MGT 6203 Group Project Proposal

TEAM INFORMATION

Team #: 64
Team Members:

1. Nitya Nandagopal: nnandagopal6, Data Scientist at Verizon
    a. Bachelor's in Electrical & Computer Engineering from the University of Texas at Austin.
    b. Previous projects include forecasting equipment run rates in a cellular network and predicting budgetary needs of different business units.
2. Jessica Petersen: jpetersen9, HSE Project Manager at Cummins Inc.
    a. Bachelor's in Chemical Engineering from the Georgia Institute of Technology.
    b. Previous projects include using a statistical approach to determine leading indicators that can predict increasing injury rates in the workplace.
3. Melissa Gibson: mgibson70, Senior Accountant at Environmental Defense Fund.
    a. Bachelor's in Accounting from The College of New Jersey.
    b. Previous projects include using a statistical approach to predict musician/entertainment booking prices for private events.
4. Stephen (Hyun Gil) Kim: hkim3183: Data Scientist at Credit Suisse
    a. Bachelor's in Business Administration from the University of Notre Dame.
    b. Previous projects include using a statistical approach to predict future times of payment completion by the bank's counterparty for intraday matching.

OBJECTIVE/PROBLEM

Project Title: *Do We Need More Babies to Save the Planet: A Study on Greenhouse Gas Emissions & Population Growth.*

Background Information on Chosen Project Topic:
The increase in greenhouse gases (GHG) since the industrial revolution has had an undeniable detrimental impact on our environment (see **Figure A**). At the same time, the world's population growth rate is slowing, with experts predicting a soon peak and decline of population. Population growth is thought to increase greenhouse gases and negatively impact our environment due to an increased strain on resources and need for higher production. Many governments over the past 50 to 100 years have enforced forms of population control to alleviate this strain; however, these policies, combined with the evolution of societal values, have resulted in many countries facing a population decline. With aging populations, can we solve the problems of the world? How will the environment be affected after the inevitable peak and decline of the global population? These are the questions we are trying to answer.

Problem Statement:
It is commonly thought that population growth negatively contributes to global warming and other environmental problems. The purpose of our investigation and analysis is to examine if and how population growth contributes to greenhouse emissions.

Primary Research Question: *How does a country's population growth affect its GHG emissions?*

Supporting Research Questions:

1. What other variables affect a country's GHG - what is their significance vs population growth?
2. Do corporations/industry actions affect greenhouse gas emissions more or less than individuals?
3. Does a population decrease correlate to a decrease in innovation and less carbon capture?
4. Does having a larger elderly population affect the maintenance and efficiency of infrastructure?

Business Justification:
Currently, "we are on a pathway to global warming of more than double the [1.5°C (2.7°F)] limit that was agreed in Paris in 2015," (source). The UN's International Labor Organization (ILO) reported that this could create "unlivable working environments" that could affect 80 million jobs globally (source). To combat these negative environmental changes, many companies have already created new business plans (e.g., manufacturers moving towards alternative energy). There are opportunities to innovate; however, need for sustained innovation might create a demand for young minds, which may not be easily available based on the declining population.

If population growth is necessary to combat climate change, the benefits to the environment must outweigh the societal cost of supporting additional people. The team's research could present solutions or pathways to achieving a healthier planet by conducting an unbiased analysis on this question.

DATASET/PLAN FOR DATA

Data Sources:
- Our World in Data: GHG Emissions: https://ourworldindata.org/greenhouse-gas-emissions
- The World Bank - World Population Growth: https://data.worldbank.org/indicator/SP.POP.TOTL

Data Description (Screenshots in Appendix):
- Greenhouse Gases Emissions Data ranges from 1990 to 2019 - shows GHG emissions per country. **Figure B** in the Appendix shows a snippet of the data.
- World Population Growth Data ranges from 1962 until 2021 - shows population data per country. **Figure C** in the Appendix shows a snippet of the data.

Key Variables:
Our plan is to merge these two datasets with country and year as the primary key. We anticipate adding further indicators as needed to see if they have a strong correlation with GHG emissions.
- Independent variable: Population
- Dependent variable: GHG Emissions
- Additional potential independent variables: young/old person ratio, technology level rating, public transport vs car ownership ratio, public transportation rating, temperature/climate, productivity, number of registered vehicles in country, % of vehicles EV/eco-friendly.

APPROACH/METHODOLOGY

Planned Approach:
Our first step will be completing exploratory data analysis to learn more about our data sets and get a feeling for means, trends, and patterns in the data. We plan on using PCA, lasso, and ridge regression to reduce the number of variables involved in our model, once we determine more potential factors. We have opted to use a 60-20-20 split for testing/training/validation. We plan to experiment with different regression models, like multi-linear and logistic regression, to determine the best fit for the data without

introducing any additional biases, using fitting values such as adjusted R and R2. Once we have decided on our final model, we will use it to predict the GHG emissions and population growth for 2020-2022. If the model is moderately successful at predicting these years, we could use the model to forecast GHG emission growth further into the future.

Anticipated Conclusions:
Our hypothesis is that population growth does not negatively affect GHG emissions and is not the most contributing factor to their increase throughout the years. This approach will allow us to look into multiple contributing factors in the increase of GHG emissions, and determine which factors have the strongest effects on the emissions.

Business Impacts and Benefits:
As an impact of our analysis, businesses could decide to take a more aggressive approach to ensure they will continue to thrive with the increase in GHG emissions. Requiring a sustained birth rate to effectively combat GHG could lead to lobbying for more pro-birth subsidies, or for more companies to focus on developing ways to increase the ease of sustaining a large family.

PROJECT TIMELINE/PLANNING

Project Timeline:
To stay on top of the course's project deadlines, we have determined our own deadlines by which we would like to have major milestones completed by. These deadlines are set one week in advance of the formal course deadline to ensure that there is enough time to engage with the TAs, and receive feedback prior to submission. Our goal is to have first drafts of our Video Plan done by 3/19, our Progress Report done by 3/26, Final Report completed by 4/9, and Final Video completed by 4/12.

APPENDIX

Figure A (source: IPCC WG III Report)

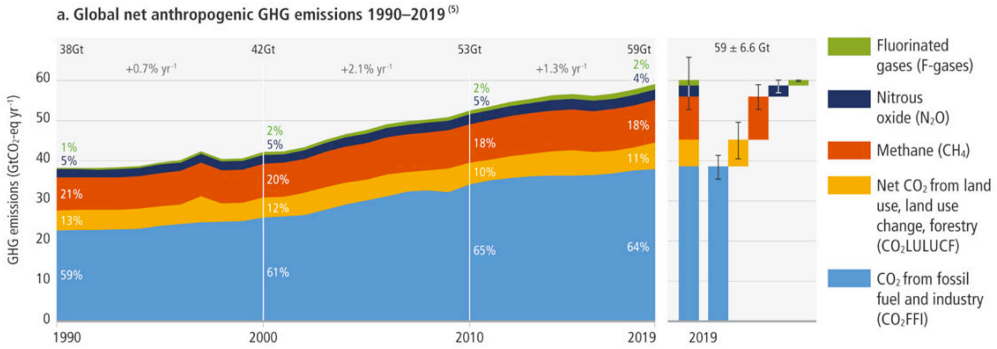

Figure B (GHG Sample Dataset)

	A	B	C	D	E	F	G
1	Entity	Code	Year	Total including LUCF			
2	Afghanistan	AFG	1990	9579999.92			
3	Afghanistan	AFG	1991	9810000.42			
4	Afghanistan	AFG	1992	9029999.73			
5	Afghanistan	AFG	1993	9109999.66			
6	Afghanistan	AFG	1994	9149999.62			
7	Afghanistan	AFG	1995	9579999.92			
8	Afghanistan	AFG	1996	10609999.7			
9	Afghanistan	AFG	1997	11579999.9			
10	Afghanistan	AFG	1998	12399999.6			
11	Afghanistan	AFG	1999	13279999.7			
12	Afghanistan	AFG	2000	11500000			
13	Afghanistan	AFG	2001	12369999.9			
14	Afghanistan	AFG	2002	15010000.2			
15	Afghanistan	AFG	2003	15649999.6			
16	Afghanistan	AFG	2004	15439999.6			
17	Afghanistan	AFG	2005	16350000.4			
18	Afghanistan	AFG	2006	16870000.8			
19	Afghanistan	AFG	2007	17260000.2			
20	Afghanistan	AFG	2008	20659999.8			
21	Afghanistan	AFG	2009	22750000			
22	Afghanistan	AFG	2010	27239999.8			
23	Afghanistan	AFG	2011	29170000.1			
24	Afghanistan	AFG	2012	28549999.2			
25	Afghanistan	AFG	2013	26770000.5			
26	Afghanistan	AFG	2014	26520000.5			
27	Afghanistan	AFG	2015	26840000.2			
28	Afghanistan	AFG	2016	27049999.2			
29	Afghanistan	AFG	2017	26680000.3			
30	Afghanistan	AFG	2018	27840000.2			
31	Afghanistan	AFG	2019	28790000.9			

Figure C (World Bank Dataset Sample)

Data Source	World Development Indicators						
Country Name	**Country Code**	**Indicator Name**	**Indicator Code**	**1960**	**1961**	**1962**	**1963**
Aruba	ABW	Population, total	SP.POP.TOTL	54,608.00	55,811.00	56,682.00	57,475.00
Africa Eastern and	AFE	Population, total	SP.POP.TOTL	130,692,579.00	134,169,237.00	137,835,590.00	141,630,546.00
Afghanistan	AFG	Population, total	SP.POP.TOTL	8,622,466.00	8,790,140.00	8,969,047.00	9,157,465.00
Africa Western an	AFW	Population, total	SP.POP.TOTL	97,256,290.00	99,314,028.00	101,445,032.00	103,667,517.00
Angola	AGO	Population, total	SP.POP.TOTL	5,357,195.00	5,441,333.00	5,521,400.00	5,599,827.00
Albania	ALB	Population, total	SP.POP.TOTL	1,608,800.00	1,659,800.00	1,711,319.00	1,762,621.00
Andorra	AND	Population, total	SP.POP.TOTL	9,443.00	10,216.00	11,014.00	11,839.00
Arab World	ARB	Population, total	SP.POP.TOTL	93,359,407.00	95,760,348.00	98,268,683.00	100,892,507.00
United Arab Emira	ARE	Population, total	SP.POP.TOTL	133,426.00	140,984.00	148,877.00	157,006.00
Argentina	ARG	Population, total	SP.POP.TOTL	20,349,744.00	20,680,653.00	21,020,359.00	21,364,017.00
Armenia	ARM	Population, total	SP.POP.TOTL	1,904,148.00	1,971,530.00	2,039,346.00	2,106,142.00
American Samoa	ASM	Population, total	SP.POP.TOTL	20,085.00	20,626.00	21,272.00	21,949.00
Antigua and Barbu	ATG	Population, total	SP.POP.TOTL	55,342.00	56,245.00	57,008.00	57,778.00
Australia	AUS	Population, total	SP.POP.TOTL	10,276,477.00	10,483,000.00	10,742,000.00	10,950,000.00
Austria	AUT	Population, total	SP.POP.TOTL	7,047,539.00	7,086,299.00	7,129,864.00	7,175,811.00
Azerbaijan	AZE	Population, total	SP.POP.TOTL	3,894,500.00	4,045,750.00	4,168,150.00	4,293,550.00
Burundi	BDI	Population, total	SP.POP.TOTL	2,746,628.00	2,815,972.00	2,887,398.00	2,948,133.00
Belgium	BEL	Population, total	SP.POP.TOTL	9,153,489.00	9,183,948.00	9,220,578.00	9,289,770.00
Benin	BEN	Population, total	SP.POP.TOTL	2,512,284.00	2,551,216.00	2,593,302.00	2,638,082.00
Burkina Faso	BFA	Population, total	SP.POP.TOTL	4,783,259.00	4,852,833.00	4,924,497.00	4,998,671.00
Bangladesh	BGD	Population, total	SP.POP.TOTL	50,396,429.00	51,882,769.00	53,461,661.00	55,094,115.00
Bulgaria	BGR	Population, total	SP.POP.TOTL	7,867,374.00	7,943,118.00	8,012,946.00	8,078,145.00
Bahrain	BHR	Population, total	SP.POP.TOTL	160,691.00	166,970.00	173,359.00	179,891.00
Bahamas, The	BHS	Population, total	SP.POP.TOTL	114,500.00	120,216.00	126,305.00	132,639.00
Bosnia and Herzeg	BIH	Population, total	SP.POP.TOTL	3,262,539.00	3,325,333.00	3,387,512.00	3,448,532.00
Belarus	BLR	Population, total	SP.POP.TOTL	8,198,000.00	8,271,216.00	8,351,928.00	8,437,232.00
Belize	BLZ	Population, total	SP.POP.TOTL	91,403.00	93,757.00	96,188.00	98,862.00
Bermuda	BMU	Population, total	SP.POP.TOTL	44,400.00	45,500.00	46,600.00	47,700.00
Bolivia	BOL	Population, total	SP.POP.TOTL	3,707,515.00	3,784,744.00	3,864,140.00	3,945,729.00
Brazil	BRA	Population, total	SP.POP.TOTL	73,092,515.00	75,330,008.00	77,599,218.00	79,915,555.00
Barbados	BRB	Population, total	SP.POP.TOTL	232,550.00	233,698.00	234,829.00	235,875.00