Autocracies and Climate Change

A Quantitative Comparative Analysis of How Autocracies Deal with Climate Change

Enrico Roseboom (s1043189)

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Supervisor: dr. M. J. Meijers

Nijmegen School of Management

Radboud University, Nijmegen, the Netherlands

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Abstract

In this thesis, I examine how autocracies deal with climate change. The existing literature explains differences between democracies and autocracies and differences among democracies, but there is still a research gap regarding autocracies in dealing with climate change. Therefore, I set out to explain the variation among autocracies climate change policy. To do so, I establish nine hypotheses based on the existing literature. I test the effect of these nine factors on the environmental performance of 74 autocracies through simple, multiple, and stepwise regression analysis. The results of the simple regression analysis show that autocracies with greater emissions, a smaller population size, a lower risk of being affected by climate change consequences, more media freedom, a higher GDP per capita, an economy more focused on services and less involvement in conflicts, engage more in climate change policy, while higher levels of democracy and government effectiveness have no effect on environmental performance. The results of the multiple and stepwise regression analyses show that population size is the strongest predictor of environmental performance, but also the factors related to economic development, such as the percentage of the population working in the service sector, and political stability, i.e. the number of political violence conflicts, should not be overlooked. As a result, I argue that countries with a larger population size should take more responsibility, economically less developed countries should be taken more by the hand in climate change policy, and the importance of peace for the sake of the climate should be emphasized.

Contents

List of Abbreviations and Acronyms

ACLED	Armed Conflict Location & Event Data Project
CCPI	Climate Change Performance Index
CRI	Global Climate Risk Index
EDI	Electoral Democracy Index
EPI	Environmental Performance Index
EU	European Union
GHG	Greenhouse Gas
OLS	Ordinary Least Squares
UN	United Nations
V-Dem	Varieties of Democracy
WGI	Worldwide Governance Indicators
WPFI	World Press Freedom Index

List of Tables and Figures

Chapter 1: Introduction

In this thesis, I examine how autocracies deal with climate change. Climate change is currently a major problem for the earth and humanity and is therefore an important issue in the societal and scientific debate and on the political agenda. Climate change refers to long-term shifts in temperatures and weather patterns, with major consequences (United Nations, 2023a). It is humans who are largely responsible for climate change. People are experiencing climate change in different ways. It can, for example, affect our health, ability to grow food, housing, safety, and work (United Nations, 2023a). Many scientists highlight the importance of political climate action, as climate change poses a grave threat to public safety. So does Mittiga (2021), who argues that legitimacy may even require an authoritarian approach, similar to the COVID-19 pandemic. The argument of ecoauthoritarianism, or a green dictatorship, is increasingly prevalent.

In this thesis, however, I look at autocracies' environmental performance. Bernauer (2013) points out that the factors that are causing variation in climate policies is one of the gaps in scientific research. According to him, more research needs to be done on factors that cause variation in climate change policy. In the second chapter, I argue that this is especially true for autocracies. The variation between democracies and autocracies in dealing with climate change has been extensively researched, as has the variation among democracies. On the other hand, the variation among autocracies has not been extensively researched. There has not been a systematic analysis of multiple autocracies, while the role of autocracies in solving the problem that is climate change should not be overlooked. To solve the global collective problem of climate change, every country must do its part, including autocracies. This makes it of great importance to also study autocracies in dealing with climate change.

In addition, it is especially important to study autocracies because, according to the 2022 Democracy Report by the Varieties of Democracy (V-Dem) Institute, autocracies are on the rise (V-Dem Institute, 2022). In 2022, as much as seventy percent of the world's population lived in an autocracy, and this number is growing. Besides, the world population is growing, especially in autocracies. This enhances the relevance of autocracies in relation to climate change, because it illustrates that autocracies play a major role in solving the global collective problem of climate change. Therefore, proper research needs to be done on autocracies and their role in solving this global problem. This research shows what factors cause autocracies to engage more or less in climate change policy. This is where policymakers can act on to ensure that autocracies take responsibility in doing their part as well.

Despite the importance of autocracies contributing to solving the problem of climate change, there is a lot of variation among autocracies in how they deal with climate change. This is showed by, among others, the 2022 Environmental Performance Index. This is also the index that is used to indicate how autocracies deal with climate change. Some countries engage more in climate change policy and some countries engage less. In this thesis, I conduct a quantitative comparative analysis to find out what explains this variation. This involves the following research question: ‘**How can the variation among autocracies in dealing with climate change be explained?**’

This research question contains the concept of autocracies, which is further clarified in the methods chapter. However, it is worth saying at this point that in this study I examine 74 autocracies according to the V-Dem Institute's classification, which can be found in *Appendix 1*. The research question also mentions the concept of dealing with climate change. For this purpose, I look at the environmental performance of the 74 autocracies according to the 2022 Environmental Performance Index. This is also further explained in the methods chapter.

To answer the research question, I first provide a literature review. From this existing literature, which represents the theoretical framework, follow factors that might explain the variation among autocracies in dealing with climate change. From this, nine hypotheses emerge. In the subsequent chapter, I discuss the quantitative method used to test these hypotheses, Ordinary Least Squares (OLS) regression analysis. I also operationalize the hypotheses and introduce the data that is used. In the following chapter, I test the hypotheses and present the results of the simple, multiple, and stepwise regression analyses. From this, several factors follow that either do or do not significantly explain the variation among autocracies in dealing with climate change.

Following from this, a conclusion is drawn in the final chapter, in which I formulate an answer to the research question and discuss the implications of my findings. I show that population size is the strongest predictor of environmental performance, but also the factors related to economic development, such as the percentage of the population working in the service sector, and political stability, i.e. the number of political violence conflicts, should not be overlooked. As a result, I argue that countries with a larger population size should take more responsibility, economically less developed countries should be taken more by the hand in climate change policy, and the importance of peace for the sake of the climate should be emphasized. I also emphasize the value of international cooperation in these three implications. This is what policymakers can act on to cause autocracies to contribute more to solving the global collective problem of climate change.

Chapter 2: Theory and Hypotheses

In this chapter, I first address the main existing literature on climate change and how democracies and autocracies engage in climate change policy. Following from this, I expose the gap that exists in the literature regarding autocracies and dealing with climate change. From this follows the aforementioned research question: 'How can the variation between autocracies in dealing with climate change be explained?' Next, I present the hypotheses of this study, based on the existing literature.

Climate Change

Climate change is an important and relevant topic at this time. According to the United Nations (UN), climate change refers to long-term shifts in temperatures and weather patterns (United Nations, 2023a). Scientific evidence that the climate is changing is overwhelming (Berrang-Ford, Ford & Paterson, 2010; VijayaVenkataRaman, Iniyan & Goic, 2010). Since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil, and gas (United Nations, 2023a). Energy, industry, transport, buildings, agriculture, and land use are among the main emitters. Greenhouse gas concentrations are at their highest levels in two million years and emissions continue to rise. This leads not only to warmer temperatures, but also to intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms, and declining biodiversity, since the earth is a system where everything is connected. Climate change can affect our health, ability to grow food, housing, safety, and work. Although climate change cannot be avoided entirely, the most severe impacts of climate change can be avoided (VijayaVenkataRaman, Iniyan & Goic, 2010). Therefore, thousands of scientists and government reviewers agreed in a series of UN reports that limiting global temperature rise to no more than 1.5 degrees Celsius would be necessary to avoid the worst climate impacts and maintain a livable climate (United Nations, 2023a). To this, everyone must contribute, as time available for beginning serious action to avoid severe global consequences is growing short (VijayaVenkataRaman, Iniyan & Goic, 2010).

That is why climate change has become one of the most important issues on the global policy agenda. Climate change emerged as a political issue in the 1970s, where activist and formal efforts were taken to ensure environmental crises were addressed on a global scale (Haibach & Schneider, 2013). This has continued to develop in subsequent years, leading to several global frameworks and agreements to guide progress, such as the Sustainable Development Goals, the UN Framework Convention on Climate Change and the Paris Agreement (United Nations, 2023a). After all, climate change is a global collective problem, which requires all countries to cooperate to achieve a solution. Bättig and Bernauer (2009) also illustrate this. They compare cooperating with climate change policy to the provision of a global public good. Everyone must participate in this, both democracies and autocracies. For example, as Weiss (2019) points out, the problem of climate change cannot be solved without the cooperation of China, an autocracy.

Are Democracies Better at Dealing with Climate Change than Autocracies?

To solve the global collective problem of climate change, every country should engage in climate change policy. There are, however, considerable differences between countries in the degree of cooperation with climate change policy. For this, one can look at indexes that measure climate change performance (Climate Change Performance Index, 2023; Burck et al., 2023) or environmental performance (Environmental Performance Index, 2022; Wolf et al., 2022), which show that some countries engage more in climate change policy than others. Scientific research also shows this, which has a crucial role in climate change policy. Scientific research has examined differences in climate change policy between democracies and autocracies, among democracies, but among autocracies it still falls short.

First, the existing literature addresses the differences between democracies and autocracies to a large extent. The main question here is whether and to what extent the level of democracy contributes to more climate change policy, with the majority of the literature leaning toward a positive influence of democracy on climate change performance. Starting with the aforementioned international agreements, Neumayer (2002) argues that democracies exhibit stronger international environmental commitment, finding that democracies sign and ratify more multilateral environmental agreements, and participate in more environmental intergovernmental organizations. In addition, he argues that democracies comply better with reporting requirements under the Convention on International Trade in Endangered Species of Fauna and Flora, put a greater percentage of their land area under protections status, are more likely to have a National Council on Sustainable Development in their country and have more environmentally relevant information available than non-democracies. The fact that democracies show more commitment does not immediately mean that this leads to better outcomes, Bättig & Bernauer (2009) also argue. They claim that democracies can indeed present better results in terms of policy output, but not in terms of policy outcomes. According to Bättig & Bernauer, democracies have a words-deeds gap: they talk the talk, but don’t walk the walk.

However, alongside this, many studies are showing that democracies can also produce better results. First of all, Li & Reuveny (2006) show that democracy, measured both dichotomously (democracy or not) and continuously (the level of democracy), produces better outcomes in terms of environmental degradation. They find that democracy reduces all five types of human-induced environmental degradation they tested: carbon dioxide emissions, nitrogen dioxide emissions, deforestation, land degradation, and organic pollution in water. Bernauer & Koubi (2009) show the effects of political institutions on air quality, coming to three main findings: the degree of democracy has an independent positive effect on air quality, presidential systems are more conducive to air quality than parliamentary systems, and labor union strengths contributes to lower environmental quality, whereas the strength of green parties has the opposite effect. This demonstrates that the political system and political institutions do matter for environmental outcomes. Also, Gleditsch & Sverdrup (2003) show a positive effect of the level of democracy on the environment. They find, for instance, that a rise in democracy reduces CO2 emissions per capita for a sample of 108 countries in 1990, so quite some time ago.

Arvin & Lew (2011) examine the impact of the level of democracy as measured by Freedom House on environmental conditions as well, but they use a large sample of developing countries. As a matter of fact, it is also important to look at developing countries in addition to industrialized countries, as the rate of emissions in developing countries has increased by a startling amount (Spilker, 2013). Arvin & Lew's (2011) conclusion is that there is no uniform relationship between democracy and the state of the environment, as their evidence that democracy is conducive to environmental improvement depends on the measure of the environmental quality that is used. This also shows the importance of the measure of the environmental quality. Spilker (2013) also looks at the effect of the level of democracy on the environment in developing countries, but she finds no significant effect either. According to her, democracy does not seem to matter for environmental outcomes in the developing world. A possible explanation Spilker gives is that citizens in low-income countries are unlikely to demand environmental commitments from politicians, as they have other policy preferences.

Besides scholars who find no effect, there are also a few scholars who even find a negative effect of democracy on the environment. Midlarsky (1998) is one of these exceptions. He examined six different variables. In his multiple regression analyses of three of the environmental indicators, deforestation, carbon dioxide emission, and soil erosion by water, the statistically significant effect of democracy on the environment was negative. For the fourth variable, protected land area, the impact of democracy was positive, while in the remaining two instances, freshwater availability and soil erosion by chemicals, there was no significant effect of democracy on the environment. Furthermore, in addition to developing countries, research has also been done on, for example, Sub-Saharan countries by Sjöstedt & Jagers (2014). They find that the more democratic a country is, the more successful it is in protecting marine environments. However, this effect disappears during turbulent times and periods of rapid political change. Again, the importance of the political system, as well as the broader political context, is apparent.

Jahanger, Usman & Balsalobre-Lorente (2021) also conducted a comprehensive study on autocracy, democracy, globalization, and environmental pollution in the developing world. Their results show that autocracy, political globalization, economic growth, financial development, energy consumption, and gross fixed capital formation significantly enhance environmental degradation, while democracy, economic, social, and overall globalization significantly reduce it. So here again a positive effect of democracy on the environment can be seen, and other factors that may be important are also included. Thus, much research has been done on the differences between democracies and autocracies and their environmental performance.

In addition to democracies and autocracies, there are also countries that fall into neither category. Kneuer (2012) researched these countries, which are neither full democracies nor full autocracies. She focuses on possible trade-offs of different regime types in the context of climate change. According to her, it is the intermediate regimes who are confronted more than either democracies or autocracies with the most difficult and cruelest choices, namely between addressing different economic and political and climate change objectives. Furthermore, Kneuer argues that autocracies do not outperform democracies in terms of combating climate change. In the long run, autocracies are very unlikely to be greener. In autocracies, climate change policy could potentially develop into a stress factor that challenges political stability and threatens the regime. Building on historic examples of the Baltic States and East Germany during the late Cold War era and the recent example of China, Kneuer shows that the environment is becoming an arena where repressive mechanisms of control over society are increasingly being challenged (Kneuer, 2012). All in all, a majority of the scientific literature argues that democracies are better at dealing with climate change than autocracies.

How Democracies Deal with Climate Change

In the debate whether democracies are better at dealing with climate change than autocracies, the term ecoauthoritarianism, which I briefly mentioned in the introduction, is interesting. Ecoauthoritarianism is a political ideology that that emerged in the 1970s and argued that liberal democracies were inadequate to combat global warming (Martini, 2022; Shahar, 2015). Therefore, it is claimed by some that a more authoritarian regime could be more effective in dealing with climate change. Von Stein (2022) builds on this claim that ecoauthoritarianism may be the best way forward. She points out that political constraints, which are present in democracies, make environmental policy change more difficult. However, there are also many scholars who do not agree with this argument, such as Shahar (2015). He argues that that current ecoauthoritarian views do not present an attractive alternative to liberal democracy even if we take a high pessimistic view of the latter sort of regime. In addition, the literature discussed above has shown that democracy often actually has a positive effect on climate change policy. Therefore, I will not elaborate on the argument of ecoauthoritarianism in this thesis, despite being it an interesting argument. In this section, I focus on how democracies deal with climate change.

There has been much research on differences among democracies in dealing with climate change. As mentioned, Bernauer & Koubi (2009) found that presidential systems are more conducive to air quality than parliamentary systems, and that labor union strengths contributes to lower environmental quality, whereas the strength of green parties has the opposite effect. Povitkina (2018) conducted research on democracies in tackling climate change. She found corruption as a moderating variable between democracy and CO_2 emissions. According to her, more democracy is only associated with lower CO_2 emissions in low-corruption contexts. If corruption is high, democracies do not seem to do better than authoritarian regimes. Povitkina also points to the role of civil society, environmental awareness through free media and collaboration in international environmental agreements as possible relevant factors.

Regarding raising environmental awareness through free media, according to Povitkina (2018), the media play a crucial role in placing environmental issues on the political agenda and adopting environmental policies. This is also Wu's (2009) reasoning, who states that a risk society is intrinsically a media society, building on Beck's (1996) argument. Invisible environmental risks need to be identified and visualized in the public sphere before they can acquire the status of 'social problems' that the public should be concerned about. The media play an important role in this, as media coverage of certain risk issues may amplify public interest and thus create a sense of urgency around them. During this process, whose framing of reality, or whose interpretation of the issue, is favored by media largely affects public perception, assessment, and management of risks (Ryan, 1991; Wu, 2009). Also new media can play a role in climate change engagement, as is argued by O'Neill & Boykoff (2011). They define new media as media which are integrated, interactive, and use digital code. This refers to the broad range of content that can be found online nowadays, including on news sites, blogs, and social networking sites. New media actors and agents play multiple roles, such as providing information, facilitating engagement, and widening participation. On the other hand, new media actors can equally provide disinformation, increase fragmentation, or not reach beyond already-engaged audiences (O'Neill & Boykoff, 2011).

Furthermore, Wang, Feng, Wang & Chang (2022) investigated political ideology as a moderating variable. They indeed found a moderating effect for democracies, but no effect for autocracies. Bernauer & Böhmelt (2013) examined whether economically kinder and gentler societies are also greener. With economically kinder and gentler societies, the authors mean countries providing stronger state-sponsored social-safety nets for their people. Bernauer & Böhmelt (2013) test in their article whether this could lead to positive spillover effects towards stronger environmental protection and higher environmental quality. Their results offer only weak and inconsistent support for the claim that social policies and environmental performance are systematically related and thus for the spillover effects. Frederiksson & Neumayer (2013) found that countries' historical experience with democracy, the democratic capital stock, determines current climate change policies rather than current levels of democracy.

Moving on to the next possible important factor, Raleigh & Urdal (2007) investigated the relationship between environmental performance and armed conflicts. However, they did not examine the effect of armed conflicts on environmental performance, but the other way around. They address some of the most important factors assumed to be strongly influenced by global warming: land degradation, freshwater availability, and population density and change. Raleigh & Urdal find that population growth and density are associated with increased risks of armed conflicts, while the effects of land degradation and water scarcity are weak and insignificant. Although this direction of this relationship between these two variables is not what I seek to investigate, armed conflicts can be a variable of relevance, due to both the direct and indirect impact of armed conflicts on the environment(al performance). After all, armed conflict has a direct impact on the environment, as it leads to environmental degradation or destruction in the form of, for example polluted water, torched crops, cut down forests, poisoned soils and killed animals (Geneva Call, 2021; Geneva Environment Network, 2023). In addition, it may have an indirect effect, since countries where armed conflict is ongoing have their priorities there rather than on climate change policy. All in all, the existing literature gives a variety of factors that explain differences among democracies in dealing with climate change, such as corruption and media freedom. Some of these factors could also explain the variation among autocracies in dealing with climate change.

Gap in the Literature: How Autocracies Deal with Climate Change

In the existing literature, however, there is a gap in research on autocracies in dealing with climate change. In the previous section, I showed that the existing literature on climate change in relation to the level of democracy covers some of the ground, but there is also a gap in the literature. The existing literature delves much into the variation between democracies and autocracies, answering the question of whether a higher level of democracy leads to better environmental performance. In this respect, the majority of the literature tends to confirm the proposition that democracy indeed leads to better environmental performance. Democracies seem to be central in the existing literature. There is also a focus on variation within democracies. Some democracies do more climate change policy, while some democracies do less. The literature has tried to explain this in different ways, using different factors such as government effectiveness. However, variation among autocracies is not considered in the existing literature. There has been an occasional look at a single country, mostly China (Engels, 2018; Weiss, 2019) or Russia (Martinot, Sinton & Haddad, 1997). Also considered is the local or city level, also mostly in China (Shan et al., 2018; Mi et al., 2019) or Russia (Sharmina, Anderson & Bows-Larkin, 2013). Yet, there is a lack of systematic analysis for autocracies, while that can be of great importance.

As Bernauer (2013) pointed out, the factors that are driving variation in climate policies is one of the gaps in scientific research. In his article, he looks at the research done on climate change policy. Bernauer (2013) presents four areas where research on climate change policy is still lacking. One of these is: factors that are driving variation in climate policies at national and subnational levels. So, according to him, more research needs to be done on factors that drive variation in climate change policy. As the previous section has shown, this is especially the case for autocracies, since much research has already been done on democracies. Therefore, in this thesis, I attempt to look into the factors that are driving variation in climate change policy in autocracies. After all, variation in climate change policy exists also within autocracies. I explore the factors that explain these differences in a systematic way. That is, I examine multiple factors in order to build a systematic picture of how autocracies deal with climate change. This involves, as mentioned in the introduction, the following research question: ‘How can the variation between autocracies in climate change mitigation policy be explained?’

Hypotheses

Based on the previously discussed existing literature, multiple hypotheses can be constructed for this analysis of how autocracies deal with climate change. In the theory part, I began with the problem of climate change as described by the UN (2023a). The UN claim that everyone must take climate action in order to solve the problem of climate change. However, some countries produce more of the emissions that cause climate change than others. In fact, the ten countries with the largest emissions contribute 68 percent of total, whereas the hundred least-emitting countries generate 3 percent of total emissions. In fact, according to the Climate Change Performance Index (2023), a group of 59 countries accounts for 92 percent of total global greenhouse gas (GHG) emissions. Since that is an uneven distribution, the UN argue that people and countries creating more of the problem have a greater responsibility to act first (United Nations, 2023a). It is the normative expectation of the UN that more emissions cause countries to engage more in climate change policy. However, this is not to say that this is the case. After all, it could also be seen another way, namely that more emissions lead to a worse environmental performance, because many emissions do not demonstrate a strong commitment to climate change policy. Therefore, I test both whether autocracies with more emissions engage more or less in climate change policy.

Hypothesis 1A: ‘Autocracies with greater emissions engage more in climate change policy’.

Hypothesis 1B: ‘Autocracies with greater emissions engage less in climate change policy’.

An important article for this thesis is that of Bättig & Bernauer (2009). They argue that smaller countries are more likely to tend to do nothing or less. According to them, small actors can, individually, make only a small contribution to solving the overall problem and should therefore have an especially strong incentive to free ride on the efforts of bigger actors. Bigger actors also have this incentive, but to a lesser extent, because they can in fact contribute significantly more to solving the overall problem. Therefore, smaller countries are expected to engage less in climate change policy than bigger countries. This reasoning would apply as much to autocracies as to democracies. Larger countries could relate to country size as well as population size. Bättig & Bernauer (2009) refer in their example to population size, so I investigate that as well.

Hypothesis 2: ‘Autocracies that are smaller in population size engage less in climate change policy’.

Bättig & Bernauer (2009) also make an argument that not all countries are equally affected by climate change. This can be called geographical mismatch. If all countries would be equally affected by climate change, every country should have an equal incentive to engage in climate change policy. However, this is not the case, since some countries are more affected by climate change than others, as can also be seen in the Global Climate Risk Index (Eckstein, Künzel & Schäfer, 2021). The UN also establish that some countries and people are more vulnerable to climate impacts, such as people living in small island nations and other developing countries. Conditions like sea-level rise and saltwater intrusion have advanced to the point where whole communities have had to relocate, and protracted droughts are putting people at risk of famine (United Nations, 2023a). Wu (2023), based on King & Jones' (2021) paper wrote about the best places to live to avoid climate change. He argues that there are certain countries, such as New Zealand, Iceland, the United Kingdom, Australia, and Ireland, with 'favorable starting conditions' that other countries do not have. It is expected that the countries more affected by climate change impacts do more regarding climate change policy. Again, this applies to both democracies and autocracies.

Hypothesis 3: 'Autocracies that are more at risk of being affected by climate change consequences engage more in climate change policy'.

After the geographical mismatch argument, the theory section discussed extensively the variation between democracies and autocracies and their effect on coping with climate change. Bättig & Bernauer (2009) examined this, as well as a lot of other authors, with a majority tending towards a positive effect of the level of democracy on environmental performance. If the level of democracy in general would have a positive effect on environmental performance, it could also be the case that an autocracy with a higher level of democracy would have a better environmental performance than an autocracy with a lower level of democracy. I investigate whether it is also true for autocracies that a higher level of democracy leads to more engagement with climate change policy.

Hypothesis 4: 'Autocracies that have a higher level of democracy engage more in climate change policy'.

It can also be examined whether the factors seen as relevant to democracies by Povitkina (2018) are also relevant to autocracies. First, corruption, which she sees as moderating variable between democracy and CO2 emissions. Related to this are domestic political institutions, to which Spilker (2013) points, and government effectiveness, to which Sjöstedt & Jagers (2014) refer. This brings me to a concept used by Dahlberg & Holmberg (2014), quality of governance. These concepts are all related, and I explore whether the quality of governance makes a difference in climate change engagement. If so, having a higher quality of governance would result in more engagement with climate change policy, since policies that are implemented can actually be executed, by working domestic political institutions and an effective government, building on Dahlberg & Holmberg's (2014) reasoning.

Hypothesis 5: 'Autocracies that have a higher quality of governance engage more in climate change policy'.

Another variable that Povitkina (2018) considers relevant is free media, which can play a role in raising environmental awareness. The role of the media in climate change engagement also emerged as important in other literature. This could also be relevant to autocracies, since there is free media in some of the countries there to some extent as well. This varies significantly from country to country, there are different degrees of media freedom. As a result, it can be tested whether free media really makes a difference to climate change engagement in autocracies. If that were to be the case, more media freedom would lead to more environmental awareness among the country's citizens, leading citizens to prefer more climate change engagement. However, it is questionable whether autocratic leaders care and respond to these preferences, but it may be the case that they do so to strengthen their legitimacy. I test this with the hypothesis below. This hypothesis could be related to the fourth hypothesis, since the level of democracy and media freedom are probably correlated. How this is tackled is discussed in the next chapter.

Hypothesis 6: 'Autocracies that have more media freedom engage more in climate change policy'.

The last variable that Povitkina (2018) considers relevant are international agreements. This is also reflected in other studies. Spilker (2013) mentions integration into the international system as an important factor for developing countries. Both Wang, Feng, Wang & Chang (2022) and Jahanger, Usman & Balsalobre-Lorente (2021) emphasize the role that globalization plays. This could also be important for autocracies. The theory part showed that because climate change has become one of the most important issues on the global policy agenda, several global frameworks and agreements have been established. Not all countries participate in these. It is expected that the countries that do participate, including autocracies, engage more in climate change policy. The hypothesis that would follow from this is: 'Autocracies that participate more in international climate agreements engage more in climate change policy'. However, as becomes clear in the next chapter, this factor is difficult to measure and is therefore not included in the study.

As mentioned, Spilker (2013) has researched the relationship between democracy and environmental performance in developing countries. A possible explanation that she came up with is that citizens in low-income countries are unlikely to demand environmental commitments from politicians, as they have other policy preferences than climate change engagement. Citizens who have lower incomes, and thus less money to spend, are more likely to worry, for example, about what to eat the next day. If citizens have higher incomes, they need to worry less about such things and their preferences may shift to things like more climate change engagement. From this research, among others, a hypothesis can be drawn up regarding wealth and environmental performance. In fact, this could also apply to autocracies, since it also matters for these countries whether they have the money for climate change policy, or whether they have other preferences. Wang, Feng, Wang & Chang (2022) and Jahanger, Usman & Balsalobre-Lorente (2021) also point to economic performance and growth as possible relevant factors, albeit with different outcomes. The expectation here is that richer countries do more on climate change policy because here these preferences are more likely to live and, more importantly, there is simply more money. For richer countries, it is easier to spend more money on climate change engagement. To examine this, I look at GDP per capita. This is explained further in the next chapter, but has already been incorporated into the hypothesis below.

Hypothesis 7: ‘Autocracies with a higher GDP per capita engage more in climate change policy’.

It is not just economic performance or growth that matters, the type of economy matters as well. An economy is usually more focused on one of three sectors: services, industry, or agriculture. According to Khan (2019), the service sector plays the biggest role in the economy of the world. The global economy is moving towards a more services-oriented structure. Nevertheless, industry and agriculture continue to play an important role in the development of many countries as well (Khan, 2019). There are countries that are more focused on the service sector, such as the United States, the United Kingdom and Japan. Countries more focused on the industrial sector include Iran, Azerbaijan, and Equatorial Guinea. Countries more focused on the agriculture sector are mostly found in Africa and Asia, such as Niger, Uganda, and Nepal (Khan, 2019). It is expected that when a country's economy is more focused on industry or agriculture, that country do less about climate change, as it is more difficult to make mitigations. Many of the countries more focused on industry or agriculture also rank lower on the EPI, for example Niger (Environmental Performance Index, 2022). I test whether a focus on industry or agriculture does in fact lead to significantly less engagement in climate change policy, because it is more difficult to apply mitigation policies in these sectors. Therefore, the hypothesis is tested whether a focus on the service sector leads to significantly more engagement in climate change policy.

Hypothesis 8: ‘Autocracies that have an economy more focused on services engage more in climate change policy’.

Coming to the last hypothesis, Sjöstedt & Jagers (2014) argue that political change has a negative effect on the relationship between the political system and climate change policy. They argue that the effect of the political system disappears during turbulent times and periods of rapid political change. Thus, the stability of a regime seems to be an important factor that can make a difference in how a country deals with climate change. Stability of a regime is a rather vague concept, but related to it could be the number of conflicts, which brings me to Raleigh & Urdal (2007), discussed in the last theory part. It was then suggested that armed conflict may be a relevant factor because of both its direct and indirect impact on the environment. Combining this leads to the expectation that countries that have a higher number of conflicts engage less in climate change policy. In these countries, because of conflicts, political stability disappears (Sjöstedt & Jagers, 2014). These countries have other priorities, rather than being a stable regime, and therefore engage less in climate change policy. Finally, I examine whether that is indeed the case.

Hypothesis 9: ‘Autocracies that are involved in more conflicts engage less in climate change policy’.

Chapter 3: Methods

In this chapter, I discuss the methods that are used for this thesis, OLS regression analysis, and the assumptions of regression analysis. Then, I operationalize the hypotheses established in the previous chapter. This involves looking at the concept of autocracies, the dependent variable, the various independent variables, and the data required to measure these variables.

Methods

The hypotheses established in the previous chapter are tested through ordinary least squares (OLS) regression analysis. OLS regression analysis is a statistical method that shows the relationship between two or more variables. It tests the relationship between a dependent variable against independent variables (Tibco, 2023). In this case, the effects of different independent variables, for example population size, on the dependent variable, climate change mitigation policy, are tested. In this way, it can be examined which of the independent variables do indeed have an impact on the dependent variable (Gallo, 2015). This is done for different countries, that is all the autocracies of the world. How this sample was constructed exactly is shown in the next section, which discusses the operationalization of the variables as well as the concept of autocracies. To conduct a regression analysis, the variables need to be operationalized in the next section. In this section, too, the data on the variables in question is gathered. After that, the regression analysis can be conducted. This is done using IBM SPSS Statistics, a statistical software platform (IBM, 2023). The results include the estimated effect, or the regression coefficient, the standard error of the estimate, and the p-value, which indicates whether the estimated effects are significant (Bevans, 2022). If a significant effect is found, the hypothesis in question is accepted. On this basis, it can be argued which factors cause autocracies to engage in climate change mitigation policy.

This is done in two parts, simple and multiple regression analysis, before the results are packed out through stepwise regression analysis. First, all nine hypotheses, as established in the previous chapter, is tested through simple regression analysis, which is used to estimate the relationship between two quantitative variables (Bevans, 2022). This merely looks at the relationship between the independent variables and the dependent variable separately. However, this bivariate association between the two variables is usually not a good representation of the causal effect of the independent variable on the dependent variable, as other variables may confound the relationship (Field, 2018). Therefore, also multiple regression analysis is done. Multiple regression tests effects of multiple independent variables at once. Whereas with simple regression nine models come out, with multiple regression one model comes out which includes all the independent variables. This shows which effects of the independent variables on the dependent variable are strongest, since the effects of the independent variables are estimated while controlling for other, possible confounding, variables (Field, 2018).

Regression analysis, both simple and multiple, involves several assumptions. A violation of these assumptions can lead to bias, which means that the estimated coefficients and standard errors are systematically different than the coefficients and standard errors in the population (Field, 2018). Outliers, endogeneity, and selection bias can also cause this. There are four assumptions regarding regression analysis. The first assumption is about additivity and linearity, which holds that the combined effect of the independent variables on the dependent variable is best described by adding their effects together and that the relationship between the independent variables and the dependent variable is linear (Field, 2018). The linearity assumption can best be tested with scatter plots (Statistics Solutions, 2023a). Here, it is also important to check for outliers since linear regression is sensitive to outlier effects. The second assumption is about independent errors. For any two observations the residual terms should be uncorrelated. This is also described as a lack of autocorrelation and can be tested with the Durbin-Watson test, which tests for serial correlations between errors. The tests statistic varies between 0.00 and 4.00, with a value of 2.00 meaning that the residuals are uncorrelated. Values less than 1.00 or greater than 3.00 are cause for concern (Field, 2018).

Here, it is also important that there is little or no multicollinearity, which refers to when your predictor variables are highly correlated with each other. Multicollinearity is only relevant for multiple linear regression, which has multiple predictor variables. Multicollinearity can be tested in two ways. Firstly, it can be tested with a correlation matrix, where the correlation coefficients should be below 0.80. Secondly, it can be tested using variance inflation factor (VIF) values, which should be below 10.00 and in the best case below 5.00 (Statistics Solutions, 2023b). The third assumption is about homoscedasticity, which means that the residuals at each level of the predictors should have the same variance. Otherwise, there is heteroscedasticity (Field, 2018). The scatter plot is good way to check whether the data are homoscedastic (Statistics Solutions, 2023a). The fourth assumption is about normally distributed errors, which means that differences between the predicted and observed data are most frequently zero or close to zero (Field, 2018). The residuals should follow a normal distribution. This assumption can best be checked with a histogram or a P-P plot (Statistics Solutions, 2023b).

Operationalization and Data

Concept	**Operationalization**	**Data Source**
Autocracies	All countries that are electoral[1] or closed[2] autocracies	V-Dem Institute (2022)
Climate change policy	Environmental Performance Index (EPI) score	Wolf et al. (2022)
Emissions	GHG emissions per capita	ClimateWatch (2019)
Population size	Population size	Worldometer (2020)
Risk of being affected by climate change	Global Climate Risk Index (CRI) score	Eckstein, Künzel & Schäfer (2021)
Level of democracy	Electoral Democracy Index (EDI) score	V-Dem Institute (2022)
Quality of governance	Government effectiveness	Kaufmann & Kraay (2022)
Media freedom	World Press Freedom Index (WPFI) score	Reporters without Borders (2023)
Wealth	GDP per capita	World Bank (2021)
Focus of economy on service sector	Percentage of the population working in service sector	World Bank Gender Data Portal (2019)
Conflicts	(The number of) political violence conflicts	ACLED (2022)

Table 1: Operationalization and Data Sources of the Concepts

In this section, I further operationalize the concepts used in this study. I also further explain the data source for these operationalized concepts. An overview of this is provided above in *Table 1*.

Autocracies

In this thesis, I aim to include all autocracies in the world. It is necessary to operationalize the concept of autocracies in order to know what is meant by autocracies and which countries are examined in this thesis. There are a lot of definitions of autocracies, but nearly all the leading works in the literature define autocracies as non-democracies, using the absence of electoral contestation as a proxy for the presence of authoritarian relations (Anderson, Brownlee & Clarke, 2021). To determine which countries are then relevant, I use V-Dem Institute measurements, based on Lührmann, Tannenberg & Lindberg

[1] Electoral autocracy: Citizens have the right to choose the chief executive and the legislature through multi-party elections, but they lack some freedoms, such as the freedoms of association or expression that make the elections meaningful, free, and fair (Lührmann, Tannenberg & Lindberg, 2018).

[2] Closed autocracy: Citizens do not have the right to choose either the chief executive of the government or the legislature through multi-party elections (Lührmann, Tannenberg & Lindberg, 2018).

(2018). Varieties of Democracy (V-Dem) is a unique approach to conceptualizing and measuring democracy (V-Dem Institute, 2023). Lührmann, Tannenberg & Lindberg (2018), divide the countries of the world into four regime types: liberal democracies, electoral democracies, electoral autocracies, and closed autocracies. To do this, they used for example Dahl's (1998) democratic criteria. According to their classification, in an electoral autocracy citizens have the right to choose the chief executive and the legislature through multi-party elections, but they lack some freedoms, such as the freedoms of association or expression that make the elections meaningful, free, and fair. In a closed autocracy, citizens do not have the right to choose either the chief executive of the government or the legislature through multi-party elections (Lührmann, Tannenberg & Lindberg, 2018). Thus, also in V-Dem Institute's (2022) classification, autocracies refer mainly to those countries where there is little or no electoral contestation.

According to this classification, there were sixty electoral autocracies and thirty closed autocracies in 2021 (V-Dem Institute, 2022, p. 45). So, there were a total of ninety autocracies in the world. It is these countries that can be examined in this thesis. However, not all data is available for all these countries. The ninety autocracies include several countries that are not always considered to be independent sovereign nations (United Nations, 2023b). As a result, many data sources lack information on these countries. Therefore, I decided not to include these countries in this study. These countries are Hong Kong, Palestine (Gaza), Palestine (West Bank), Somaliland, and Zanzibar (United Nations, 2023b). For the remaining countries, not all data is available either. After removing the countries for which not all the data is available, 74 countries remain. A list of all autocracies is attached in *Appendix 1*. 74 is the sample size for this thesis. The larger the sample, the more statistical power. That is, the ability to detect effects that exist in the population using the sample (Field, 2018). A sample size of 74 countries is a good size, since the rule of thumb says that one must have at least fifty cases. However, the sample size is not very large, so some effects could actually be more significant than found in this study. As a result, different significance levels are used in this study.

Dependent Variable

Now that the countries included in this thesis have been determined, the relevant variables can be discussed. First, the dependent variable, climate change policy, needs to be operationalized. According to the UN, climate change policy consists of three broad categories: cutting emissions, adapting to climate impacts, and financing required adjustments (United Nations, 2023a). I focus mainly on the first and the second category. To measure this, there are several indexes. Two important indexes are the Climate Change Performance Index (CCPI) and the Environmental Performance Index (EPI). The former is an instrument to enable transparency in national and international climate politics and uses a standardized framework to compare the climate performance of 59 countries and the European Union (EU), which together account for ninety-two percent of global greenhouse gas emissions. An appropriate index, but this directly addresses the problem of this index. There are only 59 single countries in this index. Many of the countries examined in this thesis are not included in the CCPI (Climate Change Performance Index, 2023; Burck et al., 2023).

Therefore, instead of the CCPI, I have chosen to use the EPI (Environmental Performance Index, 2022). This index provides a data-driven summary of the state of sustainability around the world, using 40 performance indicators across 11 issue categories. With this, this index indicates which countries are best addressing the environmental challenges that every nation faces. The 2022 EPI ranks 180 countries on climate change performance, environmental health, and ecosystem vitality. That is a lot more than the CCPI, and in it, the data from almost all countries is available. However, there are still several countries for which there is no data available on environmental performance. These are Libya, North Korea, Somalia, South Sudan, Syria, and Yemen. Therefore, these autocracies have to be dropped from the study. This variable is called the Environmental Performance Index (EPI) score (Environmental Performance Index, 2022; Wolf et al., 2022).

For each variable, I have also considered whether it is immediately suitable to conduct the study with or whether something needed to be done with it. To do this, I have examined the distribution of the variable, which should resemble a normal distribution. This is shown in histograms, which can be found in *Appendix 2*. Regarding this variable, the EPI score, *Figure A1* in the Appendix shows that it is fairly normally distributed. Therefore, this variable can be used directly in the study in this way.

Independent Variables

This brings me to the independent variables, whose effects on the dependent variable are tested. Nine hypotheses were established in the previous chapter, resulting in nine independent variables. The first hypothesis tests whether autocracies with greater emissions engage more in climate change policy. The independent variable is emissions. This could include looking at all greenhouse gas (GHG) emissions or, for example, the primary greenhouse gas, CO2. The choice was made for the former, looking at all GHG emissions. In doing so, I look at GHG emissions per capita. Regarding the data, there are indexes for this as well, although the data is sometimes unknown for some countries. For example, in the 2022 EPI, which lists greenhouse gas emissions per capita, but for a number of countries, specifically autocracies, the data is unknown. Therefore, in order not to lose too many countries, I have chosen another data source. This has become ClimateWatch (2019), which seeks to capture historical GHG emissions. Their most recent data of all GHG emissions per capita for each country is from 2019. Within this data source, of the remaining countries, only Eritrea has no data, so this country cannot be included in this study either.

For this variable, too, a histogram is used to see if it is normally distributed. The second histogram of *Appendix 2* shows that this variable is not normally distributed at all. Rather, the distribution in *Figure A2a* is right-skewed. To improve this distribution to a more normal distribution, a logarithmic transformation of the variable can be done. Therefore, I have performed a logarithmic transformation of the variable GHG emissions per capita. This resulted in a much better and more normal distribution, as can be seen in *Figure A2b*. However, the logarithmic transformation could not simply be performed. This is because one country, Fiji, had a negative value and then it is not possible to transform it logarithmically. As a result, a value of one was first added to all countries, so that all countries would have a positive value, but the ratio relative to other countries remained the same. After this, the logarithmic transformation could be carried out.

The second hypothesis tests whether autocracies that are smaller in population size engage less in climate change policy. Here, the independent variable is population size, which is a relatively concrete and easily measurable variable. For this variable, Worldometer's (2020) dataset on the countries in the world by population can be used. Worldometer keeps track of live world statistics on population, government and economics, society and media, environment, food, water, energy, and health. The most recent data for population size is from 2020, so this was used for this study. As for the countries remaining for this study, this variable is available for each country. Also, the distribution of this variable, population size, is not normally distributed, but right skewed, as *Figure A3a* shows. As a result, a logarithmic transformation was performed for this variable as well. Again, this resulted in the variable being better and more normally distributed, as can be seen in *Figure A3b*.

The third hypothesis tests whether autocracies that are more at risk of being affected by climate change engage more in climate change policy. So, with this hypothesis I look at the consequences of climate change that a country is at risk of. To this end, I look at the Global Climate Risk Index (Eckstein, Künzel & Schäfer, 2021). The Global Climate Risk Index (CRI) analyses to what extent countries and regions have been affected by impacts of weather-related loss events, such as storms, floods, and heat waves. The most recent CRI is from 2021, so this is to be used. Many countries are included in this. However, Equatorial Guinea, Gambia, Turkmenistan, and Cuba did not receive a score. Unfortunately, these countries therefore have to be dropped from the study.

For this variable, the Global Climate Risk Index (CRI) score, the distribution was also examined. *Figure A4a* in *Appendix 2* shows that this variable is not normally distributed. However, the left-skewedness of this distribution is not fixed by logarithmic transformation of the variable, as shown in *Figure A4b*. As a result, another solution is necessary. I have chosen to make the variable categorical using the 'visual binning' feature in SPSS. The 'equal percentiles based on scanned cases' option was used. Three equal percentiles, tertiles, were created using two cut points. The variable CRI score thus became a categorical variable with three categories, which then relatively represent high risk, medium risk, and low risk. To properly incorporate this into the research, dummies were created as well. As a result, there are three dummy variables, for high risk, medium risk, and low risk. The histogram of the new, categorical variable can be seen in *Figure A4c*.

The fourth hypothesis tests whether autocracies that have a higher level of democracy engage more in climate change policy. Here, the independent variable is the level of democracy. For this, I return to V-Dem and their measurements of the levels of democracy for the relevant countries. The 2022 V-Dem report, upon which it is also based which countries are autocracies, also lists countries' scores on various democratic indices (V-Dem Institute, 2022). I look at the Electoral Democracy Index (EDI), since the electoral component seemed the most important in defining autocracies. This index measures the principle of electoral or representative democracy, including whether elections were free and fair, as well as the prevalence of a free and independent media. The index is part of all the other indices as a central component of democracy (Coppedge et al., 2022). As for data availability, in this index all countries have been scored. When looking at the normal distribution of the variable Electoral Democracy Index (EDI) score in *Figure A5,* it can be concluded that the variable is fairly normally distributed, so there is no need to transform this variable.

The fifth hypothesis tests whether autocracies that have a higher quality of governance engage more in climate change policy. For this purpose, I look at the Worldwide Governance Indicators (WGI). The WGI project looks at governance as the traditions and institutions by which authority in a country is exercised. Their reports aggregate and individual governance indicators for over two-hundred countries and territories over the period 1996–2021, for six dimensions of governance: voice and accountability; political stability and absence of violence and terrorism; government effectiveness; regulatory quality; rule of law; and control of corruption. I use the fourth of these indicators, government effectiveness. It uses the most recent data, which is from 2021 (Kaufmann & Kraay, 2022). All still relevant countries have been scored on this variable, so again no countries need be dropped. The variable government effectiveness is not normally distributed, but right skewed, as can be seen in *Figure A6a* in *Appendix 2*. A logarithmic transformation was therefore performed. *Figure A6b* shows that after logarithmic transformation, the variable is now slightly left-skewed, but a lot better and more normally distributed.

The sixth hypothesis tests whether autocracies that have more media freedom engage more in climate change policy. The independent variable here is media or press freedom, which is also quite good and easy to incorporate. To this end, I use Reporters Without Borders' (2023) World Press Freedom Index (WPFI), which aims to compare the level of press freedom enjoyed by journalists and media in 180 countries and territories. The most recent World Press Freedom Index, that of 2023, scores press freedom for all needed countries. The variable is called World Press Freedom Index (WPFI) score. *Figure A7* in *Appendix 2* shows that the variable WPFI score is fairly normally distributed, so no transformation of the variable was performed.

As mentioned, the hypothesis that would test that whether autocracies that participate more in international agreements engage more in climate change policy is not tested, since it is too difficult to measure this factor. The independent variable would be participation in international agreements.

However, this is a tricky variable to measure. If the main international climate agreements, for example the Paris Agreement, are looked at, almost all but a few countries have signed them. This provides too little variation to properly test this hypothesis. Therefore, it was chosen to exclude this variable and hypothesis. This is thus related to the difficulty of measuring this variable. Only domestic factors are now considered.

The eighth hypothesis tests whether autocracies with a higher GDP per capita engage more in climate change policy. So, the independent variable wealth, which is concrete and easy to measure, is measured by looking at GDP per capita. For this the data from Worldometer is considered again, but here the data for some countries is not available. Because of data availability, I decided to turn to another data source, namely the World Bank. This source, whose most recent data is from 2021, does have the data for all the required countries (World Bank, 2021). When looking at the distribution of the variable GDP per capita in *Figure A8a,* it can be seen that this distribution is very right skewed. As a result, a logarithmic transformation was performed for this variable, after which the distribution was better and more normally distributed, as can be seen in *Figure A8b.*

The eighth hypothesis tests whether autocracies that have an economy more focused on services engage more in climate change policy. For this hypothesis, the independent variable relates to the proportion of the population employed in the service sector, or in the industry sector, or in the agriculture sector. There are also lists of these, although these are outdated or not quite correct. However, the right information can be found through the World Bank Gender Data Portal. All necessary information can be found here for all relevant countries. This information is dated from 2019. Thus, for this variable, the World Bank Gender Data Portal (2019) is used to see what percentage of the population works in the service sector, not making a distinction in gender. The percentage of the population working in the service sector is the variable used to test the hypothesis. This variable, as shown in *Figure A9* of *Appendix 2*, is fairly normally distributed. A logarithmic transformation only results in the distribution becoming left-skewed. Thus, the variable percentage of population working in service is not transformed but used in this way.

The ninth and last hypothesis tests whether autocracies that are involved in more conflicts engage less in climate change policy. The independent variable is the number of conflicts of a country. This can include ongoing armed conflicts, considering the number of fatalities in these armed conflicts. Rather, it is decided to look at the number of political violence conflicts. With this, also a country's domestic political stability is considered. For this hypothesis, the Armed Conflict Location & Event Data Project (ACLED) is used, which collects real-time data on the locations, dates, actors, fatalities, and types of all reported political violence and protest events around the world. Specifically, the number of political violence conflicts in 2022 is used (ACLED, 2023). Therefore, the variable is referred to as (the number of) political violence conflicts.

This number says something about both the number of conflicts and political stability in the country. This makes it a good variable to test the hypothesis. However, when looking at the distribution of this variable in *Figure A10a*, the conclusion can be drawn that it is very right skewed. After performing a logarithmic transformation, the distribution in *Figure A10b* is already better, but still not as it should be. Therefore, for the variable political violence conflicts, as with the variable CRI score, I have chosen to make it a categorical variable. This was done in the same way as for the CRI score, using 'visual binning' and the 'equal percentiles' option to create five equal percentiles. This created a categorical variable that indicate a relatively very high, high, medium, low, or very low number of political violence conflicts. Because five categories were created instead of three, not too much data was lost and this variable can be considered an ordinal variable, which can be put directly into the model. The distribution of this new, categorical variable is showed in *Figure A10c.*

This covers all variables, dependent and independent. For the dependent variable, the Environmental Performance Index (EPI) score, the variable is used untransformed. This is also true for independent variables the Electoral Democracy Index (EDI) score, the World Press Freedom Index (WPFI) score and the percentage of the population working in the service sector. However, logarithmic transformation is used for several variables. The variables GHG emissions per capita, population size, government effectiveness and GDP per capita are used logarithmically transformed. For two variables, the Global Climate Risk Index (CRI) score and (the number of) political violence conflicts, it was necessary to make them a categorical variable and then use them that way in this study.

In this thesis, I do not specifically examine one hypothesis, but multiple hypotheses with multiple possible explanations. In this way, I hope to have found and find as many possible explanations as possible for the variation in how autocracies deal with climate change. If other explanations were known to offer a possible explanation, they would also be included in the study. But that is not the case, I have included all known possible explanations included in this research and thus those are also the control variables. GDP per capita or the level of democracy, for example, would be relevant control variables, but these are already included in this study. In the multiple regression model, the variables of the hypotheses also serve as control variables for the other variables. No other control variables are added.

Chapter 4: Results

In this chapter, I present the results of the study. For this, first of all, I test the assumptions of regression analysis discussed in the previous chapter, showing for example scatter plots of the dependent variables plotted against the various independent variables. Next, I show and explain some descriptive statistics of the variables. Then, I perform the simple regression analysis, in which the effect of the independent variables on the dependent variables are examined separately. After that, I perform the multiple regression analysis, where the effect of all the independent variables on the dependent variable are tested in one single model. Finally, I provide stepwise regression analyses in which the results of the regression analysis are unpacked.

Testing Regression Analysis Assumptions

Before performing the regression analysis itself, it is necessary to take a close look at the assumptions of regression analysis. As discussed in the methods chapter, the first assumption of regression analysis, the linearity assumption, can be tested with scatter plots, by checking whether the relationship between the independent and dependent variable is linear. Looking at the scatter plots in *Figure 1* on the page below, an imaginary linear line can be drawn, indicating linearity. For some scatter plots, this line can be drawn better than for others. For population size and the percentage of population working in services, for example, the linear relationship between with the EPI score is fairly easy to see. The same is true for the categorical variables CRI score and political violence conflicts. For the EDI score in relation to the EPI score, the linear relationship is least well seen, with dots all over the place. In general, it is worth noticing that a fairly large number of dots are not on or close to the imaginary line. Hence, the question is whether these linear relationships are significant, which is tested in the following sections.

In addition to looking at linear relationships in the scatter plots, the linearity test was performed. This was done using the 'compare means' feature in SPSS and the 'test for linearity' option. However, this turned out not to be possible for all variables. For the variables population size, government effectiveness, WPFI score and GDP per capita, it was not possible to perform the linearity test because there were too few cases. For the other variables, the p-value of the linearity test should be higher than 0.05 to be able to speak of a linear relationship between the independent and dependent variable. For the first variable, GHG emissions per capita, in relation to the dependent variable EPI score, the linearity test gives a p-value of 0.427, which indicates a linear relationship. For the variable CRI score, the linearity test gives a p-value of 0.874, again showing a linear relationship. For the variable EDI score, a p-value of 0.619 is given, so again the relationship is clearly linear. For the percentage of the population working in services, the p-value is 0.911, also indicating a linear relationship. Finally, for the number of political violence conflicts, the p-value is 0.837, likewise indicating a linear relationship. A linearity test could be performed for five of the nine independent variables, and thus all five show a linear relationship. Unfortunately, no test could be performed for the other four independent variables.

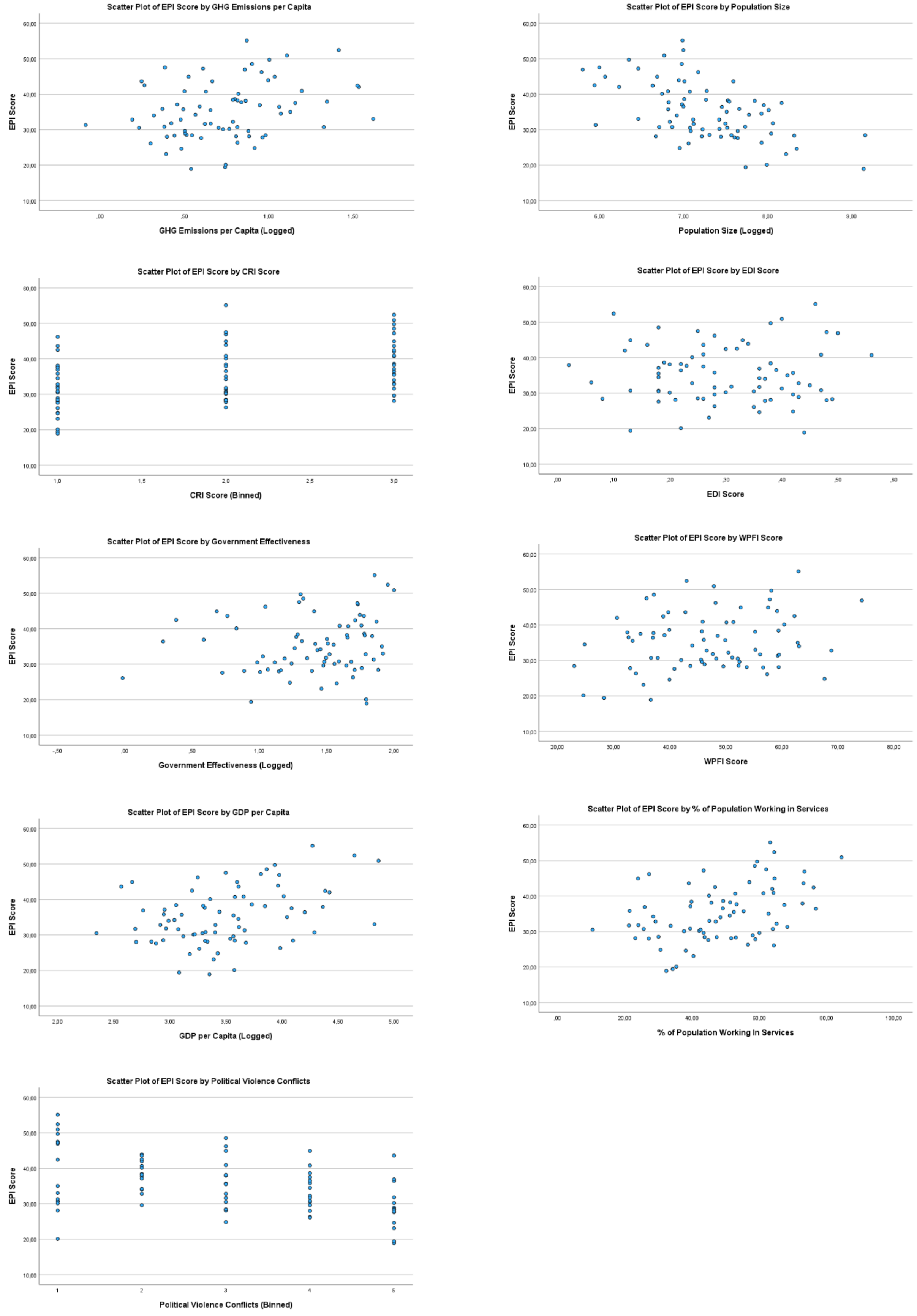


Figure 1: Scatter Plots of Independent Variables Plotted Against EPI Score

The second assumption of regression analysis, the independent error assumption, can be tested using the Durbin-Watson test. This test was done while performing the multiple regression analysis and produced a value of 2.491. A value of two is good, as that means no autocorrelation at all, values below one and above three are cause for concern. The value of 2.491 means that there is somewhat negative autocorrelation. The value is above two, so it is not perfect, but it is not above three, so it is not problematically high. It is also important to look at multicollinearity, rather its absence. The two ways to test this are, first, a correlation matrix, in which the correlation coefficients should be below 0.80, and second, using VIF values, which should be below 10.00 and in the best case below 5.00. As for the first, there is no correlation coefficient above 0.80, so this regression analysis satisfies that condition. There are some variables that are correlated with each other, though. Specifically, the variable GDP per capita has some high correlation coefficients. For GDP per capita and GHG emissions per capita, the Pearson's correlation coefficient is 0.694, and for GDP per capita and the percentage of the population working in the service sector, the coefficient is 0.765, just below the threshold. As for the second way to test multicollinearity, all VIF values are well under 10.00 and almost all are also under 5.00. Only the VIF value of GDP per capita is 7.072 and therefore above five. This could create a problem when performing the regression analyses, but this is addressed in the last section of the next chapter. So, except for the variable GDP per capita, the regression analysis satisfies the lack of multicollinearity.

The third assumption, that of homoscedasticity, can also be checked through a scatter plot of the predicted value plotted against the residual value. This can be seen on the left graph in *Figure 2* below. A loess line can then be drawn through this by SPSS, which can be seen in on the right graph. If the data is homoscedastic, there would appear a flat and smooth line, parallel to the X-axis. However, the line goes down a bit at the beginning and then slightly up again, ending just a bit lower than it should be. So, it is definitely not a very bad result, but the data is not completely homoscedastic.

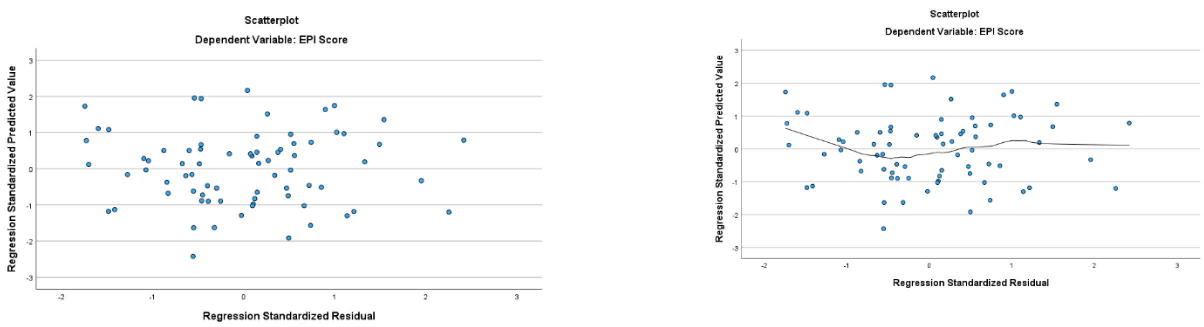


Figure 2: Scatter Plots of Predicted Value Against Residual Value

The fourth assumption, the normally distributed error assumption, can be checked with a histogram or a P-P plot. The two are shown below. On the left, in *Figure 3*, is the histogram of the distribution of errors, where it can be seen that the errors are fairly normally distributed. On the right, in *Figure 4*, is the P-P plot, which looks good. The errors are normally distributed on the graph. Relying on these two methods, the regression analysis succeeds for the fourth assumption.

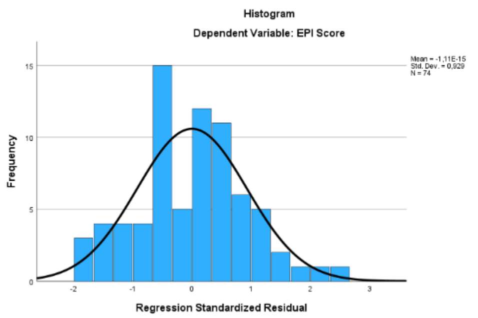


Figure 3: Histogram of Distribution of Errors

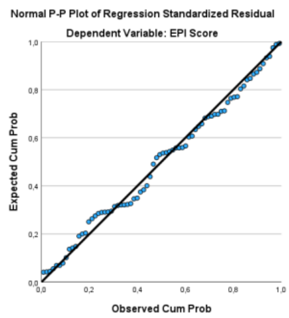


Figure 4: P-Plot of Errors

Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	St. Deviation
Environmental Performance Index (EPI) score	74	18.90	55.10	35.24	8.01
GHG Emissions per Capita	74	-0.09	1.62	0.74	0.34
Population Size	74	5.80	9.16	7.25	0.67
Global Climate Risk Index (CRI) Score	74	1.00	3.00	1.97	0.83
Electoral Democracy Index (EDI) Score	74	0.02	0.56	0.30	0.12
Government Effectiveness	74	-0.02	2.00	1.41	0.42
World Press Freedom Index (WPFI) Score	74	22.97	74.28	47.03	11.21
GDP per Capita	74	2.35	4.86	3.49	0.54
Percentage of the Population Working in Service Sector	74	10.40	84.40	48.13	15.97
(The Number of) Political Violence Conflicts	74	1.00	5.00	2.96	1.43

Table 2: Descriptive Statistics of the Variables

The above *Table 2* shows the descriptive statistics of the different dependent and independent variables used in this thesis. It is worth reflecting on this to know what the values of these variables imply. For all variables, N, the number of cases, is 74. This is because there are 74 countries in the dataset, which are the 74 countries for which values of all variables were available. Autocracies for which one or more variable was not available were not included in this study. For each variable, the table shows the minimum value found within this dataset, as well as the maximum value found. Also given is the mean value and the standard deviation.

When looking at what these values mean, I begin with the dependent variable, the EPI score. In the EPI, the countries are scored and ranked on their environmental performance (Environmental Performance Index, 2022). As discussed in the previous chapter, I use EPI data in an untransformed way. Countries are scored between 0.00 and 100.00, with 100.00 being the highest. In reality, such high scores on the overall index are difficult to achieve, as Denmark tops the list with a score of 77.90 (Wolf et al., 2022). India is at the bottom with a score of 18.90. India also belongs to the dataset of this thesis, fulfilling the minimum score of 18.90 as shown in *Table 2*. *Table 3* below shows the ten best and ten worst scoring autocracies included in this thesis on the EPI. Hungary achieves the highest score with 55.10 and thus represents the maximum value in the descriptive statistics in *Table 2*. This ranks the country in 33rd place overall, which is indicated in parentheses in *Table 3*. Hungary is followed by the United Arab Emirates, ranked 39th with a score of 52.40, and Singapore, ranked 44th with a score of 50.90.

Besides India, countries like Myanmar, 179th and thus second to last with a score of 19.40, and Vietnam, 178th with a score of 20.10, also score relatively bad on the 2022 EPI (Wolf et al., 2022). The mean score of the autocracies in this dataset is 35.24. This average would rank 128th out of 180, in terms of autocracies just below Egypt and just above Malaysia, which thus score quite average. The standard deviation of this score is 8.01, meaning that a score differs on average 8.01 from the mean score. *Figure 5* below shows a map of the world in which the autocracies included in this study have been assigned a color based on their EPI score. This ranges from very light orange, indicating a relatively good EPI score, to very dark red, indicating a bad EPI score.

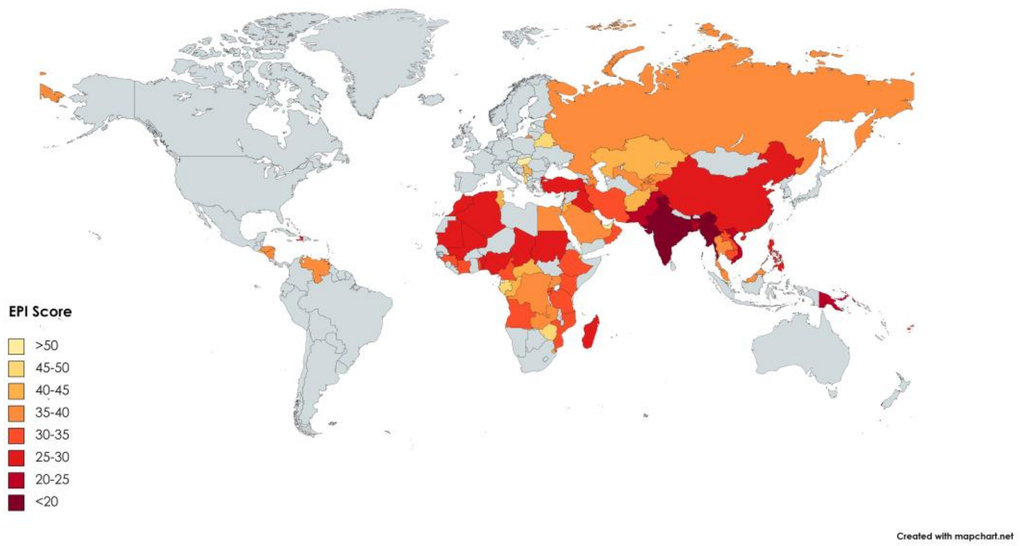


Figure 5: Map of the EPI Score of the Autocracies in this Research

Top 10 Best Scoring Autocracies on EPI		Top 10 Worst Scoring Autocracies on EPI	
1. Hungary (33rd overall)	55.10	1. India (180)	18.90
2. United Arab Emirates (39)	52.40	2. Myanmar (179)	19.40
3. Singapore (44)	50.90	3. Vietnam (178)	20.10
4. Gabon (51)	49.70	4. Bangladesh (177)	23.10
5. Belarus (55)	48.50	5. Pakistan (176)	24.60
6. Djibouti (60)	47.50	6. Papua New Guinea (175)	24.80
7. Albania (62)	47.19	7. Haiti (173)	26.10
8. Montenegro (63)	46.90	8. Turkey (172)	26.30
9. Zimbabwe (69)	46.20	9. Sudan (171)	27.60
10. Eswatini (75)	44.90	10. Iraq (169)	27.80

Table 3: Top 10 Best and Worst Scoring Autocracies in this Research on the EPI

The first independent variable is GHG emissions per capita. Here, total GHG emissions are thus converted per capita, so this is no longer influenced by country size. As a result, small countries can and do score high on this as well. As accounted for in the methods chapter, a value of one was added to all the countries, before a logarithmic transformation of the variable was carried out. Thus, the values now no longer represent the literal numbers GHG emissions per capita, but the ratios are still the same. On ClimateWatch's (2019) ranking, the highest overall score is for the Solomon Islands with 69.21 GHG emissions per capita, whereas the lowest score is for Fiji with -0.18, which is a remarkable score. Fiji as an autocracy is also in this dataset, so that country represents the minimum value that can be found in *Table 2*, which is -0.09 after logarithmic transformation. The maximum value of 1.62, which was 40.52 GHG emissions per capita before logarithmic transformation, belongs to Qatar. Nearby countries Bahrain and Kuwait also score high on this index, while Rwanda and Burundi, like Fiji, score low (ClimateWatch, 2019). The average score is 0.74 and the standard deviation is 0.34, but they say less because of the transformation of the variable. Relative to the overall ranking, the autocracies included in this thesis score relatively low, with a high standard deviation, which can mainly be explained by the fact that there are some countries that score relatively very high.

The second independent variable, population size, is fairly self-explanatory, as it refers to the total number of citizens of the country. However, a logarithmic transformation also occurred for this variable, partly because there are two countries, China and India, with a very high value compared to the rest of the autocracies. The country with the largest population size at over 1.4 billion, China, represents the maximum value of 9.16 in *Table 2*, while Montenegro, which has the smallest population size, represents the minimum value of 5.80 (Worldometer, 2020). Besides Montenegro, Comoros, Fiji, and Djibouti also have a population size smaller than one million. The mean value of population size after logarithmic transformation for this dataset is 7.25 with a standard deviation of 0.67. After all, there are large differences in population size.

The third independent variable is the Global Climate Risk Index (CRI) score. The most important thing to note here is that a low score indicates higher risk. The scores range from low, with Mozambique's 2.67 being the lowest of all, to high, with 118.00, a score achieved by many countries, including 19 autocracies from the dataset of this thesis (Eckstein, Künzel & Schäfer, 2021). Mainly because of this, a distribution emerged that was very left-skewed. As discussed in the methods chapter, this was not solved by logarithmic transformation and a categorical variable was created, consisting of three categories. These categories are high risk, indicated by a score of 1.00, medium risk, indicated by a score of 2.00, and low risk, indicated by a score of 3.00. Obviously, 1.00 is the minimum value found in *Table 2* and 3.00 is the maximum value. The groups are now approximately equal in size, as can be seen in *Figure A4c* in *Appendix 2*. The high risk group consists of 26 countries, while the medium risk group and the low risk group consist of 24 countries. Besides Mozambique, Zimbabwe, Afghanistan, and India are countries at high risk of being affected by the consequences of climate change. The mean score of this categorical variable is 1.97, just slightly more tending toward high risk than low risk, with a standard deviation of 0.83, suggesting quite a bit of variability.

The fourth independent variable is the Electoral Democracy Index (EDI) score. This variable is not categorical or logarithmically transformed. In the EDI, all countries are given a score ranging from 0.00 to 1.00, 1.00 being the highest. Countries like Sweden and Denmark, both with a score of 0.91, score high here. Autocracies evidently score low on this index. Tunisia scores highest with 0.56, ahead of Montenegro with 0.50. Saudi Arabia is at the bottom, representing the minimum value in *Table 2*, with an extremely low score of 0.02, right below Qatar with 0.06 and China with 0.08. The mean score on the EDI index of autocracies within this study is 0.30, a score obtained by Kuwait and Cameroon (V-Dem Institute, 2022). The standard deviation of 0.12 is low, because the range of scores here is not large.

The fifth independent variable is government effectiveness. In this, countries are given a percentile score from 0.00 to 100.00, with the latter representing high government effectiveness. The maximum value is achieved by Singapore, which consequently has the best government effectiveness (Kaufmann & Kraay, 2022). The United Arab Emirates and Qatar also have good government effectiveness. Nevertheless, this variable was very right skewed because the autocracies included in this thesis did, in general, not score relatively well on this index with an initial mean of 35.51. Comoros, Venezuela and especially Haiti are countries that score very badly on this index. Due to the right-skewedness of the distribution, this variable is logarithmically transformed. As a result, the maximum value in *Table 2* represented by Singapore is now 2.00. The minimum value, represented by Haiti, is now -0.02. The mean score is 1.41 and the standard deviation is 0.42.

The sixth independent variable is the World Press Freedom Index (WPFI) score. Again, countries could score from 0.00 to 100.00. This variable, like the EPI score and the EDI score, was not transformed and used in this way for the research. The highest scores were achieved by European democracies, such as the easily first-ranked Norway with 95.18. The highest ranked country in this study is also a European country with a relatively good democracy, Montenegro, with a score of 74.28, as can be seen in *Table 2*. North Korea scored the very worst on Reporters without Borders' (2023) ranking, with a score of 21.72. Unfortunately, due to a lack of data, this country could not be included in this thesis. As a result, China represents the minimum score of 22.97. The mean score is 47.03 and the standard deviation is 11.21, which is not very peculiar.

The seventh independent variable is GDP per capita, as indexed by the World Bank (2021) in US dollars. Small countries like Monaco, Liechtenstein and Luxembourg score high on this. The highest autocracy included in this research is also a small country, namely Singapore with 72,794 US dollars. The country is followed by Qatar and the United Arab Emirates. However, because there are some countries that score very high on this variable and the rest relatively low, the distribution of this variable is very right skewed. As a result, a logarithmic transformation was chosen in the methods chapter, which produced a much more normal distribution, as shown in *Figure A8b* in *Appendix 2*. As a result, the maximum value according to the descriptive statistics in *Table 2* is now 4.86, represented by Singapore. The minimum value is 2.35, which is Burundi's score after logarithmic transformation. Afghanistan and African countries such as the Central African Republic and Mozambique also score low here (World Bank, 2021). The mean score is 3.49 and the standard deviation is 0.54.

The eight independent variable is the percentage of the population working in services. This can range from 0.00 to 100.00 in extreme cases. Because this resulted in a fairly normal distribution, this variable did not need to be transformed. Again, Burundi represents the minimum value in *Table 2* with 10.40 percent of the labor force employed in the service sector. The country is followed by other African countries, such as Mozambique and Uganda, whose economies are also mainly focused on agriculture. Here again the same country is responsible for the maximum value, namely Singapore with 84.40 percent. It is followed by Venezuela and Kuwait. On average, 48.13 percent of the labor force is employed in the service sector. The standard deviation is 15.97 (World Bank Gender Data Portal, 2019).

The ninth and final independent variable is the number of political violence conflicts. As accounted for in the methods chapter, it was necessary to make this a categorical variable. As a result, the scores on this variable can be divided into five categories. A score of 1.00 represents little to none political violence conflicts and a score of 5.00 represents a relatively high number of political violence conflicts. Therefore, the minimum score in *Table 2* is 1.00, achieved by countries with few political violence conflicts, such as Qatar, Kuwait, and Singapore (ACLED, 2022). The maximum score here is 5.00, achieved by countries with high levels of political violence conflicts, such as Myanmar, Iraq, and Nigeria. The mean score is 2.96 and the standard deviation 1.43, which makes sense for this kind of categorical variable.

Simple Regression Analysis

In this section, I examine whether the independent variables have an effect on the environmental performance of the autocracies through simple regression analysis. For this purpose, first, the coefficient, particularly for the direction of the effect, and the standard error are examined. Next, the p-value is examined to determine whether the effect is significant. Finally, the R-value for each model, specifically the (adjusted) R-squared, is examined to see how much of the variation between autocracies in dealing with climate change this model explains.

Model	**Independent Variable**	**Coefficient (Std. Error)**
1	GHG Emissions per Capita	6.919* (2.671)
2	Population Size	-6.669*** (1.169)
3	*CRI Score (Baseline: Medium Risk)*	
	Low Risk	3.758+ (2.128)
	High Risk	-4.342* (2.087)
4	Electoral Democracy Index (EDI) Score	0.098 (7.862)
5	Government Effectiveness	2.691 (2.230)
6	World Press Freedom Index (WPFI) Score	0.160+ (0.082)
7	GDP per Capita	5.687*** (1.630)
8	% of the Population Working in Services	0.212*** (0.054)
9	Political Violence Conflicts	-2.522*** (0.590)

Table 4: Simple Regression Analysis

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Note: The constant or intercept is not shown in this table because these are all different models with different constants.

The results of the simple regression analysis together are in *Table 4* above. The results of the individual simple regression analyses are in *Appendix 3*. The first model is a simple regression analysis of the effect of GHG emissions per capita on the Environmental Performance Index (EPI) score, also shown in *Table A1* in *Appendix 3*. This shows that the constant coefficient is 30.116, which means that is the EPI score of a country with a score of zero on the logarithmically transformed variable of GHG emissions per capita. Then, the GHG emissions coefficient is 6.919. That is, from an EPI score of 30.116, for every one value of GHG emissions per capita added, 6.919 is added to the EPI score. This is on average and includes a standard error of 2.671. The positive coefficient means the effect of GHG emissions per capita on the EPI score is positive. This effect is significant with a significance level of 0.05, given a p-value of 0.012. This is indicated by one asterisk in *Table 4*. Thus, the independent variable GHG emissions per capita has a significant positive effect on the EPI score, which is consistent with hypothesis 1A, which argues that autocracies with more emissions engage more in climate change policy. The R-value of this model is 0.292, giving an R-squared of 0.085. The adjusted R-squared given by SPSS is 0.073. According to this value, this model, viewed separately, would explain 7.3 percent of the variation between autocracies in dealing with climate change.

The second model, whose results are, next to the above *Table 4*, also visible in *Table A2*, considers the effect of population size on the EPI score. Looking at the coefficient of -6.669, this effect is negative, with a standard error of 1.169. The negative effect is significant, considering a p-value smaller than 0.001. Therefore, there are three asterisks in *Table 4* for the variable population size, which has a very significant negative effect on the EPI score. That is, a higher population size leads to a lower EPI score. This effect is in the opposite direction as was hypothesized. Furthermore, according to the adjusted R-squared value of 0.302, this model explains no less than 30.2 percent of the variation. Hence, the variable population size does seem to be a significant part of the explanation of the EPI score.

In *Table A3* of *Appendix 3*, the results of the simple regression analysis of the effect of the categorical variable Global Climate Risk Index (CRI) score on the EPI score are shown. This was done using dummy variables. The countries at medium risk of being affected by climate change consequences were used as a baseline, therefore in the results both the effect of low risk and high risk countries are given, in order to examine which has more effect on environmental performance. This shows that both low risk and high risk have a significant effect on the EPI score. Low risk has a positive effect on the EPI score of 3.758 with a standard error of 2.128 and a p-value of 0.082. High risk has a negative effect on the EPI of -4.342 with a standard error of 2.087 and a p-value of 0.041. This makes the effect of high risk on the EPI score according to the simple regression analysis larger and more significant than the effect of low risk. So, both lower risk leads to a higher EPI score and higher risk leads to a lower EPI score. This is in line with each other, but not in line with the third hypothesis, which states that higher risk leads to a higher EPI score. In addition, this relationship explains 15.2 percent of the variance, which is also relatively high. Thus, in this significant positive effect of the CRI score on the EPI score seems to lie part of the explanation as well.

Table A4 shows the effect of the fourth independent variable, the Electoral Democracy Index (EDI) score, on the EPI score. This is a small positive effect, with a coefficient of 0.098. This would be aligned with the fourth hypothesis. However, the standard error is very high at 7.862. Moreover, the p-value is also very high at 0.990. As a result, according to this simple regression analysis, there is no significant effect of the EDI score on the EPI score at all. Therefore, also according to the adjusted R-squared value, no variation is explained by this model. Thus, an explanation for the level of the EPI score does not seem to lie in the EDI score.

The next independent variable whose effect on the EPI score is examined is government effectiveness, a variable that is logarithmically transformed. The results of this simple regression analysis are shown in *Table A5*. This variable has a positive effect on the environmental performance of 2.691. This is accompanied by a standard error of 2.230. The direction of this effect too would be consistent with the established hypothesis if it were not for the fact that the p-value of this effect at 0.065 is not significant according to the used significance level of 0.232. The adjusted R-squared of 0.006 makes it also clear that with 0.6 percent, very little of the variance is explained by this model. Thus, government effectiveness does not seem to offer an explanation either.

Table A6 shows the simple regression analysis of the effect of World Press Freedom Index (WPFI) score on EPI score. With a significance level of 0.1, a significant effect is found here, given a p-value of 0.055. For this reason, there is a plus after the coefficient of the WPFI score. The effect of the WPFI score on the EPI score is positive, meaning that higher press freedom would yield a higher EPI score, with a coefficient of 0.160. This direction of the effect is in line with the sixth hypothesis. Here, the adjusted R-squared value shows that not much variance is explained by this model, 3.7 percent. Hence, again, not much of the explanation is found here.

The seventh independent variable, GDP per capita, does find another significant effect on the EPI score. This is also shown in *Table A7*, where a p-value smaller than 0.001 is given. The table also gives a positive coefficient of 5.687. Thus, the logarithmically transformed variable GDP per capita has a significant positive effect on the EPI score, which is aligned with the expectation of the eighth hypothesis. Additionally, this model would explain 13 percent of the variance, given the adjusted R-squared value of 0.133.

Table A8 shows the effect of the percentage of the population working in the service sector on the EPI score. This effect is positive with a coefficient of 0.212. That means that with each percent more employed in the service sector relative to the other sectors, the EPI score increases by 0.212. Associated with this is a relatively low standard error of 0.054. The constant coefficient is 26.061. Thus, a country with a percentage of zero employed in the service sector would achieve an EPI score of 26.061. The significance of this effect is less than 0.001 and thus the positive effect is clearly significant. This is also in accordance with the established hypothesis, which is the ninth. Also, according to the adjusted R-squared value, this model explains as much as 16.7 percent of the existing variance.

The last independent variable whose effect on the EPI score is examined is the number of political violence conflicts, which is shown in *Table A9.* This variable is, as well as the CRI score, transformed to a categorical variable. No dummies were used for this variable, however, since the variable could be transformed to five categories. The SPSS output showed a coefficient of -2.522, representing a negative effect. This means that more political violence conflicts lead to a lower EPI score. This includes a standard error of 0.590. The negative effect is significant with a p-value smaller than 0.001, which is why there are three asterisks in *Table 4*. The direction of this effect agrees with the tenth hypothesis. In addition, the effect explains 19.1 percent of the variance, which is quite a lot.

Multiple Regression Analysis

Independent Variable	**Coefficient (Std. Error)**
GHG Emissions per Capita	4.118 (3.675)
Population Size	-4.712* (1.818)
CRI Score (Baseline: Medium Risk)	
Low Risk	1.905 (1.952)
High Risk	-0.203 (2.050)
Electoral Democracy Index (EDI) Score	0.038 (8.831)
Government Effectiveness	0.894 (2.772)
World Press Freedom Index (WPFI) Score	0.055 (0.102)
GDP per Capita	-0.535 (3.780)
% of the Population Working in Services	0.101 (0.093)
Political Violence Conflicts	-0.254 (0.839)
Constant	59.718 (15.614)
N	74
R^2	0.431

Table 5: Multiple Regression Analysis

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Having tested all the effects of the independent variables on the dependent variable separately, all the independent variables are thrown into one model to see what effects the different variables then have on environmental performance. This multiple regression model has an adjusted R-squared of 0.340, meaning that this model should explain 34.0 percent of the variance. The further results of the multiple regression analysis can be found in the above *Table 5*, as well as in *Table A10* in Appendix 3. Again, this also includes the variable CRI score by dummy variables, with medium risk as baseline, so the effects of low risk and high risk are shown in the table. The constant coefficient is 59.718, meaning that would be the EPI score without considering the effects of the independent variables. On this, according to the model, four variables have a negative effect: population size, high risk, GDP per capita and the number of political violence conflicts. However, only the negative effect of the population size has a significant effect on the EPI score, given the p-value of 0.012. The coefficient of this variable is -4.712, with a standard error of 1.818. This is a smaller effect than emerged from the simple regression analysis, which makes sense given the addition of other variables.

As with the simple regression analysis, however, the direction of this effect is not in line with the established hypothesis. Also, the negative effects of high risk and GDP per capita are not consistent with the hypotheses. The negative effect of the number of political violence conflicts is. Six variables have a positive effect on the EPI score. These are GHG emissions per capita, low risk, the Electoral Democracy Index (EDI) score, government effectiveness, the World Press Freedom Index (WPFI) score and the percentage of the population working in the service sector. The positive effect of low risk is not aligned with the hypothesis. The other positive effects are. However, of these five effects, not one is significant. Thus, after performing the multiple regression analysis, only one significant effect remains, the negative effect of population size on the EPI score.

Interpretation of the Findings

Now that the regression analysis and testing of its assumptions has been done, the results of the regression analysis can be interpreted. First, the simple regression analyses were performed. This showed that seven independent variables had a positive effect on the Environmental Performance Index (EPI) score, while three independent variables had a negative effect on the EPI score. Of these ten effects, including the two effects of the dummy variables of the independent variable (Global Climate Risk Index (CRI) score, seven were significant. GHG emissions per capita, low risk, the World Press Freedom Index (WPFI) score, GDP per capita and the percentage of the population working in the service sector all had a significant positive effect on the EPI score. Population size, high risk and the number of political violence conflicts both had a significant negative effect on the EPI score. The Electoral Democracy Index (EDI) score and government effectiveness had no significant effect on the EPI score. Based on these simple regression analyses, it could be said that autocracies with greater emissions, a smaller population size, a lower risk of being affected by climate change consequences, more media freedom, a higher GDP per capita, an economy more focused on services and less involvement in conflicts, engage more in climate change policy. This would support hypothesis 1A, 6, 7, 8 and 9, since these effects are also all in the expected direction. Indeed, the variables of hypothesis 1B, 2 and 3 also have an effect on environmental performance, but the effects of these variables were not in the expected direction. In contrast, a higher level of democracy and a higher quality of governance do not cause autocracies to engage more in climate change policy. On this basis, hypothesis 4 and 5 are not supported.

However, not only simple regression analyses were performed. In fact, these tested for single effects without considering confounders, for example. Therefore, a multiple regression analysis was also performed, with all independent variable and their effect on EPI score in one single model. Significantly different results emerged from this. As a matter of fact, from this model came not seven positive effects but six, and not three negative effects but four. As in the simple regression analysis, GHG emissions per capita, low risk, the EDI score, government effectiveness, the WPFI score, the percentage of the population working in the service sector had a positive effect on the EPI score. GDP per capita, which had a positive effect on the EPI score in the simple regression analysis, had a negative effect in the multiple regression analysis. Also population size, high risk and number of political violence conflicts had a negative effect on the EPI score in the multiple regression analysis. However, the negative effect of the population size was found to be significant. Thus, this is the only effect that remained after conducting the multiple regression analysis and this effect was not in the expected direction by the second hypothesis. Based on this analysis, none of the constructed hypotheses can be supported. According to the multiple regression analysis, only autocracies with a smaller population size engage more in climate change policy, while the other variables seem less relevant.

Since India has a very large population size, this could be a significant outlier as they achieved the lowest EPI score, which can be seen in *Table 3*. Due to this very high population size and very low EPI score, India could have a big impact on the results. This could be a reason that only population size has a significant effect on the EPI score after conducting the multiple regression analysis. Therefore, I tested whether this is actually the case. When India is removed from the analysis, however, the results remain the same. Population size is still the only independent variable with a significant effect on the dependent variable, the EPI score. The negative effect becomes slightly smaller and slightly less significant, but removing India does not lead to significantly different results. With this, India is not such a big outlier that strongly influences the results.

Unpacking the Findings

It is remarkable that only one effect remained significant after the multiple regression analysis, while seven variables had a significant effect on the Environmental Performance Index (EPI) score after the simple regression analysis. This section explores what these results mean by unpacking these findings. I do this through stepwise analyses and thereby examines when effects that were first significant disappear. On the page below in *Table 6* is one of the stepwise analyses illustrating the unpacking of the findings. Here, the sustainability of the effect of GHG emissions per capita on the EPI score is examined by adding variable(s) to the model step by step.

Independ. Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
GHG Emissions per	6.919*	6.014**	5.029*	5.275*	4.215	4.118
Capita	(2.671)	(2.228)	(2.293)	(2.537)	(3.635)	(3.675)
Population Size		-6.454***	-5.724***	-5.796***	-5.012**	-4.712*
		(1.124)	(1.232)	(1.424)	(1.514)	(1.818)
CRI Score (Baseline:						
Medium Risk)						
Low Risk			2.246	2.264	1.902	1.905
			(1.879)	(1.926)	(1.938)	(1.952)
High Risk			-1.053	-0.585	-0.181	-0.203
			(1.922)	(2.005)	(2.034)	(2.050)
Electoral Democracy				4.149	-0.273	0.038
Index (EDI) Score				(8.191)	(8.708)	(8.831)
Government				1.473	1.260	0.894
Effectiveness				(1.965)	(2.475)	(2.772)
World Press Freedom				0.008	0.059	0.055
Index (WPFI) Score				(0.095)	(0.101)	(0.102)
GDP per Capita					-0.452	-0.535
					(3.743)	(3.780)
% of the Population					0.100	0.101
Working in Services					(0.092)	(0.093)
Political Violence						-0.254
Conflicts						(0.839)
Constant	30.116	77.597	69.269	69.162	60.217	59.718
	(2.173)	(8.461)	(9.792)	(12.714)	(15.416)	(15.614)
N	74	74	74	74	74	74
R^2	0.085	0.376	0.400	0.409	0.430	0.431

Table 6: Stepwise Multiple Regression Analysis 1

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

The variable GHG emissions per capita was one of six variables that had a significant effect on the EPI score in the simple regression analysis, but no longer had one in the multiple regression analysis. Through stepwise multiple regression analysis, I attempt to find out how these significant effects could have disappeared. The results of the stepwise regression analysis for GHG emissions per capita are shown above in *Table 6*. The first model, which is the simple regression analysis, shows a significant positive effect of GHG emissions per capita on the EPI score. In the second model, the variable population size was added, the only variable that still had a significant effect on the EPI score after the multiple regression analysis. However, adding this variable does not cause the effect of GHG emissions per capita to disappear. Rather, in the second model the effect of GHG emissions per capita is more significant than in the first model. In the third model, the categorical variable Global Climate Risk Index (CRI) score was added. Again, this variable does not eliminate the significance of the effect of GHG emissions per capita. Even in the fourth model, in which the Electoral Democracy Index (EDI) score, government effectiveness and the World Press Freedom Index (WPFI) score are added together, the variable GHG emissions per capita still has a significant positive effect on the EPI score.

In the fifth model, however, the variables GDP per capita and the percentage of the population working in the service sector were added. This does cause the effect of GHG emissions per capita to disappear. Both GDP per capita and the percentage of the population working in the service sector cause the effect of GHG emissions to disappear, even if only one of these variables is added. The variable political violence conflicts, added in the sixth model, also affects the significance of the effect of GHG emissions per capita, but this by itself is not enough to make the effect disappear. The effect of GHG emissions per capita on the EPI score disappears when adding GDP per capita or the percentage of the population working in the service sector.

This stepwise regression analysis can also be performed in many other ways and for the other variables. Not all of these are shown in this thesis. However, it has been examined when the significant effects disappear, become weaker or stronger. The variable Global Climate Risk Index (CRI) score also had a significant effect on EPI score in the simple regression analysis, but no longer in the multiple regression analysis. For this variable, when a variable is added, no matter which one, the effect of the CRI score on the EPI score becomes less significant. However, there is one variable that makes the significance of the effect disappear altogether, and that is population size. When this variable is added, the effect of the CRI score on the EPI score is no longer significant. Thus, the variable CRI score does appear to be a strong predictor of the EPI score, the variable population size is just a stronger predictor, so that when added, the effect of the CRI score is no longer significant.

The variables Electoral Democracy Index (EDI) score and government effectiveness were already not significant in the simple regression analysis and were not significant in the multiple regression analysis. Therefore, these effects cannot disappear when certain variables are added. However, when certain combinations are made, they do come closer to a significant effect. This is also reflected in the stepwise regression analyses done regarding the World Press Freedom Index (WPFI) score, which did reach significance in the simple regression analysis. When the EDI score and government effectiveness are added to the model with the WPFI score, the effect of the WPFI score on the EPI score becomes more significant. This is also the case when GHG emissions per capita, GDP per capita and the percentage of the population employed in the service sector are added. However, the variable population size completely removes the effect of the WPFI score on the EPI score. This is also true to a lesser extent for the CRI score and political violence conflicts. So, interesting things happen in these stepwise regression analyses, sometimes even leading to a more significant effect of the WPFI score on the EPI score.

The variable GDP per capita was also significant in the simple regression analysis, but the effect was no longer significant in the multiple regression analysis. Thereby, the effect was initially positive but then negative. This may have been caused by the fact that GDP per capita is closely correlated with some other variables, as pointed out at the beginning of this chapter. The change in direction and significance of this effect is caused by adding the variable the percentage of the population working in the service sector, which is strongly correlated with GDP per capita. Adding every other variable makes the effect slightly less significant, but the effect remains significant.

Then, when looking at that variable percentage of the population working in the service sector, this effect only disappears when adding multiple variables. Each variable separately causes the effect of the variable percentage of the population working in the service sector to become slightly less significant, but not disappear. Only when multiple variables are added does this effect disappear. With that, these variables together, especially the percentage of the population working in the service sector, do seem to have part of the explanation. This is related to the economic development of the country, which I discuss further in the next chapter. Unpacking the results continues with a second example of stepwise regression analysis on the next page in *Table 7*.

Independ. Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
GHG Emissions per					3.107	4.118
Capita					(3.814)	(3.675)
Population Size						-4.712*
						(1.818)
CRI Score (Baseline:						
Medium Risk)						
Low Risk				2.293	2.174	1.905
				(2.024)	(0.289)	(1.952)
High Risk				-1.465	-1.284	-0.203
				(2.077)	(2.094)	(2.050)
Electoral Democracy			-8.146	-4.895	-3.791	0.038
Index (EDI) Score			(8.809)	(8.962)	(9.087)	(8.831)
Government			-1.555	-2.261	-1.571	0.894
Effectiveness			(2.551)	(2.575)	(2.717)	(2.772)
World Press Freedom			0.179+	0.141	0.146	0.055
Index (WPFI) Score			(0.097)	(0.100)	(0.100)	(0.102)
GDP per Capita		-0.543	1.077	1.468	-0.683	-0.535
		(2.478)	(2.928)	(2.923)	(3.944)	(3.780)
% of the Population		0.168*	0.161+	0.120	0.149	0.101
Working in Services		(0.078)	(0.085)	(0.088)	(0.095)	(0.093)
Political Violence	-2.522***	-2.014**	-1.593*	-1.458*	-1.437+	-0.254
Conflicts	(0.590)	(0.632)	(0.731)	(0.732)	(0.734)	(0.839)
Constant	42.706	35.012	24.637	26.414	28.603	59.718
	(1.937)	(7.459)	(9.908)	(10.042)	(10.420)	(15.614)
N	74	74	74	74	74	74
R^2	0.202	0.289	0.335	0.363	0.370	0.431

Table 7: Stepwise Multiple Regression Analysis 2

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Of the last variable, the number of politically violent conflicts, the significance also disappeared when conducting the multiple regression analysis. A stepwise multiple regression analysis was also conducted for this variable, the results of which are shown above in *Table 7*. The first model shows the effect of the number of political violence conflicts on the EPI score as in the simple regression analysis. In the second model, the variables GDP per capita and the percentage of the population working in the service sector were added. This reduces the size and significance of the effect of the number of politically violence conflicts on the EPI score. In addition, the effect of the percentage of the population working in the service sector is also significant, the effect of GDP per capita is not. In the third model, the EDI score, government effectiveness and the WPFI score were added. Of these, the WPFI score has a significant positive effect on the EPI score. The effects of the number of political violence conflicts and the percentage of the population working in the service sector are still significant, but increasingly less significant.

The addition of the dummy variables low risk and high risk of being affected by climate change consequences even causes both the effect of the WPFI score and the percentage of the population working in the service sector to no longer be significant. The effect of the number of politically violent conflicts is still significant. This is still true after adding GHG emissions per capita in the fifth model. This makes the variable political violence conflicts the only variable that has a significant effect on the EPI score when all variables except population size are included in the model. When population size is added, as seen in the sixth model, we are back to the main multiple regression model, in which only population size has a significant effect on the EPI score. If it would not be included, as seen in the fifth model of *Table 7*, only the number of political violence conflicts would have a significant effect on the EPI score. However, the effect of this variable disappears when population size is added to the model.

Several conclusions can be drawn from these stepwise regression analyses. Population size is the strongest predictor of the Environmental Performance Index (EPI) score. This variable nullifies the significance of the effects of the Global Climate Risk Index (CRI) score, World Press Freedom Index (WPFI) score and the number of political violence conflicts. Of these, removing the variable population size from the model shows that the number of political violence conflicts is the strongest predictor, as it is then the only variable that has a significant effect on the EPI score. In addition, the variables GHG emissions per capita, GDP per capita, and the percentage of the population working in the service sector, especially those last two, relate to each other and influence each other's effects. The effect of GHG emissions per capita disappears by adding one of the other two. The effect of GDP per capita disappears when adding the variable percentage of the population working in the service sector. With that, the latter also seems to be a strong predictor. However, it falls away when adding all the other variables. Part of the explanation of the variation in environmental performance, however, can also be sought in the degree of economic development, to which these three variables are all related. All in all, the strongest predictor of the EPI score is population size, but also the factors related to economic development, such as the percentage of the population working in the service sector, and to political stability, i.e. the number of political violence conflicts, should not be overlooked.

Chapter 5: Conclusion

In this thesis, I have examined how autocracies deal with climate change. For this purpose, I argued that it is both scientifically and societally relevant to study autocracies in dealing with climate change, since there was a gap in the literature there. As a result, I established the following research question: 'How can the variation among autocracies in climate change mitigation policy be explained?' To answer this research question, the second chapter developed a theoretical framework based on the existing literature on the topic. From this theoretical framework followed nine hypotheses with nine factors that could possibly explain the variation among autocracies in climate change policy, while the tenth factor, participation in international agreements, could not be included in this thesis. The third chapter explained the method used for this research, simple and multiple regression analysis, and operationalized the variables.

I have examined the effect of nine independent variables on a dependent variable for 74 electoral or closed autocracies. The dependent variable was the EPI score, which indicates the environmental performance of the 74 autocracies. The nine dependent variables were GHG emissions per capita, population size, the Global Climate Risk Index (CRI) score, the Electoral Democracy Index (EDI) score, government effectiveness, the World Press Freedom Index (WPFI) score, GDP per capita, the percentage of the population working in the service sector and the number of political violence conflicts. The fourth chapter presented the results of the research. After first testing the regression analysis assumptions and providing descriptive statistics, the results of the simple and multiple regression analysis were shown. These results were then interpreted and unpacked in the final section through stepwise regression analysis.

Several key findings emerged from the results. The simple regression analysis showed that GHG emissions per capita, low risk, the WPFI score, GDP per capita and the percentage of the population working in the service sector all had a significant positive effect on the EPI score, whereas population size, high risk and the number of political violence conflicts both had a significant negative effect on the EPI score. The EDI score and government effectiveness had no significant effect on the EPI score. Based on these simple regression analyses, it could be said that autocracies with greater emissions, a smaller population size, a lower risk of being affected by climate change consequences, more media freedom, a higher GDP per capita, an economy more focused on services and less involvement in conflicts, engage more in climate change policy. This would support the first, sixth, seventh, eighth and ninth hypothesis.

The multiple regression analysis showed very different results. Only the negative effect of the population size was found to be significant. Since this effect was not in the expected direction, none of the constructed hypotheses could be supported. The stepwise regression analyses confirmed that population size is the strongest predictor of EPI score. However, this does not mean that the effects of the other variables can be neglected. Based on these stepwise analyses, especially the percentage of the population working in the service sector also seems to play a role, but its effect disappears when adding all the other variables together. The variables CRI score and the number of political violence conflicts also seem to play a role, but their effect disappears when adding the population size, as it is a stronger predictor.

This brings me back to the research question how the variation among autocracies in dealing with climate change can be explained. The answer to this research question is that this is mainly explained by the variable population size, but also the factors related to economic development, such as the percentage of the population working in the service sector, and to political stability, i.e. the number of political violence conflicts, should not be overlooked. Based on this, it could be argued that autocracies with a smaller population size, a higher economic development and more political stability engage more in climate change policy.

First, these results imply that smaller autocracies, with a smaller population size, engage more in climate change policy. Apparently, it is easier for smaller countries to engage more in climate change policy and more difficult for larger countries. This is also reflected in the EPI, for example, where one of the largest countries in the world, India, is at the very bottom (Environmental Performance Index, 2022). So, the larger countries, specifically the larger autocracies, are not doing enough on climate change policy, while it is the large countries that are key to solving the collective problem of climate change. Larger countries must therefore take more responsibility in this, with international cooperation being crucial in order to avoid the free-rider problem.

Second, these results imply that autocracies with a higher economic development engage more in climate change policy. This is reflected in several variables studied, namely the percentage of the population working in the service sector, GDP per capita, GHG emissions per capita and also the Global Climate Risk Index (CRI) score. After all, these variables are all related to the degree of economic development. I first address the first three together, before I discuss the latter. For the first three variables, it has been shown earlier in the thesis that these three variables are related to each other, and it is quite evident that all three are also related to higher economic development. On this basis, I argue that economic development, with an accompanying higher percentage of the population working in the service sector, higher GDP per capita, more GHG emissions per capita leads to more engagement with climate change policy. However, that therefore also means more GHG emissions per capita, which in turn is harmful to the climate. This creates a difficult area of tension where, in an ideal scenario, economic development can go hand in hand with sustainability and other climate action.

In addition, attention should be paid to how to fight climate change in economically less developed autocracies. Economically less developed countries remain behind in terms of environmental performance, the results showed. These countries therefore have to be taken by the hand by the economically higher developed countries. Again, international cooperation is crucial here, so that every country can do their part in solving this problem. So, there is a task for economically more developed countries, international organizations, and unions, such as the EU, to take economically less developed by the hand in engaging in climate change policy, but also to ensure development in these countries takes place in a sustainable manner.

Also, the results implied that a higher Global Climate Risk Index (CRI) score cause autocracies to engage more in climate change policy. A higher CRI score indicates less risk of being affected by climate change consequences. Remarkably, this means that autocracies that are less at risk engage more in climate change policy. However, the autocracies that are less at risk are also the higher economically developed countries that were referred to in the previous paragraph. So, this, too, is related to this. Besides being remarkable, this finding is also very worrisome. In fact, the countries most at risk of being affected by climate change consequences engage significantly less in climate change policy. As a result, their risk does not decrease, rather increase, and these countries suffer greatly from climate change impacts. Again, these are mainly the economically less developed countries, which further emphasizes the importance of taking these countries by the hand and helping them. To illustrate, a country like Mozambique scores poorly on environmental performance despite being at high risk of being affected by the consequences of climate change. However, such a country is economically less developed, making it difficult to protect the country against these consequences. This is where international organizations and unions can come in and take these countries by the hand, to combat climate change and its consequences.

Finally, the results implied that autocracies with less political violence conflicts engage more in climate change policy. This is consistent with the theory and hypothesis established in this thesis. It therefore implies that a stable regime, involved in fewer conflicts, has a better environmental performance. Political stability is thus crucial to environmental performance. So, in the context of climate change, the importance of political stability and peace emerges as well. Therefore, for the sake of the climate, political stability and peace must be promoted at all times in all regions of the world. Here too, countries as individuals and bundled into organizations and unions such as the EU and the UN play an important role. This role seems to be acknowledged by the aforementioned organizations, which can also be seen in the war between Ukraine and Russia, but in the context of climate change, there is yet another reason to emphasize it even more, also in autocracies a further away. To illustrate, when there is a conflict in a country like Nigeria and the EU members or the UN are hesitant about whether to intervene, this is an additional reason to do it, in order to bring the conflict to an end as quickly as possible, minimizing damage to the climate.

At the beginning of this thesis, it was shown why it is of vital importance to research this. Climate change is a major global collective problem. To solve this problem, all countries must do their part, including autocracies. Therefore, research should be done not only on democracies or how they differ from autocracies, but also on autocracies. I hope to have contributed to this by examining what factors cause autocracies to engage more in climate change policy. The results emphasize that larger countries must take more responsibility in this, that economic development must go hand in hand with sustainability and other climate action, that economically less developed countries must also be taken by the hand in this, and that the importance of peace is vital for the climate. In all this, international cooperation between both democracies and autocracies is crucial in order to collectively solve the problem of climate change.

However, this thesis also has its limits. I have examined the effect of nine factors on the environmental performance of 74 autocracies. These nine factors are probably not the only factors that matter. In addition, choices had to be made in operationalizing these factors that could have been made differently. Moreover, the effect of the tenth factor, international agreements, was not tested because of the difficult measurability of this factor, even though it could be important. As for the 74 autocracies, unfortunately those are not all the autocracies of the world. Some autocracies had to be left out of this thesis due to lack of data availability, which may have affected the results. Another limitation of this thesis is that it does not include a longitudinal analysis. If it did, it could have looked at changes in how autocracies deal with climate change and what has moved autocracies over time to engage more in climate change policy.

It is essential that more research is done on how autocracies deal with climate change. In this, limits of this thesis can be compensated for, or gaps left by this thesis can be filled. I did a systematic analysis of 74 countries and nine different factors. As mentioned, these nine factors are probably not the only relevant factors. Further research can be done on what other factors are important, looking specifically at autocracies. Also, follow-up research can focus on the factor that I was unable to examine, international agreements. This is certainly of importance since I have argued that international cooperation is crucial in solving the problem of climate change. Regarding the 74 autocracies, follow-up research can zoom in on a country or region specifically to come up with more concrete solutions to the problem that is climate change. It would be interesting to examine the lowest ranked country on the EPI, India, to see how climate change can be better dealt with in this country specifically. As a region, it would be interesting to consider Southeast Asia, many of whose countries are low on the EPI, or the Middle East, where there are also many autocracies. After all, for a systematic analysis like this with 74 countries, it is difficult to come up with concrete solutions that work for every country, since different factors are at play in each country or region.

References

ACLED. (2023). The Armed Conflict Location & Event Data Project (ACLED). Retrieved at 27-04-2023 from https://acleddata.com/

Anderson, A., Brownlee, J. & Clarke, K. (2021). Autocracy: A Substantive Approach. Retrieved at 11-05-2023 from https://fsi-live.s3.us-west-1.amazonaws.com/s3fs-public/abc_autocracy_v4_0.pdf

Arvin, M. & Lew, B. (2011). Does Democracy Affect Environmental Quality in Developing Countries? *Applied Economics, 43(9),* 1151-1160.

Bättig, M. & Bernauer, T. (2009). National Institutions and Global Public Goods: Are Democracies More Cooperative in Climate Change Policy? *International Organization, 63(2),* 281-308.

Beck, U. (1996). Risk Society and the Provident State. In: S. Lash, B. Szerszynski & B. Wynne (eds.), *Risk, Environment and Modernity: Towards a New Ecology.* London: SAGE.

Bernauer, T. (2013). Climate Change Politics. *Annual Review of Political Science, 16,* 421-448.

Bernauer, T. & Betzold, C. (2012). Civil Society in Global Environmental Governance. *The Journal of Environment & Development, 21(1),* 62-66.

Bernauer, T. & Böhmelt, T. (2013). Are Economically "Kinder, Gentler Societies" also Greener? *Environmental Science & Technology, 47(2),* 11993-12001.

Bernauer, T. & Koubi, V. (2009). Effects of Political Institutions on Air Quality. *Ecological Economics, 68(5),* 1355-1365.

Berrang-Ford, L., Ford, J. & Paterson, J. (2010). Are we Adapting to Climate Change? *Global Environmental Change, 21*, 25-33.

Bevans, R. (2022, 15 November). Simple Linear Regression: An Easy Introduction & Examples. Retrieved at 26-04-2023 from https://www.scribbr.com/statistics/simple-linear-regression

Burck, J., Uhlich, T., Bals, C., Höhne, N., Nascimento, L., Tavares, M. & Strietzel, E. (2023). 2023 Climate Change Performance Index: Results. Germanwatch, NewClimate Institute & Climate Action Network.

Climate Change Performance Index. (2023). CCPI 2023: Ranking and Results. Retrieved at 28-03-2023 from https://ccpi.org/

ClimateWatch. (2019). Historical GHG Emissions: 2019 GHG Emissions per Capita. Retrieved at 15-05-2023 from https://www.climatewatchdata.org/ghg-emissions?calculation=PER_CAPITA

Coppedge, M., Gerring, J., Knutsen, C., Lindberg, S., Teorell, J. et al. (2022). V-Dem Codebook v11.1. Varieties of Democracy (V-Dem) Project.

Dahl, R. (1998). *On Democracy.* New Haven, CT: Yale University Press.

Dahlberg, S. & Holmberg, S. (2014). Democracy and Bureaucracy: How Their Quality Matters for Popular Satisfaction. *West European Politics, 37(3),* 515, 537.

Eckstein, D., Künzel, V. & Schäfer, L. (2021). Global Climate Risk Index 2021. Retrieved at 17-04-2023 from https://www.germanwatch.org/en/cri

Engels, A. (2018). Understanding how China is Championing Climate Change Mitigation. *Palgrave Communications, 4(1),* 101-106.

Environmental Performance Index. (2022). About the EPI. Retrieved at 28-03-2023 from https://epi.yale.edu/

Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics.* London: SAGE.

Frederiksson, P. & Neumayer, E. (2013). Democracy and Climate Change Policies: Is History Important? *Ecological Economics, 95,* 11-19.

Gallo, A. (2015, 4 November). A Refresher on Regression Analysis. Retrieved at 26-04-2023 from https://hbr.org/2015/11/a-refresher-on-regression-analysis

Geneva Call. (2021, 8 October). Armed Conflict and the Environment. Retrieved at 13-04-2023 from https://www.genevacall.org/armed-conflict-and-the-environment/

Geneva Environment Network. (2023, 15 March). Protecting the Environment in Armed Conflict. Retrieved at 13-04-2023 from https://www.genevaenvironmentnetwork.org/resources/updates/protecting-the-environment-in-armed-conflict/

Gleditsch, N. & Sverdrup, B. (2003). Chapter 2: Democracy and the Environment. In: E. Page & M. Redclift (eds.), *Human Security and the Environment: International Comparisons*. Cheltenham: Edward Elgar.

Haibach, H. & Schneider, K. (2013). Chapter 11: The Politics of Climate Change: Review and Future Challenges. In: O. Ruppel, C. Roschmann & K. Ruppel-Schlichting (eds.), *Climate Change: International Law and Global Governance (Volume II).* Baden-Baden: Nomos Verlagsgesellschaft mbH.

IBM (2023). IBM SPSS Statistics. Retrieved at 26-04-2023 from https://www.ibm.com/products/spss-statistics

Jahanger, A., Usman, M. & Balsalobre-Lorente, D. (2021). Autocracy, Democracy, Globalization, and Environmental Pollution in Developing World: Fresh Evidence from STIRPAT Model. *Journal of Public Affairs, 22(4),* e2753.

Kaufmann, D. & Kraay, A. (2022). Worldwide Governance Indicators. Retrieved at 27-04-2023 from https://info.worldbank.org/governance/wgi/

Khan, F. (2019, 27 September). The Role of Services, Industry & Agriculture in the Global Economy. Retrieved at 25-04-2023 from https://medium.com/technicity/the-role-of-services-industry-agriculture-in-the-global-economy-cb9ace644987

King, N. & Jones, A. (2021). An Analysis of the Potential for the Formation of 'Nodes of Persisting Complexity'. *Sustainability, 13(15),* 8161.

Kneuer, M. (2012). Who is Greener? Climate Action and Political Regimes: Trade-Offs for National and International Actors. *Democratization, 19(5),* 865-888.

Li, Q. & Reuveny, R. (2006). Democracy and Environmental Degradation. *International Studies Quarterly*, *50(4)*, 935-956.

Lührmann, A., Tannenberg, M. & Lindberg, S. (2018). Regimes of the World (RoW): Opening New Avenues for the Comparative Study of Political Regimes. *Politics and Governance, 6(1),* 60-77.

Martini, E. (2022). Eco-Authoritarianism. Retrieved at 12-04-2023 from https://www.americanpurpose.com/articles/eco-authoritarianism/

Martinot, E., Sinton, J. & Haddad, B. (1997). International Technology Transfer for Climate Change Mitigation and the Cases of Russia and China. *Annual Review of Energy and the Environment, 22*, 357-401.

Mi, Z., Guan, D., Liu, Z., Liu, J., Viguié, Fromer, N. & Wang, Y. (2019). Cities: The Core of Climate Mitigation. *Journal of Cleaner Production, 207,* 582-589.

Midlarsky, M. (1998). Democracy and the Environment: An Empirical Assessment. *Journal of Peace Research, 35(3),* 341-361.

Mittiga, R. (2021). Political Legitimacy, Authoritarianism, and Climate Change. *American Political Science Review, 116(3),* 998-1011.

Neumayer, E. (2002). Do Democracies Exhibit Stronger International Environmental Commitment? A Cross-Country Analysis. *39(2),* 139-164.

O'Neill, S. & Boykoff, M. (2011). Chapter 13: The Role of New Media in Engaging the Public with Climate Change. In: L. Whitmarsh, I. Lorenzoni & S. O'Neill (eds.), *Engaging the Public with Climate Change: Behavior Change and Communication.* London: Routledge.

Povitkina, M. (2018). The Limits of Democracy in Tackling Climate Change. *Environmental Politics, 27(3),* 411-432.

Raleigh, C. & Urdal, H. (2007). Climate Change, Environmental Degradation and Armed Conflict. *Political Geography, 26(6),* 674-694.

Reporters Without Borders (2023). 2023 Press Freedom Index. Retrieved at 27-04-2023 from https://rsf.org/en/index

Ryan, C. (1991). *Prime Time Activism: Media Strategies for Grassroots Organizing.* Boston: South End Press.

Shahar, D. (2015). Rejecting Eco-Authoritarianism, Again. *Environmental Values, 24(3),* 345-366.

Shan, Y., Guan, D., Hubacek, K., Zheng, B., Davis, S., Jia, L, Liu, J., Liu, Z., Fromer, N., Mi, Z., Meng, J., Deng, X., Li, Y., Li, J., Schroeder, H., Weisz, H. & Schellnhuber, H. (2018). City-Level Climate Change Mitigation in China. *Environmental Studies, 4(6),* 190027.

Sharmina, M. & Anderson, K. & Bows-Larkin, A. (2013). Climate Change Regional Review. *WIREs Climate Change, 4,* 373-396.

Sjöstedt, M. & Jagers, S. (2014). Democracy and the Environment Revisited: The Case of African Fisheries. *Marine Policy, 43,* 143-148.

Spilker, G. (2013). *Globalization, Political Institutions and the Environment in Developing Countries*. New York: Routledge.

Statistics Solutions. (2023a). Assumptions of Linear Regression. Retrieved at 11-05-2023 from https://www.statisticssolutions.com/assumptions-of-linear-regression/

Statistics Solutions. (2023b). Testing Assumptions of Linear Regression in SPSS. Retrieved at 11-05-2023 from https://www.statisticssolutions.com/testing-assumptions-of-linear-regression-in-spss/

Tibco. (2023). What is Regression Analysis? Retrieved at 26-04-2023 from https://www.tibco.com/reference-center/what-is-regression-analysis

United Nations. (2023a). What is Climate Change? Retrieved at 12-04-2023 from https://www.un.org/en/climatechange/what-is-climate-change

United Nations. (2023b). Member States. Retrieved at 12-05-2023 from https://www.un.org/en/about-us/member-states

University of Gothenburg (2023). The QoG Institute. Retrieved at 27-04-2023 from https://www.gu.se/en/quality-government

VijayaVenkataRaman, S., Iniyan, S. & Goic, R. (2010). A Review of Climate Change, Mitigation and Adaptation. *Renewable and Sustainable Energy Reviews, 16,* 878-897.

V-Dem Institute. (2023). The V-Dem Project. Retrieved at 26-04-2023 from https://v-dem.net/about/v-dem-project/

V-Dem Institute. (2022). Democracy Report 2022: Autocratization Changing Nature? Retrieved at 26-04-2023 from https://v-dem.net/media/publications/dr_2022.pdf

Von Stein, J. (2022). Democracy, Autocracy, and Everything in Between: How Domestic Institutions Affect Environmental Protection. *British Journal of Political Science, 52(1),* 339-357.

Wang, Q., Feng, G., Wang, H. & Chang, C. (2022). The Influence of Political Ideology on Greenhouse Gas Emissions. *Global Environmental Change, 74,* 102496.

Weiss, J. (2019). A World Safe for Autocracy? China's Rise and the Future of Global Politics. *Foreign Affairs, 98(4),* 92-108.

Wolf, M., Emerson, J., Esty, D., De Sherbinin, A., Wendling, Z., et al. (2022). 2022 Environmental Performance Index. New Haven, CT: Yale Center for Environmental Law & Policy.

World Bank. (2021). GDP per Capita (Current US $). Retrieved at 15-05-2023 from https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

World Bank Gender Data Portal. (2019). Employment by Sector (%). Retrieved at 15-05-2023 from https://genderdata.worldbank.org/indicators/sl-empl-zs/?employment=Services&gender=total

Worldometer. (2020). Countries in the World by Population. Retrieved at 15-05-2023 from https://www.worldometers.info/world-population/population-by-country/

Worldometer. (2023a). Largest Countries in the World (by Area). Retrieved at 26-04-2023 from https://www.worldometers.info/geography/largest-countries-in-the-world/

Wu, T. (2023, 26 February). Best Places to Live to Avoid Climate Change in 2023. Retrieved at 17-04-2023 from https://earth.org/best-places-to-live-to-avoid-climate-change/

Wu, Y. (2009). Chapter 13: The Good, the Bad, and the Ugly: Framing of China in News Media Coverage of Global Climate Change. In: T. Boyce & J. Lewis (eds.), *Climate Change and the Media*. New York: Peter Lang.

Appendices

Appendix 1: Autocracies of the World

Electoral Autocracies (60)

Albania
Algeria
Angola
Azerbaijan
Bangladesh
Belarus
Benin
Burundi
Cambodia
Cameroon
Central African Republic
Comoros
Congo
Djibouti
Democratic Republic of the Congo
Egypt
El Salvador
Equatorial Guinea**
Ethiopia
Fiji
Gabon
Gambia**
Haiti
Honduras
Hungary
India
Iran
Iraq
Ivory Coast
Kazakhstan

Closed Autocracies (30)

Afghanistan
Bahrain
Chad
China
Cuba**
Eritrea**
Eswatini
Guinea
Hong Kong*
Jordan
Kuwait
Laos
Libya**
Mali
Morocco
Myanmar
North Korea**
Oman
Palestine (Gaza)*
Qatar
Saudi Arabia
Somalia**
South Sudan**
Sudan
Syria**
Thailand
United Arab Emirates
Uzbekistan
Vietnam
Yemen**

Kenya

Kyrgyzstan

Lebanon

Madagascar

Malaysia

Mauritania

Montenegro

Mozambique

Nicaragua

Nigeria

Pakistan

Palestine (West Bank)*

Papua New Guinea

Philippines

Russia

Rwanda

Serbia

Singapore

Somaliland*

Tajikistan

Tanzania

Togo

Tunisia

Turkey

Turkmenistan**

Uganda

Venezuela

Zambia

Zanzibar*

Zimbabwe

Source: V-Dem Institute (2022, p. 45)

* These countries are not included in this study because of their questionable independence and the resulting lack of data availability (United Nations, 2023b).

** These countries are not included in this the study because of the lack of data availability.

Appendix 2: Histograms of the Variables

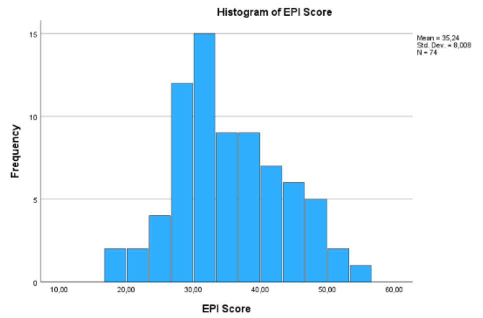


Figure A1: Histogram of EPI Score

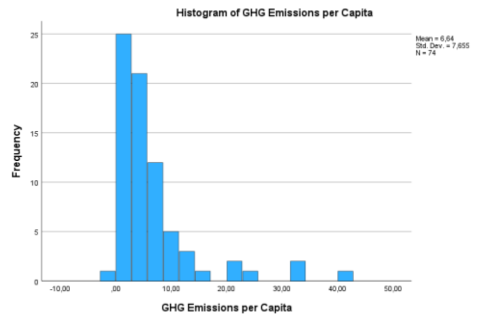


Figure A2a: Histogram of GHG Emissions per Capita

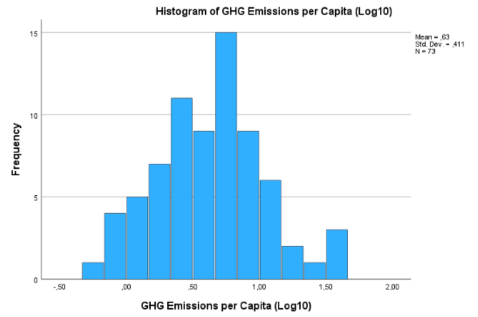


Figure A2b: Histogram of GHG Emissions per Capita after Logarithmic Transformation

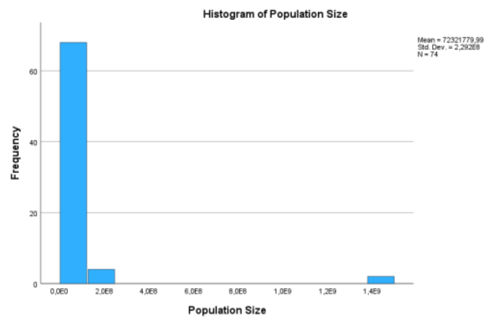


Figure A3a: Histogram of Population Size

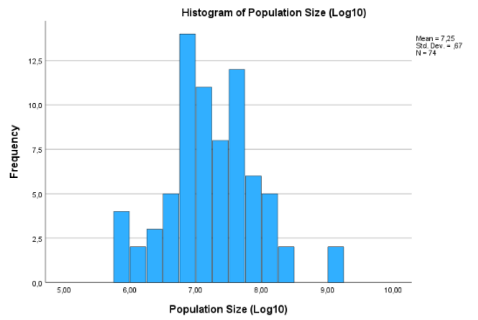


Figure A3b: Histogram of Population Size after Logarithmic Transformation

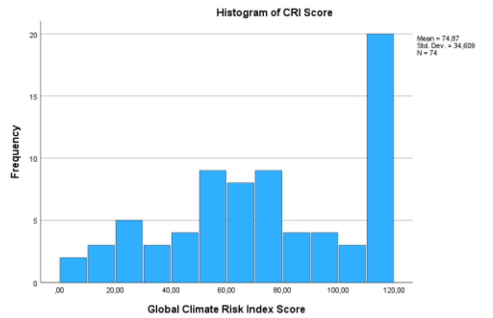


Figure A4a: Histogram of CRI Score

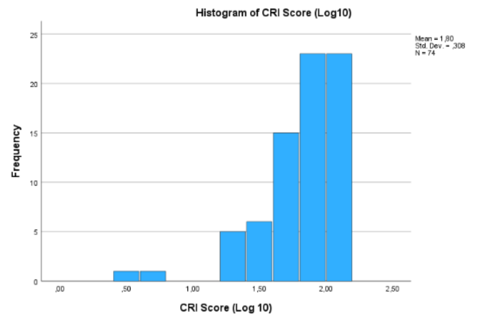
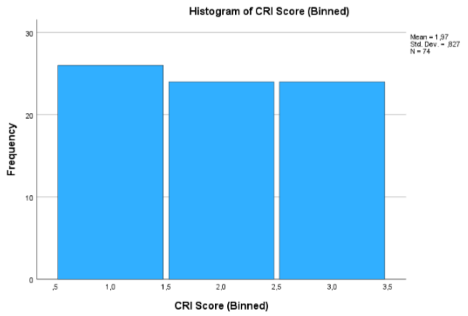


Figure A4b: Histogram of CRI Score after Logarithmic Transformation



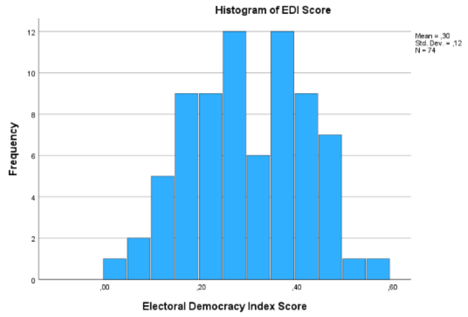


Figure A4c: Histogram of CRI Score after Visual Binning; Figure A5: Histogram of EDI Score

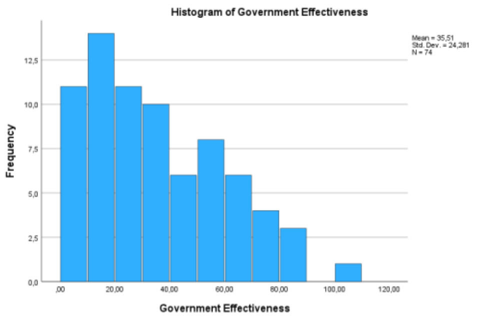


Figure A6a: Histogram of Government Effectiveness

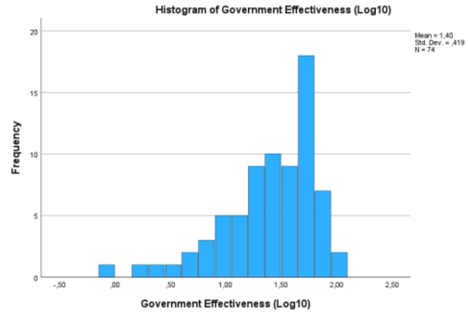


Figure A6b: Histogram of Government Effectiveness after Logarithmic Transformation

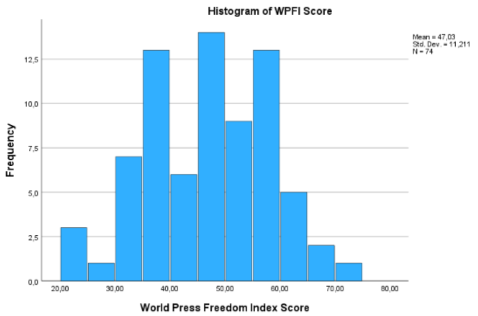


Figure A7: Histogram of WPFI Score

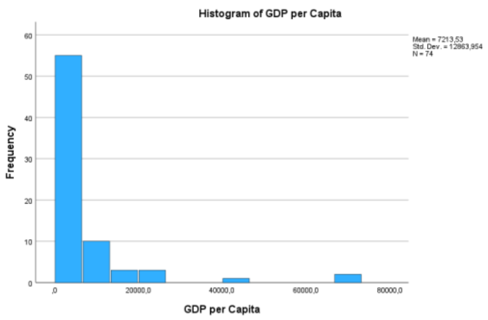


Figure A8a: Histogram of GDP per Capita

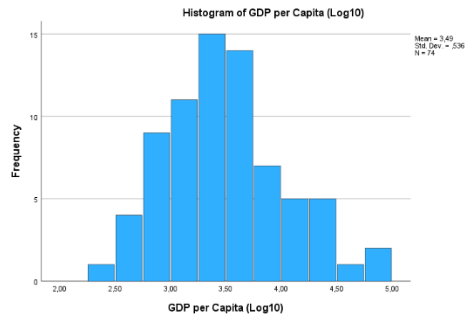


Figure A8b: Histogram of GDP per Capita after Logarithmic Transformation

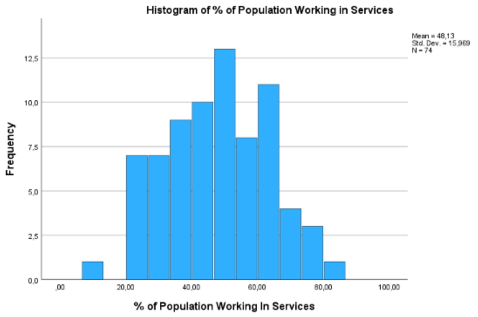
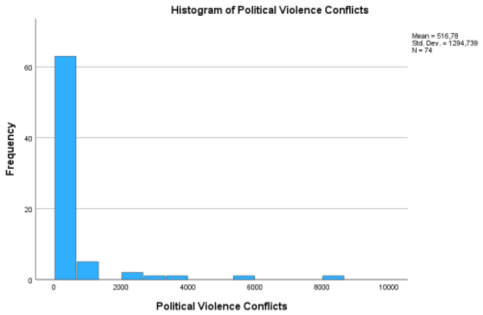


Figure A9: Histogram of % of Population Working in Services



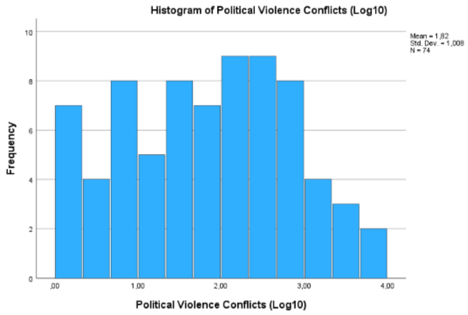


Figure A10a: Histogram of Political Violence Conflicts

Figure A10b: Histogram of Political Violence Conflicts after Logarithmic Transformation

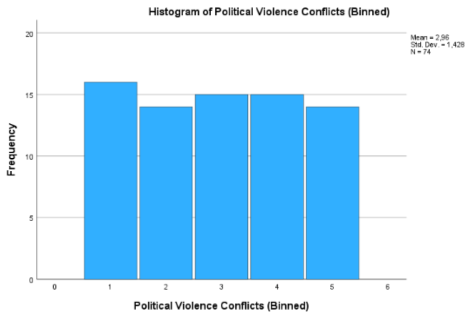


Figure A10c: Histogram of Political Violence Conflicts after Visual Binning

Appendix 3: Models of Simple and Multiple Regression Analysis

	Coefficient	**Std. Error**	**T-value**	**P-value**
GHG Emissions	6.919	2.671	2.591	0.012
Constant	30.116	2.173	13.862	<0.001

Table A1: Simple Regression Analysis of the Effect of GHG Emissions per Capita

	Coefficient	**Std. Error**	**T-value**	**P-value**
Population Size	-6.669	1.169	-5.706	<0.001
Constant	83.609	8.511	9.823	<0.001

Table A2: Simple Regression Analysis of the Effect of Population Size

	Coefficient	**Std. Error**	**T-value**	**P-value**
Low Risk	3.758	2.128	1.766	0.082
High Risk	-4.342	2.087	-2.081	0.041
Constant	35.550	1.505	23.623	<0.001

Table A3: Simple Regression Analysis of the Effect of CRI Score

	Coefficient	**Std. Error**	**T-value**	**P-value**
EDI Score	0.098	7.862	0.013	0.990
Constant	35.214	2.519	13.977	<0.001

Table A4: Simple Regression Analysis of the Effect of EDI Score

	Coefficient	**Std. Error**	**T-value**	**P-value**
Gov. Effectiven.	2.691	2.230	1.207	0.232
Constant	31.463	3.268	9.629	<0.001

Table A5: Simple Regression Analysis of the Effect of Government Effectiveness

	Coefficient	**Std. Error**	**T-value**	**P-value**
WPFI Score	0.160	0.082	1.955	0.055
Constant	27.702	3.965	6.987	<0.001

Table A6: Simple Regression Analysis of the Effect of WPFI Score

	Coefficient	**Std. Error**	**T-value**	**P-value**
GDP per Capita	5.687	1.630	3.489	<0.001
Constant	15.371	5.760	2.668	0.009

Table A7: Simple Regression Analysis of the Effect of GDP per Capita

	Coefficient	Std. Error	T-value	P-value
% in Services	0.212	0.054	3.949	<0.001
Constant	25.061	2.715	9.230	<0.001

Table A8: Simple Regression Analysis of the Effect of % of Population Working in Services

	Coefficient	Std. Error	T-value	P-value
Pol. Viol. Conf.	-2.522	0.590	-4.273	<0.001
Constant	42.706	1.937	22.047	<0.001

Table A9: Simple Regression Analysis of the Effect of Political Violence Conflicts

	Coefficient	Std. Error	T-value	P-value
GHG Emissions	4.118	3.675	1.120	0.267
Population Size	-4.712	1.818	-2.592	0.012
CRI Score				
Low Risk	1.089	1.122	0.976	0.333
High Risk	-0.203	2.050	-0.099	0.922
EDI Score	0.038	8.831	0.004	0.997
Gov. Effectiven.	0.894	2.772	0.323	0.748
WPFI Score	0.055	0.102	0.538	0.592
GDP per Capita	-0.535	3.780	-0.141	0.888
% in Services	0.101	0.093	1.085	0.282
Pol. Viol. Conf.	-0.254	0.839	-0.302	0.763
Constant	59.718	15.614	3.825	<0.001

Table A10: Multiple Regression Analysis