Carbon Emissions and Economic Success

How does the carbon emissions per capita of a country affect its GDP per capita and unemployment rate?

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1 Identifying the Context

When thermal energy reflects off the surface of the Earth, some of it is captured and stored by greenhouse gases instead of dissipating into space. These greenhouse gases then release some of their stored energy into the lower atmosphere. Excess greenhouse gases can lead to an increase in tropospheric temperature, a phenomenon known as climate change. Climate change has numerous detrimental effects, including altered precipitation patterns, rising sea levels, extreme drought, and more. If climate change increases, areas in which crops can grow and humans can live will shift, leading to disruptions in food production and millions of environmental refugees being forced to leave their homes. In addition, property will be damaged and lives will be lost in the extreme weather events that many believe are worsened by climate change (Miller and Spoolman 2015).

One of the most-discussed greenhouse gases is carbon dioxide (CO_2). Humans release millions of tons of CO_2 annually through transportation, electricity generation, manufacturing, and more. The fact that human carbon emissions are contributing to climate change, and that climate change needs to be slowed and eventually stopped is widely accepted (Miller and Spoolman 2015). However, many people believe that cutting carbon emissions will have detrimental effects on the economy. In a 2018 interview with the Associated Press, Donald Trump said "[…] I'm not willing to […] sacrifice the economic well-being of our country for [climate change]." ("Read the Transcript of AP's Interview with President Trump" 2018) Many other politicians and members of the general public also believe that lowering carbon emissions will harm the economy, and it's not an unreasonable assumption to make. Whether raising livestock, transporting lumber, or heating an office or home, the creation and transportation of goods, raw materials, and services will almost always create carbon emissions. It would seem to be logical that a country would need to have ever-increasing levels of carbon emissions to create and ship useful products, and increase their economic success.

However, I want to analyze the actual relationship between carbon emissions and a country's economic success. It has already been found that some countries are decoupling their carbon emissions and GDP, meaning that while their carbon emissions decrease, their GDP increases (Ciara Nugent and Emily Barone 2021). I want to answer the more specific question of "How does the carbon emissions per capita of a country affect its GDP per capita and unemployment rate?" I feel that these are better indicators of a country's actual quality of life and economic success than the overall GDP. More people, whether citizens or politicians, understanding the actual relationship between carbon emissions and economic success could be one less roadblock to enacting and enforcing regulations to decrease carbon emissions, slow climate change, and protect a safe and sustainable future for ourselves and future generations.

2 Planning

I gathered this data from the The World Bank's data bank. I downloaded the CSV files for GDP per capita, unemployment rate, and CO_2 emissions per capita on March 17, 2023. The unemployment rate dataset was last accessed by the World Bank on February 21, 2023, the CO_2 dataset was last updated in 2020, and the GDP dataset's most recent recorded year was 2021.

I chose to examine Argentina, France, Greece, Guatemala, Madagascar, and the United States because I felt these countries represented a wide range of different levels of development and different areas of the world. I chose to analyze CO_2 emissions per capita because it is one of the most measurable contributions to climate change, and GDP per capita and unemployment rate because they are reasonable and widely used measures of a country's economic success. In addition, I believe GDP per capita and unemployment rate reflect a country's economic success and wellbeing more accurately than the total GDP. The first year recorded in the CO_2 emissions dataset was 1990, so I trimmed the other two datasets to match.

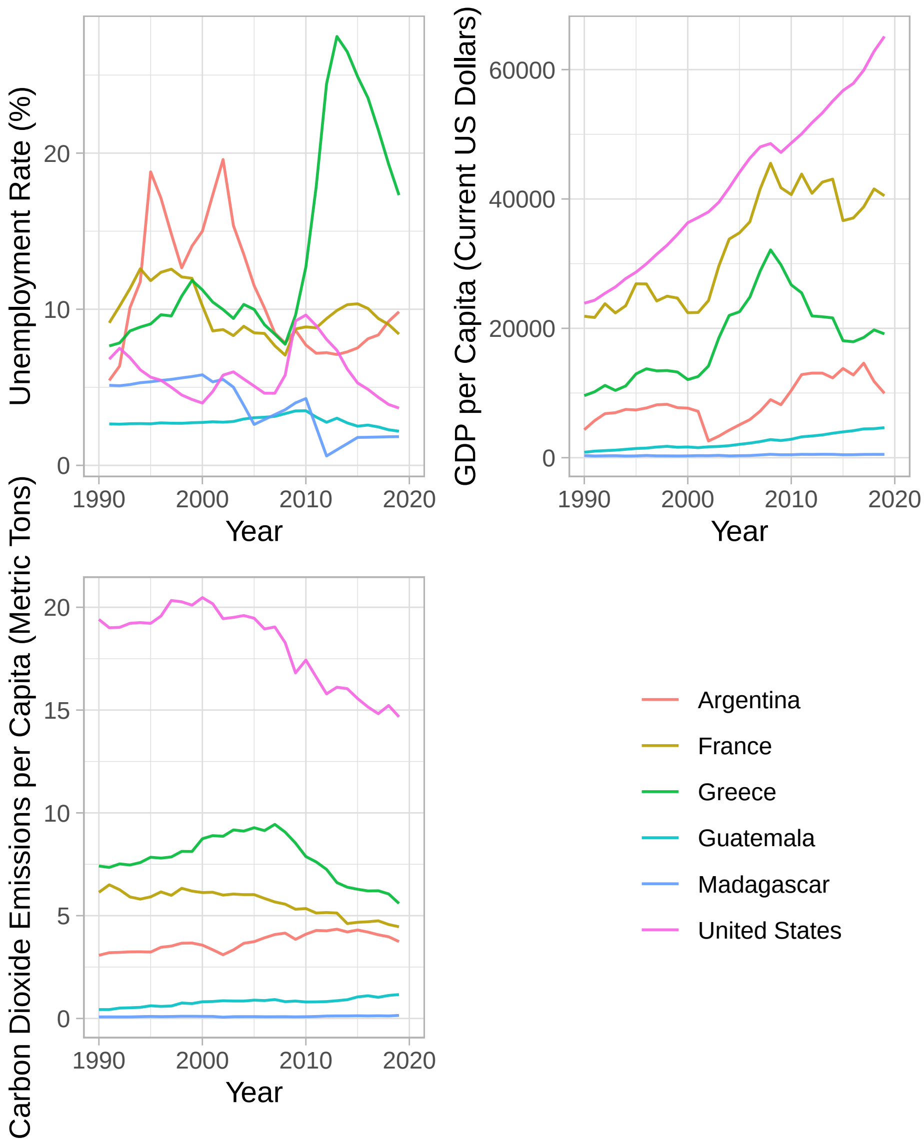
These datasets were compiled by the World Bank from various organizations. The unemployment rate dataset was originally from the International Labour Association, the CO_2 emissions per capita dataset from Climate Watch, and the GDP per capita dataset from the OECD and the World Bank. The agencies from which this data was originally sourced all have a commitment to high-quality, publicly available data, and are well respected, which is why I chose to use their data. However, a large amount of this data was originally from national statistics divisions ("Frequently Asked Questions | Climate Watch," n.d.; "Methodologies," n.d.; "Data Collection and Production," n.d.; "Quality Framework for OECD Statistical Activities," n.d.). While it was processed by the organizations before being published, some of this data may hold inaccuracies because of inconsistencies between countries. In addition, developing countries do not have the same capacity to collect and report data that more-developed countries do, which could lead to inaccurate data. The processing by these organizations will hopefully have removed most of the inaccuracies, but some may remain.

This data was aggregated at the country level, and as such there is no personal data is being unethically released. All of this data is licensed under Creative Commons. The "Unemployment, total (% of total labor force) (modeled ILO estimate)" dataset from the International Labour Organization and the "GDP per capita (current US$)" dataset from World Bank and OECD national accounts data are both licensed under CC BY-4.0. The "CO2 emissions (metric tons per capita)" dataset from Climate Watch is licensed under Attribution-NonCommercial 4.0 International (CC BY-NC 4.0). These licenses allow me to copy, modify (which I have done by selecting only certain countries and years to analyze), and distribute all of this data for noncommercial uses, such as for this academic paper.

3 Results and Analysis

In almost every country, GDP per capita is trending upward. Unemployment rate shows much less consistency, but in most countries it is trending down. CO_2 emissions per capita are trending down or staying consistent in most countries. The unemployment rate and GDP per capita were both affected by the economic crisis of 2008, which reversed their respective trends.

Figure 3.1: Unemployment rate, GDP per capita, and carbon dioxide emissions per capita over time



The individual countries show wide variation in the relationship of CO_2 emissions per capita and GDP per capita. Argentina and Guatemala show a fairly strong positive correlation, with R^2 values well above 0.50. Madagascar also has a positive correlation, but with a much lower R^2 value of 0.34. Greece also has a positive correlation, but has a R^2 value of only 0.04. France and the United States however, have negative correlations with high R^2 values.

In the higher-GDP countries (the United States and France), as GDP per capita increases, CO_2 emissions per capita decrease. In Greece, a historically high-GDP country affected particularly harshly by the 2008 economic recession ("Greek Bailout Crisis in 300 Words" 2018), there is almost no relationship between GDP per capita and CO_2 emissions per capita. In the less-developed countries, as CO_2 emissions per capita increase, GDP per capita also increases.

Figure 3.2: Carbon dioxide emissions per capita vs. GDP per capita by country

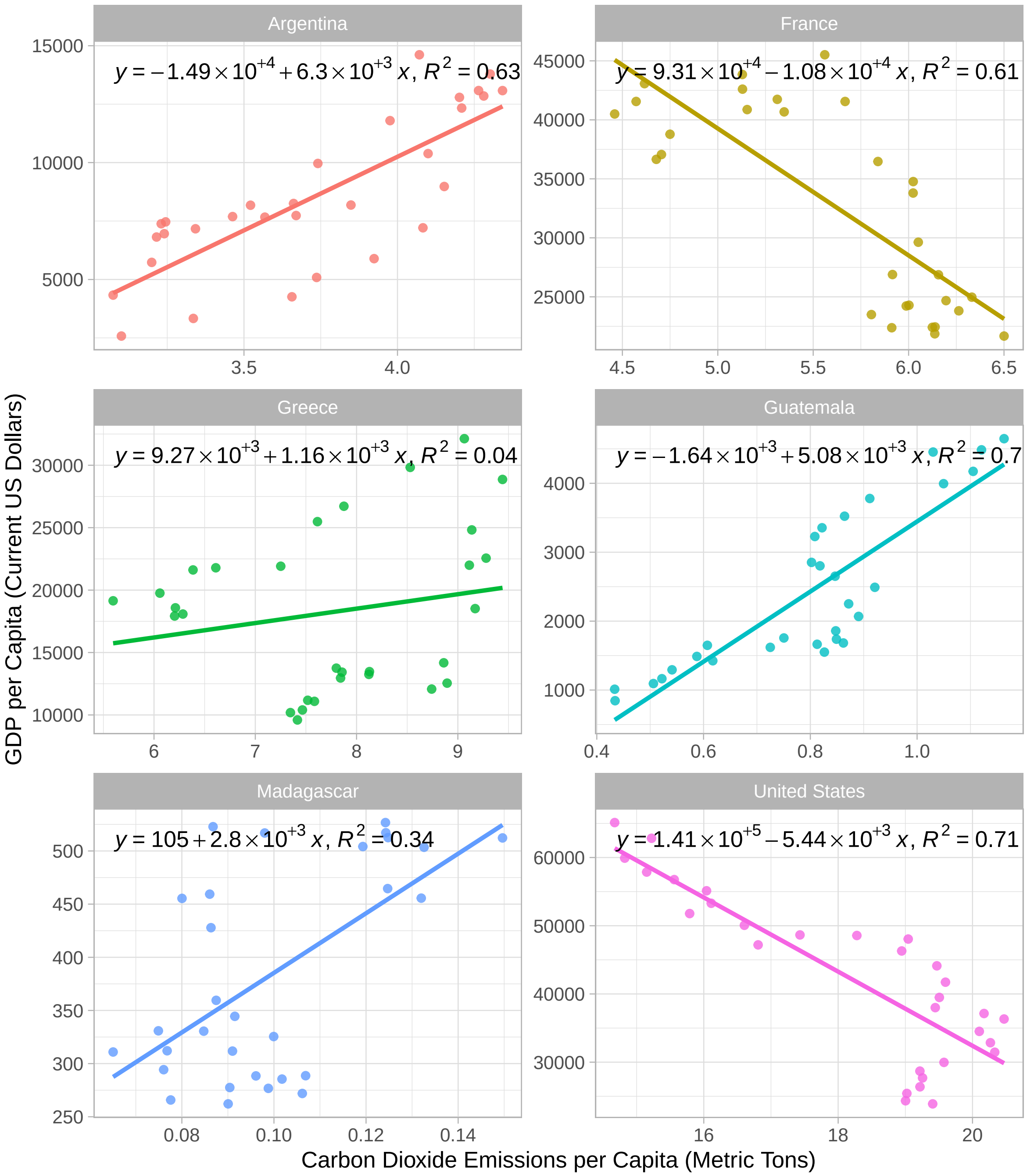
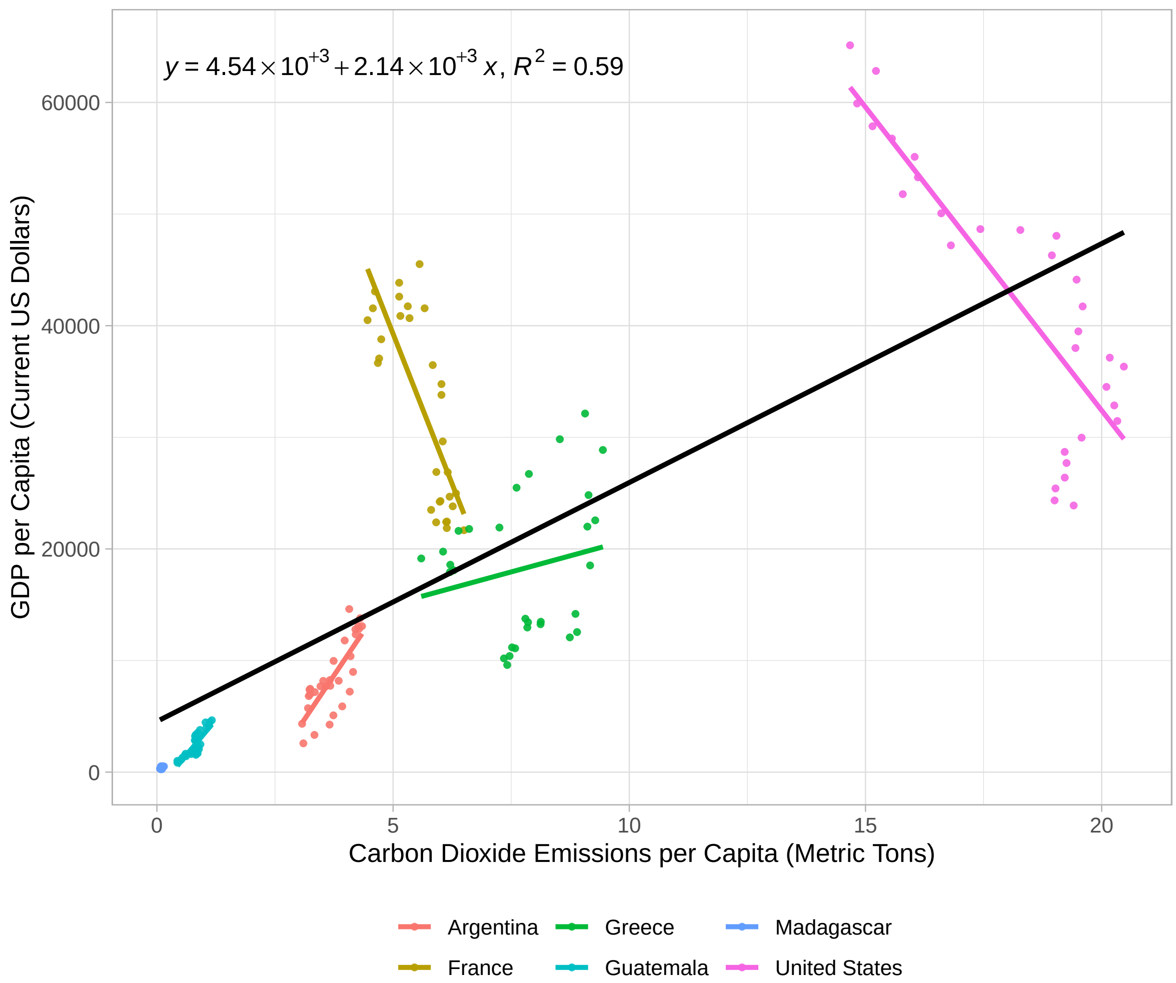
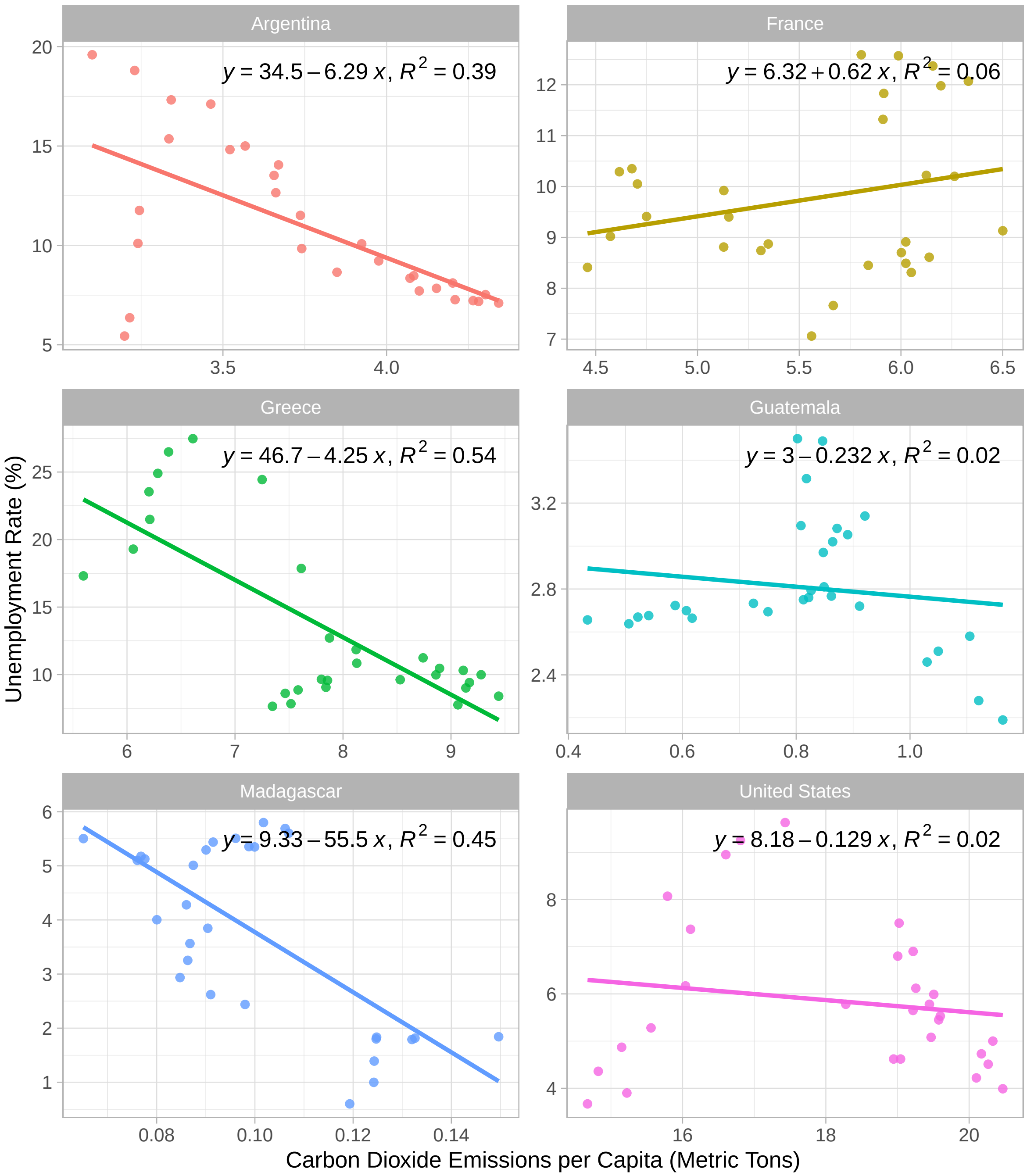


Figure 3.3: Carbon dioxide emissions per capita vs. GDP per capita overall



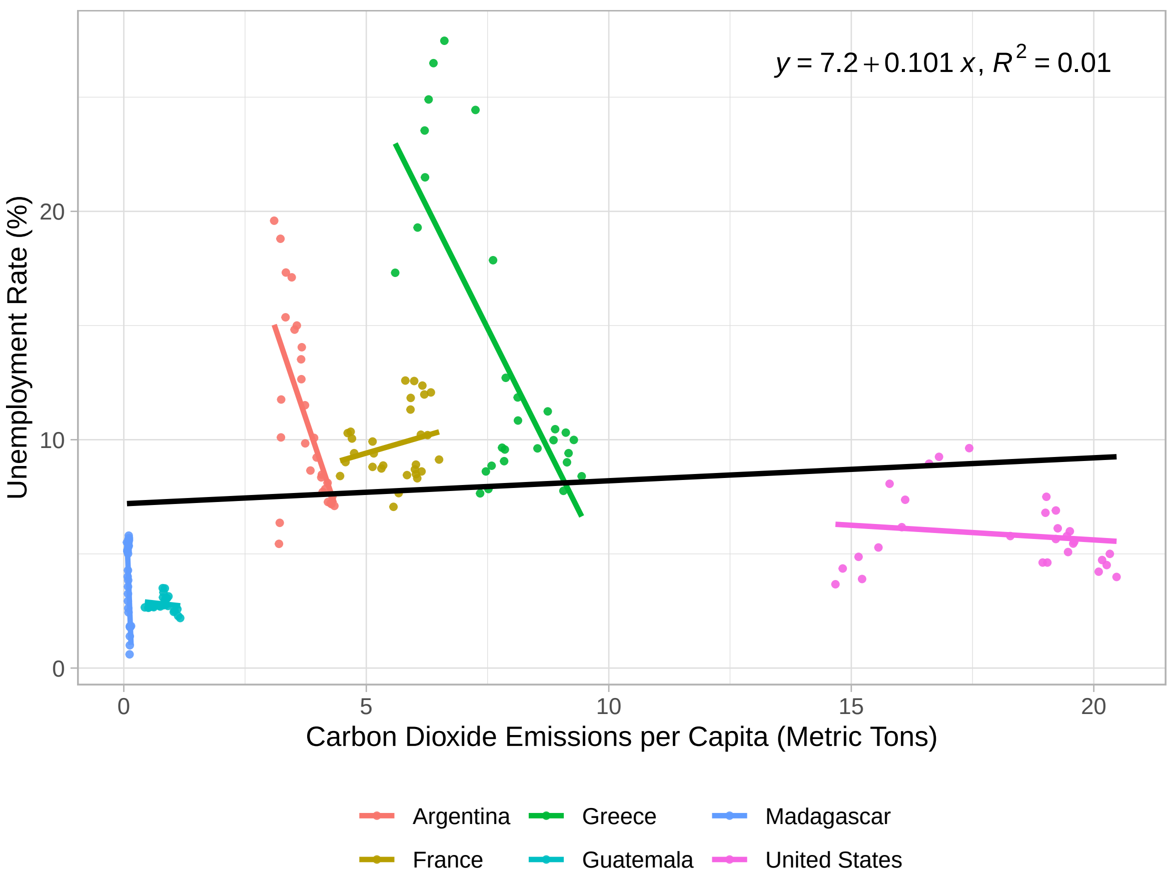
Within countries, the relationship between CO_2 emissions per capita and GDP per capita can vary widely. However, between countries, the relationship is clear. As CO_2 emissions per capita increase, so does GDP per capita. While individual countries have managed to decrease their CO_2 emissions per capita while increasing their GDP per capita, overall, a country's CO_2 emissions per capita predict their GDP per capita fairly accurately, with a R^2 value of 0.59.

Figure 3.4: Carbon dioxide emissions per capita vs. unemployment rate by country



In every country except for France, as CO_2 emissions increase, unemployment decreases. However, the R^2 values vary widely between countries. In Argentina, Madagascar, and Greece, CO_2 emissions is a somewhat accurate predictor of unemployment, with an R^2 value of at least .35, and in Greece, over .50. However, Guatemala and the United States both have R^2 values of 0.02. France's positive correlation is also very weak, with an R^2 value of 0.06. Unemployment rate is much less correlated with CO_2 emissions than GDP per capita is. 4 of the 6 examined countries had R^2 values of over .60 when investigating the relationship between CO_2 emissions per capita and GDP per capita, while no country has an R^2 value over .60 when investigating the relationship between CO_2 emissions per capita and unemployment rate.

Figure 3.5: Carbon dioxide emissions per capita vs. unemployment rate overall



Overall, CO_2 emissions have next to no correlation with unemployment rate, with an R^2 value of 0.01. We can see the lack of effect of CO_2 emissions has even within countries represented, as Argentina's and Madagascar's unemployment rates varied wildly while their CO_2 emissions per capita varied very little. In addition, we can see that at certain points France and Greece had nearly the same carbon emissions per capita, yet their respective unemployment rates differed by 10% or more. Different countries' CO_2 emissions per capita do not accurately predict their respective unemployment rates.

4 Conclusion

When CO_2 emissions per capita increase, in lower-GDP countries, GDP per capita increases, while in higher-GDP countries, GDP per capita decreases. France and the United States have the two highest GDP per capita overall, and they are the only ones that have a negative correlation between GDP per capita and CO_2 emissions per capita. Argentina, Guatemala, and Madagascar all have significantly lower GDP per capita, and all have a positive correlation between GDP per capita and CO_2 emissions per capita. Greece's lowest GDP per capita has overlap with Argentina, while its highest GDP per capita has overlap with France. Greece was a high GDP country before the 2008 economic crisis, but its GDP fell steeply and has not yet recovered. It has next to no correlation between its carbon emissions per capita and GDP per capita. Greece marks both the boundary between a "high-GDP" and "low-GDP" country, and the boundary between a positive and negative correlation. This helps illustrate that the relative GDP of a country determines the relationship between its CO_2 emissions per capita and its GDP per capita.

As CO_2 emissions per person go up, unemployment rate is minimally affected. When analyzing the relationship between unemployment rate and CO_2 emissions per capita, France, Guatemala, and the United States all have R^2 values of less than .10, and Greece's R^2 value, the highest of all of the countries, is only 0.54. The R^2 value for all data points is only 0.01. These relatively low R^2 values across the board mean that CO_2 emissions per capita is not an accurate predictor of unemployment rate and therefore does not significantly affect unemployment rate.

5 Discussion and Evaluation

Higher-GDP countries, such as France and the United States, have the highest carbon emissions per capita, and are contributing the most to the harm that climate change is causing. These higher-GDP countries have the resources to decrease their carbon emissions per capita while increasing their GDP per capita and keeping their unemployment rate stable. These countries decreasing their carbon emissions per capita will help slow the speed of climate change and mitigate the harmful effects. These higher-GDP countries have a responsibility to decrease their carbon emissions, so that lower-GDP countries can continue to develop, and the human race does not come to significant harm. This analysis shows that these countries' politicians and citizens can no longer use the economy as a reason or an excuse to not decrease their carbon emissions. Decreasing carbon emissions per capita will not make GDP per capita decrease, will not affect the unemployment rate, and will provide protection from harm for all citizens and all ecosystems of the world.

One strength of my investigation is the sheer amount of data used. I had approximately 30 years of data for 6 different countries and 3 different indicators. I was able to analyze around

500 observations, which helps reduce the impact of outliers on my conclusions. I was also able to analyze data from countries with different levels of development and different areas of the world. Had I analyzed only the United States or only Madagascar, I would have drawn wildly different conclusions than after analyzing 6 very different countries. In addition, I used well-known and reliable measurements, methods, and sources in this investigation. GDP per capita, linear regression, and the World Bank are all well-respected and known to be reliable.

Some weakness includes the limited scope within my investigation. I analyzed only 6 of the dozens of countries in the world. The differences between Madagascar and the United States, as well as the extremes of Greece's economy, show that there is a wide variety of how CO_2 emissions effect a country's economy. I could be missing key information about the relationship between carbon emissions and economic success because that information was not present within the six countries I chose. In addition, I did not analyze any countries from Asia, Continental Africa, or Oceania, whose economies may function very differently than the countries that I did analyze. I also have no data from before 1990, while humans have been increasing CO_2 emissions for at least 150 years ("Sources of Greenhouse Gas Emissions," n.d.). This analysis provides a very limited snapshot of the long and complex relationship between carbon emissions and economic success. It also does not account for loss of growth. Reducing carbon emissions may lead to a loss of growth ("How Much Will It Cost to Cut Global Greenhouse Gas Emissions?" 2022), while not leading to a direct decrease in GDP. This analysis only discusses increase or decrease in GDP per capita, not increase or decrease in growth or loss of potential growth. Finally, this analysis does not show any causality.

I have analyzed the relationship between CO_2 emissions per capita, GDP per capita, and unemployment rate, but do not know why they have that relationship.

One limitation of this analysis is confounding variables and outlying behavior, such as Greece's extreme response to the 2008 economic crisis. While all countries analyzed were affected by the crisis, Greece was affected very severely ("Greek Bailout Crisis in 300 Words" 2018). Similarly, Argentina experienced recessions in both 1995 and the beginning of the 21st century ("Economy of Argentina," n.d.). The relationship between CO_2 emissions and the economic success of a country is likely different in a recession, but I cannot control whether or not recessions occur. In addition, much of this data was originally collected from country's internal statistical agencies ("Frequently Asked Questions | Climate Watch," n.d.; "Methodologies," n.d.; "Data Collection and Production," n.d.; "Quality Framework for OECD Statistical Activities," n.d.), which could lead to inaccuracies, misreporting, and differences in data collection and reporting between countries.

A simple solution to the limited scope of my investigation would be to analyze as many countries possible. This could make the report very long, but it could be possible to simply include all of the countries on a general graph, then select countries that exemplify certain behaviors to be analyzed in depth. A modification to solve the limited time range of the investigation could be to find new data sets that have data from a longer time period. This could possibly entail going directly to smaller organizations instead of a large organization like the World Bank, or even going to individual country's statistics divisions to find the most data available, which may lead to a loss of accuracy.

One further area of research is trying to find causality within the CO_2 emissions and economic success relationship by investigating which causes which, or if they are both caused by an outside variable. Another further area of study is examining whether specific policies or actions change the relationship between CO_2 emissions and economic success. One could ask whether the United States' and France's GDP per capita increasing as their CO_2 emissions per capita are decreasing because of specific policies and actions, and if there is a way to implement these policies or actions in other countries. The results for how CO_2 emissions affects GDP per capita and how it affects unemployment rate were very different, so one could also study other measures of economic and/or environmental impact, and see if those relationships reflect the relationships studied here, or are entirely different. Finally, one could search for a point or range of GDP per capita in which the correlation between CO_2 emissions per capita and GDP per capita changes from positive to negative.

6 Applications

A possible solution to people's misconceptions about the relationship between CO_2 emissions and economic success, and their resulting unwillingness to reduce CO_2 emissions, is a science outreach campaign publicizing the results from this analysis or similar studies. Dispelling people's misconceptions about the economy and carbon emissions could inspire individuals and politicians to decrease their CO_2 emissions and protect themselves, their fellow human beings, and natural ecosystems from the damage of climate change. This campaign would be targeted at higher-GDP countries, because they are the ones with the most CO_2 emissions per capita and the most ability to reduce their CO_2 emissions per capita without harming their economy. Increasing the knowledge and involvement of the general public is an effective way to bring about real change, and could be very effective in decreasing carbon emissions and slowing climate change.

Some strengths of this solution include that it is easier to implement than many other possible solutions. In the "age of information," distributing this information would be relatively easy, and certainly much easier than trying to pass extensive policies. This solution can help pave the way to future solutions, such as large policies or treaties, by inspiring individual citizens to push for those policies and treaties. In addition, this solution is the most convincing to high-GDP and high-emissions countries, so will create maximal emissions reductions. Finally, this solution can be rolled out on a country-by-country basis, and does not necessarily require international cooperation.

One weakness of this solution is that it requires communicating to laypeople effectively. Showing exhaustive, in-depth scientific proof is not convincing or interesting to many, but communicating in a way that most people understand could lead to loss of information. In addition, this solution would require funding and organization in order to create a cohesive message and disseminate the information. Finally, this solution would be less convincing in low GDP countries, and would likely not help reduce the emissions as countries continue to develop.

Limitations of this solution include people's internal attitudes. Some people do not believe we should not reduce carbon emissions because of the economy because of a genuine lack of information. However, this information has already been published (Ciara Nugent and Emily Barone 2021). Some people are willfully ignorant of the already available data saying that the economy and CO_2 emissions are not necessarily linked. In addition, even if someone knows and believes this information, it doesn't necessarily mean that they will act on it. If someone know this information but continues to support policies and actions that increase CO_2 emissions, then them learning the information does not further the goal of mitigating the harm of climate change. Finally, a science outreach campaign cannot feasibly reach every single ignorant person. No matter what we did or how we spread this message, there would still be people who are unaware of this information.

Spreading awareness of the true relationship between CO_2 emissions and economic success, especially in higher-GDP countries, will lead to new policies and actions that lead to a safer, more beautiful world for all people. Scientists, governments, and ordinary citizens all have a responsibility to educate themselves about the consequences of climate change, and take action to prevent it.

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8 Data

Table 8.1: Argentina emissions, unemployment, and GDP over time

Year	GDP per Capita in Current US Dollars	CO~2~ Emissions (Metric Tons per Capita)	Unemployment Rate
1990	4330.959	3.073750	NA
1991	5730.724	3.199443	5.440
1992	6815.618	3.215237	6.360
1993	6957.417	3.240345	10.100
1994	7464.475	3.244831	11.760
1995	7383.705	3.230402	18.800
1996	7690.157	3.462905	17.110
1997	8176.771	3.521334	14.820
1998	8250.673	3.661560	12.650
1999	7735.322	3.669819	14.050
2000	7666.518	3.568040	15.000
2001	7168.976	3.342005	17.320
2002	2579.489	3.100697	19.590
2003	3333.153	3.335061	15.360
2004	4258.160	3.656178	13.520
2005	5086.628	3.736579	11.510
2006	5890.978	3.923818	10.080
2007	7210.596	4.082896	8.470
2008	8977.507	4.152330	7.840
2009	8184.390	3.848410	8.650
2010	10385.964	4.099690	7.710
2011	12848.864	4.280989	7.180
2012	13082.664	4.264224	7.220
2013	13080.255	4.342115	7.100
2014	12334.798	4.209096	7.270
2015	13789.060	4.301914	7.524
2016	12790.242	4.201846	8.109
2017	14613.042	4.071308	8.350
2018	11795.159	3.975772	9.220
2019	9963.673	3.740650	9.840

Table 8.2: France emissions, unemployment, and GDP over time

Year	GDP per Capita in Current US Dollars	CO~2~ Emissions (Metric Tons per Capita)	Unemployment Rate
1990	21865.56	6.137339	NA
1991	21675.71	6.500440	9.13
1992	23814.23	6.263218	10.20
1993	22380.33	5.911735	11.32
1994	23496.37	5.805057	12.59
1995	26889.43	5.915659	11.83
1996	26870.29	6.156649	12.37
1997	24226.88	5.987499	12.57
1998	24971.57	6.331489	12.07
1999	24678.39	6.196242	11.98
2000	22416.43	6.124615	10.22
2001	22449.34	6.138928	8.61
2002	24288.27	6.001983	8.70
2003	29627.92	6.050889	8.31
2004	33797.16	6.023792	8.91
2005	34768.18	6.024208	8.49
2006	36470.21	5.839386	8.45
2007	41557.62	5.667294	7.66
2008	45515.96	5.560604	7.06
2009	41737.76	5.311781	8.74
2010	40676.06	5.347946	8.87
2011	43846.47	5.128760	8.81
2012	40870.85	5.153952	9.40
2013	42602.72	5.129519	9.92
2014	43068.55	4.616053	10.29
2015	36652.92	4.677807	10.35
2016	37062.53	4.704747	10.05
2017	38781.05	4.749543	9.41
2018	41557.85	4.572030	9.02
2019	40494.90	4.459548	8.41

Table 8.3: Greece emissions, unemployment, and GDP over time

Year	GDP per Capita in Current US Dollars	CO~2~ Emissions (Metric Tons per Capita)	Unemployment Rate
1990	9600.185	7.416058	NA
1991	10188.370	7.346951	7.65
1992	11176.458	7.517987	7.84
1993	10401.983	7.465287	8.61
1994	11091.284	7.584000	8.86
1995	12959.324	7.842151	9.06
1996	13749.115	7.800128	9.65
1997	13427.833	7.856483	9.57
1998	13472.138	8.127413	10.84
1999	13249.663	8.121395	11.85
2000	12072.929	8.741595	11.24
2001	12549.037	8.894202	10.46
2002	14177.572	8.860741	9.98
2003	18518.379	9.170878	9.41
2004	21995.478	9.113529	10.31
2005	22560.147	9.278883	9.99
2006	24821.937	9.137631	9.01
2007	28863.973	9.441123	8.40
2008	32127.983	9.064041	7.76
2009	29828.756	8.529743	9.62
2010	26716.649	7.874950	12.71
2011	25483.883	7.613757	17.86
2012	21912.998	7.251237	24.44
2013	21787.788	6.609996	27.47
2014	21616.710	6.385179	26.49
2015	18083.878	6.285069	24.90
2016	17923.967	6.203617	23.54
2017	18582.089	6.211250	21.49
2018	19756.990	6.058018	19.29
2019	19144.284	5.596189	17.31

Table 8.4: Guatemala emissions, unemployment, and GDP over time

Year	GDP per Capita in Current US Dollars	CO~2~ Emissions (Metric Tons per Capita)	Unemployment Rate
1990	845.307	0.4342486	NA
1991	1011.755	0.4334818	2.656
1992	1093.963	0.5060742	2.638
1993	1164.374	0.5219282	2.669
1994	1293.470	0.5409702	2.676
1995	1424.683	0.6172968	2.664
1996	1487.608	0.5874570	2.723
1997	1649.002	0.6071357	2.699
1998	1755.850	0.7504833	2.694
1999	1619.511	0.7249530	2.733
2000	1664.299	0.8127864	2.750
2001	1550.360	0.8263443	2.793
2002	1682.995	0.8619045	2.767
2003	1737.879	0.8489502	2.810
2004	1859.098	0.8476509	2.970
2005	2068.500	0.8904649	3.053
2006	2251.088	0.8718469	3.082
2007	2490.749	0.9208269	3.140
2008	2802.462	0.8180912	3.314
2009	2651.817	0.8464171	3.489
2010	2852.547	0.8022616	3.500
2011	3228.046	0.8084556	3.095
2012	3355.037	0.8219488	2.760
2013	3522.774	0.8641330	3.020
2014	3779.642	0.9113885	2.720
2015	3994.637	1.0496281	2.510
2016	4173.302	1.1050254	2.580
2017	4454.048	1.0299975	2.460
2018	4485.731	1.1206983	2.280
2019	4647.693	1.1629709	2.190

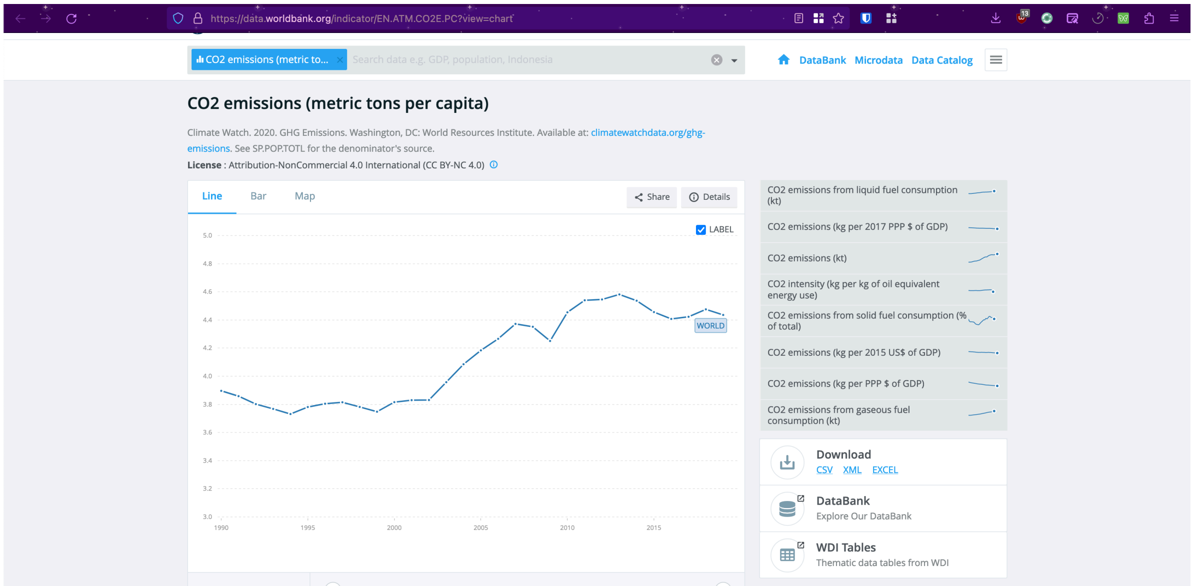
Table 8.5: Madagascar emissions, unemployment, and GDP over time

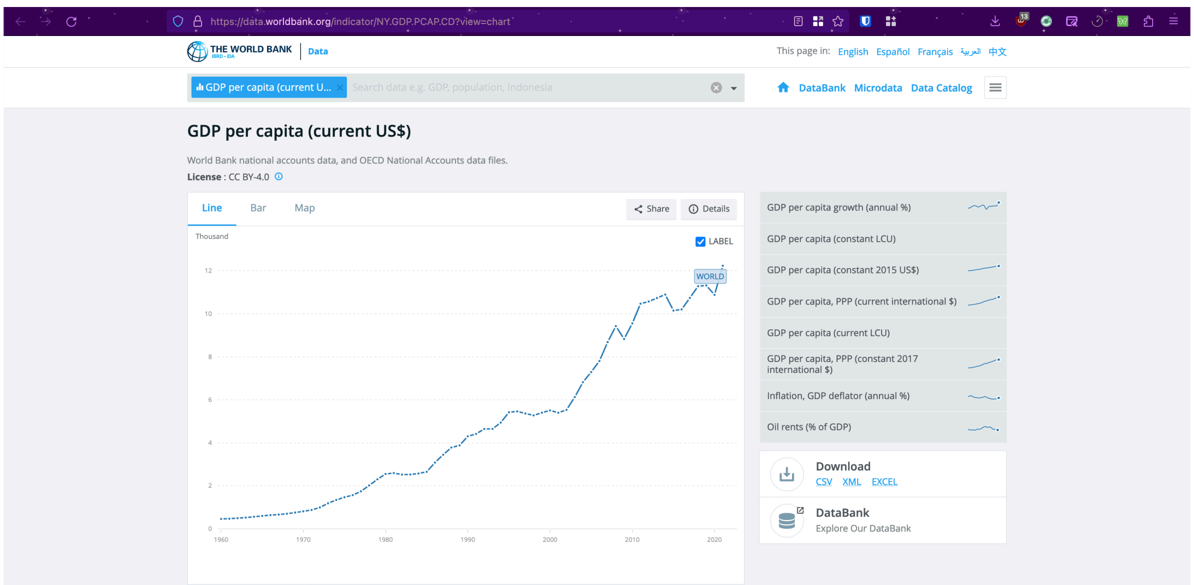
Year	GDP per Capita in Current US Dollars	CO~2~ Emissions (Metric Tons per Capita)	Unemployment Rate
1990	330.8435	0.0748984	NA
1991	265.7937	0.0775810	5.128
1992	294.2935	0.0760496	5.102
1993	312.0789	0.0768043	5.176
1994	262.1461	0.0900558	5.294
1995	276.7368	0.0987805	5.355
1996	344.4650	0.0914967	5.439
1997	288.4494	0.0960829	5.509
1998	288.6359	0.1068787	5.603
1999	271.9430	0.1061606	5.691
2000	285.4665	0.1017487	5.800
2001	325.4603	0.0999422	5.350
2002	310.9297	0.0650711	5.504
2003	359.5344	0.0874505	5.010
2004	277.5078	0.0904071	3.846
2005	311.7931	0.0909953	2.620
2006	330.5227	0.0847532	2.935
2007	427.8363	0.0863239	3.253
2008	522.8306	0.0867717	3.564
2009	455.4074	0.0800300	4.004
2010	459.3754	0.0860520	4.280
2011	516.9025	0.0979947	2.438
2012	504.1737	0.1193056	0.600
2013	526.6880	0.1242153	0.998
2014	517.1362	0.1242981	1.391
2015	455.6380	0.1319871	1.790
2016	464.6162	0.1246964	1.800
2017	503.4981	0.1325969	1.815
2018	512.5440	0.1247833	1.833
2019	512.2797	0.1496379	1.841

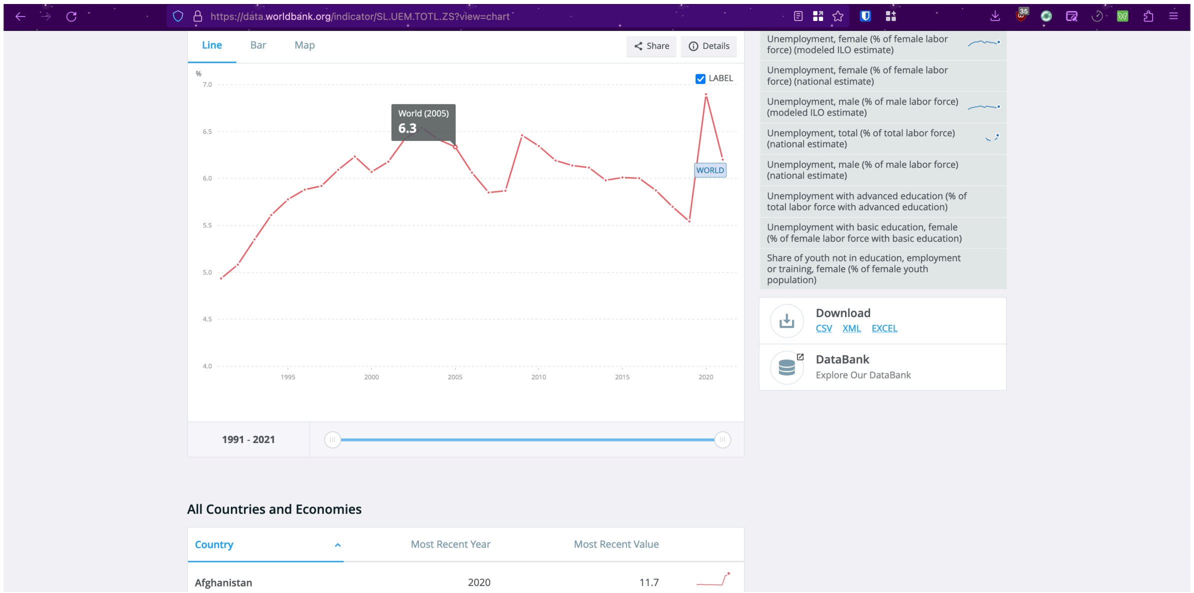
Table 8.6: United States of America emissions, unemployment, and GDP over time

Year	GDP per Capita in Current US Dollars	CO~2~ Emissions (Metric Tons per Capita)	Unemployment Rate
1990	23888.60	19.40735	NA
1991	24342.26	19.00340	6.80
1992	25418.99	19.02286	7.50
1993	26387.29	19.21833	6.90
1994	27694.85	19.25621	6.12
1995	28690.88	19.21691	5.65
1996	29967.71	19.57538	5.45
1997	31459.14	20.33086	5.00
1998	32853.68	20.26630	4.51
1999	34515.39	20.10113	4.22
2000	36329.96	20.46981	3.99
2001	37133.62	20.17153	4.73
2002	37997.76	19.44555	5.78
2003	39490.27	19.50650	5.99
2004	41724.63	19.59763	5.53
2005	44123.41	19.46926	5.08
2006	46302.00	18.94591	4.62
2007	48050.22	19.04291	4.62
2008	48570.05	18.27849	5.78
2009	47194.94	16.80870	9.25
2010	48650.64	17.43174	9.63
2011	50065.97	16.60422	8.95
2012	51784.42	15.78978	8.07
2013	53291.13	16.11118	7.37
2014	55123.85	16.04092	6.17
2015	56762.73	15.56003	5.28
2016	57866.74	15.14989	4.87
2017	59907.75	14.82326	4.36
2018	62823.31	15.22255	3.90
2019	65120.39	14.67341	3.67

8.0.0.1 *Proof of Work*



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World (2005)
6.3
WORLD
1991 - 2021
Unemployment, female (% of female labor force) (modeled ILO estimate)
Unemployment, female (% of female labor force) (national estimate)
Unemployment, male (% of male labor force) (modeled ILO estimate)
Unemployment, total (% of total labor force) (national estimate)
Unemployment, male (% of male labor force) (national estimate)
Unemployment with advanced education (% of total labor force with advanced education)
Unemployment with basic education, female (% of female labor force with basic education)
Share of youth not in education, employment or training, female (% of female youth population)
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2020
11.7