PS367: Climate Change: Science and Politics of a Global Crisis

Short analysis paper: “What drives CO2 emissions?” (10%)

# Goal of the assignment and grading criteria

### This assignment has three goals

* Get you familiar with the international aspects of climate change – who is polluting?
* Get you thinking “causally” – thinking about DVs and IVs and why some countries are polluting more than others, why some are getting better over time and others are getting worse, and thinking about the IPAT equation and what explains why emissions are going up?
* Getting you to learn how to explore data and feel comfortable with it. It’s scary at first but doesn’t need to be. Work in groups of 2 or 3 people!

### Grading criteria

* Finding a good pattern. Good patterns are those that are interesting and come from seeing a pattern across SEVERAL countries, not just one or two.
* Demonstrate that you actually thought about the project. You can complete this in 5 minutes if you like but that is NOT the goal. The goal is for you to spend 1-2 hours just exploring the data because you are interested in it, not just to complete the assignment. You have *not done the assignment correctly* if you don’t have at least 2 moments where you say to yourself “Wow, that’s weird?” or “Hey, what explains that?” or “Dang, that is a bummer of a pattern that doesn’t bode well for fixing the climate change problem?”
* Make sure you do both parts of the assignment: identify the pattern AND explain it. Make sure your explanation makes sense and that you can explain it.

# Assignment

* Using the graphs/charts in the CO2 emission\_data.xlsx Excel workbook ***identify two interesting patterns related to climate change emissions***
* Using other graphs/charts in the Excel workbook, ***find data that explains the pattern you identified***
* *In 1000 words or fewer, explain both patterns that you observe.*
* You can include graphs of your data if you want to

# Example (this is too short but gives you a sense of what I am looking for

***Where did you find the data with the pattern?*** On the “CO2 graph”

***What is the interesting pattern you found?*** The two biggest emitters of CO2 are China and the US. What is interesting is that Chinese emissions since 1970 have increased much, much faster than US emissions. I looked at the “CO2” tab and calculated that US emissions in 2010 were 125% of the US level in 1970 (5433057/4328905= 1.25 or 125%) while China emissions in 2010 were 1074% of the Chinese level in 1970 (8286892/771617 = 10.74 or 1074%). So, US emissions were only 25% larger while Chinese emissions were 10 times larger.

***What appears to explain this interesting pattern?*** I looked at two different explanations. At first, I looked at population to explain this but both countries populations grew about the same amount between 1970 and 2010 – the US population grew by 51% and China’s population grew by 63%. Since China’s population only grew a bit more than the US but their emissions grew WAY more, this does not seem to explain the difference in emissions growth.

The second thing I looked at was the “gdp per person” tab. The US “gdp per person” doubled (207% change) but China’s went up 10 times that fast (2185%). So, the big growth in income (gdp per person) explains a lot of the big growth in emissions.

It seems that when people get more income, they produce more CO2 emissions.

# Logistics of the exercise

The variables are as follows and correspond to elements of the IPAT equation you will read about. For each variable, there are two tabs – one has the data, one has the chart.

* DVs: Potential dependent variables (use these to find interesting patterns)
* CO2: Carbon dioxide, a major greenhouse gas. This corresponds to “I” or environmental Impact.
* CO2 $gdp: CO2 emitted per dollar of GDP produced. This is sometimes called “pollution intensity” – notice that large numbers mean more pollution per dollar of GDP and small numbers mean less pollution per dollar. *This corresponds to “T” or Technology.*
* CO2 per person: CO2 emitted per person. Basically this is how much each person pollutes, so you can see whether individual’s are polluting more in one country than another, or are polluting more or less over time. *This corresponds to I/P or Impact divided by Population.*
* CO2-income: CO2 emissions per GDP per person. This one is a bit confusing but shows you the relationship between CO2 and affluence. *This corresponds to I/A or Impact divided by Affluence.*
* IVs: Potential independent variables (use these to explain the patterns you find in the DVs)
* gdp: GDP or gross domestic product – this is the overall size of the country’s economy. This corresponds to “P\*A” (it’s the product of multiplying # of people times $ per person)
* income (gdp per person): GDP per person – this is a rough measure of the average person’s annual income (as if all the wealth produced by GDP were distributed to everyone equally). *This corresponds to “A” or Affluence.*
* population: total number of people living in the country. *This corresponds to “P” or Population.*

# Four strategies for finding patterns

* Look at the graphs #1: **for big or small countries**
* Go to one of the graph tabs, e.g., CO2.
* Click on the highest line in the graph
* Notice what country it is
* Press the delete key.
* Do this several times. You have now identified which are the set of 3 or 4 biggest countries for that variable.
* Alternatively, get rid of most of the big CO2 emitters and see who are the small ones.
* Do you notice anything interesting about those 3 or 4 countries? Are they all developing countries? All developed countries? Something else?
* Look at the graphs #2: **for trajectories**
* Do the same as for #1 but classify each country as you click and delete it.
* For example, in the CO2 graph, click on US and write down “increasing only a little”
* click on China and write down “increasing a lot”
* click on Japan and write down “increasing only a little”
* click on India and write “increasing a lot”
* click on United Kingdom and write “decreasing”
* click on France and write “decreasing”
* You see the point – looks like there are at least three types of trajectories.
* Look at the data tabs
* Which countries have the biggest 1970-2010 growth rates?
* Which have the smallest 1970-2010 growth rates?
* What seems to be the difference between the countries with high growth rates and low growth rates? Something else?
* Compare between graphs
* China’s CO2 is increasing a lot (CO2 tab) but its CO2 per $gdp (CO2 $gdp graph tab) is coming down a lot. What explains that?
* Indonesia’s emissions went up 1211% (CO2 tab 1970-2010 column) but their CO2 per $gdp (CO2 $gdp graph tab) only went up a little (122%). Why the big difference? Their technology is getting a little dirtier so why are they emitting so much more?