141470

Correlation coefficient between CO2 emissions in developed countries and various variables

$$C = 6.923X + 2.833Y + 0.532Z$$

	co2_per_thousand
co2_per_thousand	1.000000
Number_of_cars_per_thousand_people	0.591719
Forest_Land_Percentage_of_all_land	-0.071004
Heads_per_thousand_people	-0.039683

Correlation coefficient between CO2 emissions in developing countries and various variables

$$C = 14.696X + -20.7Y - 0.475Z$$

IV. Conclusion

- It can be clearly found that the per capita CO₂ emissions and total amount of developed countries are much higher than those of developing countries. It can also be concluded from the example of Argentina that there is a strong positive correlation between CO₂ emissions and GDP.
- Although there are many factors affecting CO₂ emissions, leading to the weak correlation coefficient of each variable, we can still see that if countries with different economic levels, the influence weight of different factors is also different. For example, Car ownership per thousand people is more relevant in developing countries, but it is not the main relevant factor in developed countries, which may be related to policies and conditions. These analysis results can provide some reference for different countries to control carbon dioxide emissions.

