

Midterm
ENGM 182 Winter 2023
Due at 11:59 pm on Monday, 13 February 2023 via Canvas

Submission Format

You are to submit two files:

1. Word document or pdf with your main response to the prompt, and
2. R code.

Your main response should be at most 8 single-spaced pages, including visualizations. Your response should be written as a report. You may organize the response as you find appropriate, but it should generally include an introduction, descriptions of the modeling approach, model formulations, model estimates, model interpretations, and conclusions. The main response should not include code.

Help

If you have questions, please attend Professor Mayfield's office hours. Additional office hours, beyond the normally scheduled office hour, will be scheduled to provide additional support. Do not ask TAs or colleagues for help.

Academic Integrity

You are expected to complete the midterm independently. For the duration of the midterm period, you may not discuss the midterm with anyone other than Professor Mayfield. Academic integrity violations will be handled in accordance with university policies.

Rubric

Words (10): The text is laid out with clear divisions and transitions between sections. The writing itself is well-organized, free of grammatical errors, and easy to follow.

Numbers (5): All numerical results or summaries are reported to suitable precision, and with appropriate measures of uncertainty attached when applicable.

Code (10): The code is formatted, organized, and commented, so that it is easy for others to read and understand. It only includes computations which are needed to respond to the prompt. The code is technically correct and runs.

Visualizations (30): Figures and tables are legible, technically correct, appropriately convey the intended message, and aesthetically appropriate. Figures and tables include informative captions, axis labels, and legends.

Modeling (30): Modeling approach, specifications, and estimation are described clearly, in appropriate detail, and responsive to the prompt. The estimation of model parameters and any calculations are technically correct. Models are appropriately checked and validated.

Interpretation and conclusions (15): Appropriate conceptual and numerical interpretations and conclusions are drawn from the modeling and are responsive to the prompt.

Prompt

There is substantial evidence that economic outcomes (e.g., crop yields, industrial output, labor productivity) are related to climatic variables (e.g., temperature, wind, precipitation). An understanding of this climate-economy relationship is important in projecting monetary damages from anticipated climate change, which can be useful in public and private decision-making to weigh the benefits and costs of climate change mitigation.

Suppose that you are a program officer for the World Bank assisting with developing climate insurance instruments based on macro-economic and climate trends. Your supervisor has tasked you with evaluating the historical and future impact of climate change on gross domestic product. Specifically, your supervisor requested the following information:

1. Pairwise comparisons of historical climatic variables and gross domestic product;
2. Geographic representations of historical changes in gross domestic product, temperature, and precipitation over time;
3. Estimation of the historical effect of climatic variables on gross domestic product;
4. Prediction of the future impact of climate change on gross domestic product, and
5. Suggestions on additional data or analyses that may be useful for evaluating the impact of climate change on gross domestic product.

You already compiled and cleaned two datasets. The first dataset (Historical.csv) includes data of historical climatic, economic, and population variables for 146 countries for the years 1961 to 2013. The second dataset (Future.csv) includes data of projected climatic variables for seven countries (i.e., Chile, China, India, Iran, Nigeria, Poland, and the United States) under alternative future socioeconomic scenarios.

Table 1. Data descriptions for Historical.csv

Variable Name	Variable Description
country	country name
year	historical year, 1961-2013
gdp	Global domestic product per capita. GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not. (2023 USD)
temp	historical annual mean temperature (°C)
prec	historical annual mean precipitation (mm)

Table 2. Data descriptions for Future.csv

Variable Name	Variable Description
country	country name
year	future year, 2023-2100
scenario	<p>Shared Socio-Economic Pathway (SSP)</p> <p>SSP5-8.5 represents a future characterized by rapid and fossil-fueled development with high socio-economic challenges to mitigation and low socio-economic challenges to adaptation.</p> <p>SSP1-2.6 represents a future characterized by a gradual but pervasive shift toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. Management of the global commons slowly improves, educational and health investments accelerate the demographic transition, and the emphasis on economic growth shifts toward a broader emphasis on human well-being</p>
temp	projected annual mean temperature (°C)
prec	projected annual mean precipitation (mm)