Another Security Dilemma

Security Preferences in Context of Climate Change

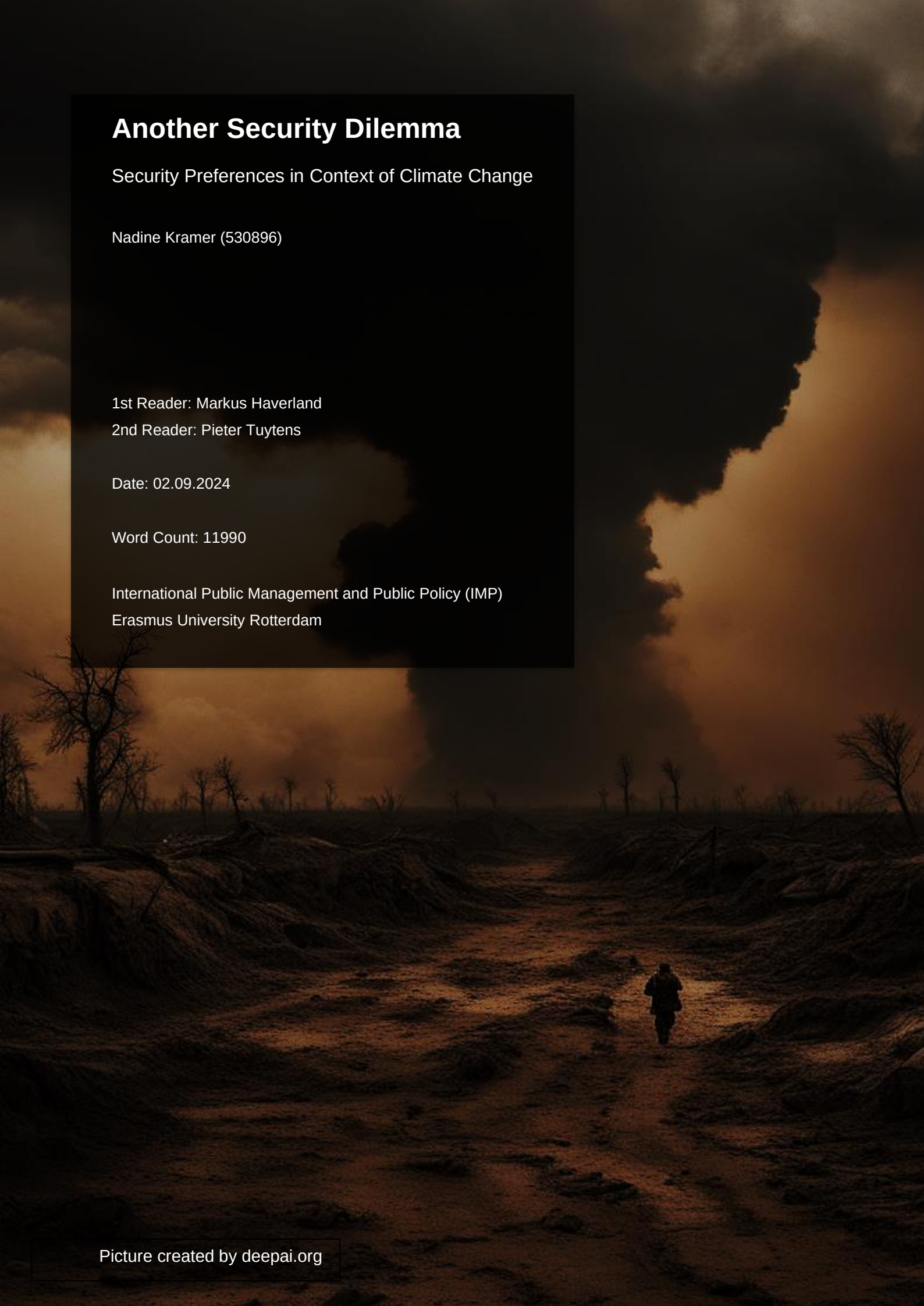
Nadine Kramer (530896)

1st Reader: Markus Haverland
2nd Reader: Pieter Tuytens

Date: 02.09.2024

Word Count: 11990

International Public Management and Public Policy (IMP)
Erasmus University Rotterdam



Picture created by deepai.org

Summary

How can states cooperate on global environmental issues while military conflicts divide them? Not much research has been focusing on the relationship between environmental and military security but with advancing technology, humanity has changed the rules of national security considerations. New theories and models are needed to understand the decisions of past state governments and to guide future decision-makers and researchers. This paper uses established theory to address the lack of a comprehensive theoretical framework. Based on this, parallel game theory could deliver new insights on possible developments. The main finding of the research is the significance of the model which should be further developed in future projects. However, the research also indicates an urgency in creating cooperation on climate change and the development of alternatives to traditional military security efforts.

Acknowledgment

I would like to express my gratitude to my thesis advisor, Markus Haverland, for his guidance and encouragement throughout this research journey. Your insights and support helped me navigating the challenges of this project. I would also like to extend my appreciation to my thesis group, for their collaboration and constructive feedback. Additionally, I am grateful to Shyamika Jayasundara-Smits and Mansoob Murshed, who supported me with their expertise in conflict analysis and modelling. Finally, my family and friends for their unwavering support and encouragement.

Thank you for being a part of this journey.

List of Tables

List of Figures

List of Graphs

Contents

1. Introduction

What is more dangerous, the environment or other people? Providing national security is one of the main functions of politics. As the world enters the Anthropocene, humankind has increased control over the environment and is altering it to a level that has become a problem (Steffen et al., 2015). It is an era in which human action has created its own 'actorless threats' including pandemics, biodiversity loss and climate change (Goodman & Kertysova, 2022). Threats that originate from cumulative global actions rather than other states directly. Therefore, the environment has increasingly become a national security threat, while its impact is still underestimated, and theories need to be adjusted.

In many traditional theories of international relations, the state's main goal is national security. Following Hobbes' ideas on the state of nature, state actions are legitimised by their added value to provide security to their people as a higher authority (Yurdusev, 2007). His theory is also seen as the origin of realism. Realism argues that as the international level has no authority, states are in perpetual conflict and security is a scarce good (Yurdusev, 2007; Viotti & Kauppi, 2009, Armitage, 2006). Newer concepts such as agonistic peace support the idea of conflict as a constant reality, but attention has also been brought to other dimensions of national security (Shinko, 2008).

Human security introduced the understanding of security to include among others environmental security (UNDP, 1994). The environmental dimension is particularly important, as lasting challenges such as climate change, resource depletion, and natural disasters increasingly pose direct threats to people's livelihoods, health, and overall well-being (UNDP, 1994). Human security is not state-centred but recognises aspects of security that individuals would ask for from a legitimate government as in Hobbes' theory. Combined, realist and human security perspectives can provide the basis for a theoretical framework appropriate to explain global environmental efforts.

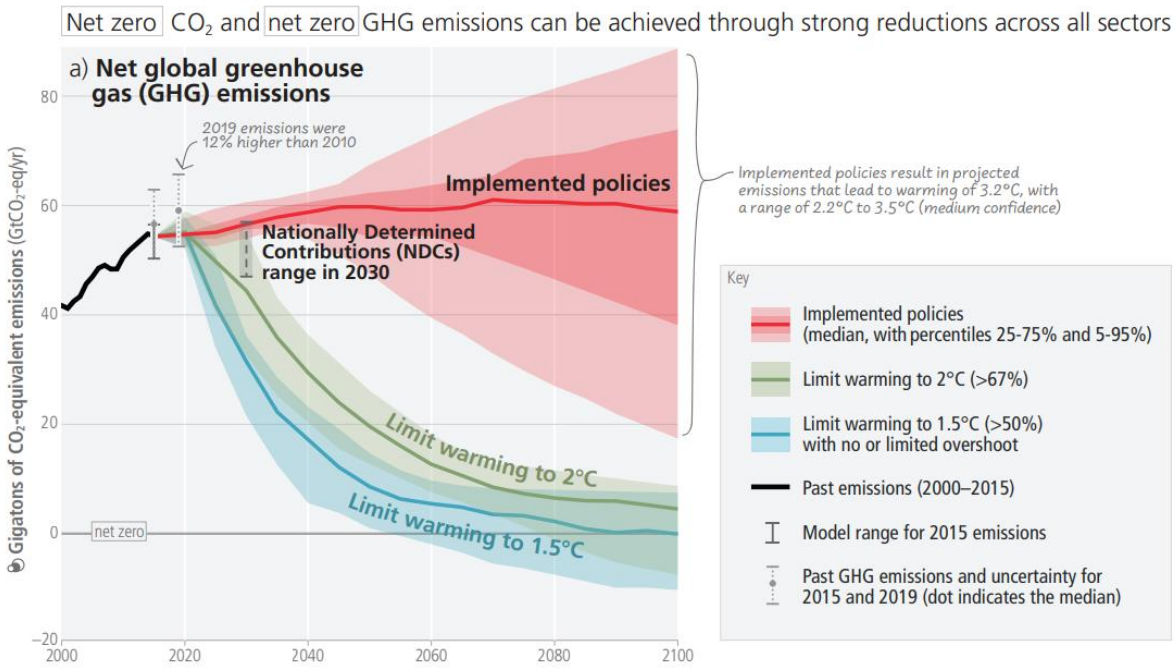


Figure 1: Current Policies are not Sufficient to Reach Emission Goals (IPCC, 2023)

Despite increasing environmental awareness, the progress on environmental security issues has been limited. The United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and later the Kyoto Protocol in 1997 followed by the Paris Agreement in 2015 have been great steps towards environmental security. However, they lacked contextual understanding as there was little involvement of security experts and today most climate scientists are not confident that their targets will be reached (Grantham Research Institute, 2022; Carrington, 2024). This is supported by the IPCC report of 2023, showing a misalignment of policies to keeping global warming below 1.5°C and 2°C (Figure 1). Furthermore, most countries fail to fully implement and fund environmental policies while "public and private finance flows for fossil fuels are still greater than those for climate adaptation and mitigation" (IPCC, 2023, p.11). Even if states would not defect from existing commitments, current policies and laws "make it likely that global warming will exceed 1.5°C during the 21st century and make it harder to limit warming below 2°C" (IPCC, 2023, p. 10). Interestingly, the IPCC report does not mention military conflict as a threat to the global climate and Mcfarlane and Volcovici calls it the 'military blind spot' (2023).

As the interconnection between military and environmental security has not been recognised, environmental security has long been neglected. Historically, environmental threats have been viewed as separate from military threats, limiting national security strategies mostly to realist approaches, looking at freeriding behaviour (Goodman & Kertysova, 2022;

Tørstad, 2020). However, already in 1992, Severn Cullis-Suzuki, at 12 years old, tried to make people aware of the connection suggesting that “If all the money spent on war was spent on finding environmental answers ending poverty and finding treaties what a wonderful place this earth would be " (DW News, 2012). However, just as Porfiriev’s (1992) work on the importance of environmental security, her speech had limited impact at the time. Further attention to the relationship between military and environmental security is crucial to increase environmental action.

State governments are increasingly aware of interconnections with environmental security, but they lack theoretical support when making decisions. In 2007 the OSCE Madrid Declaration on Environment and Security recognized the linkages and in 2010 climate change was included in the Strategic Concept of NATO (OSCE, n.a.; Goodman & Kertysova, 2022). Furthermore, many national forces consider environmental change as a security threat (Barnett, 2009). However, most still focus on the indirect threat to military initiatives rather than as a direct threat to their national security (Barnett, 2009). This might also be linked to the fact that research on the interaction between military and environmental security has been limited. Most of it focuses on environmental changes as a threat multiplier, resource conflicts, disaster relief or the direct environmental impact of military actions such as contamination of soil, resource depletion or secondary impacts such as refugee camps (Weir, 2020). However, the underlying impact of decisions based on a realist understanding of security has not been mostly overlooked as there is little theory regarding the interconnections between military and environmental security to support a shift in national security approaches.

Not only in political practice but also in research requires new theories and models to understand the new reality of national security. Several authors asked for more comprehensive theories and models reflecting the complexity of national security and providing guidance to policymakers (Gellers, 2010; Gilmore et al., 2018). Barkdull (2017) also argues that while decision-makers increasingly consider environmental security in their foreign policy decisions, the separation of military and environmental theories and models may cause some problems in understanding the issues. Furthermore, Haas, as referenced by Ravenhill (2020), found that linkage across issues can lead decision-makers to come to different strategies and better outcomes, indicating a possible improvement for environmental security problems. Striving towards military security may circumvent true action on environmental security. This has also been found by Kivimaa and Sivonen (2021) in the context of national security and low-carbon energy transitions. Cooperation or confrontation strategies seem to be a matter of priority and understanding that may incentivise policymakers to reevaluate the cohesion and orientation of current national security strategies. A new model reflecting ideas

of realism and human security could provide additional explanatory value for the historical progress and predict or suggest paths of future national security decisions.

The new theory and model based on human security aspects and realism must focus on the inherent contradictions of military and environmental security strategies. Realism and military security would disregard the impact of other dimensions of security than military strength such as environmental security while focusing only on human security would underestimate the impact of states' struggle for power. The solution to understanding security decisions is to recognise that military and environmental security goals and strategies are at least in part mutually exclusive. It is increasingly known that environmental and military security compete for resources, and political priority, and inherently impact each other (Harris, 2022; Weise, 2024; Manzanaro, 2024, Vogler, 2024; Conca & Beevers, 2018). This makes sense, as maximum military security is traditionally achieved through military investment, maximisation of power and a focus on relative gains, while environmental problems require investment in economic, social and environmental aspects, global cooperation and a focus on absolute benefits. This contradiction should be reflected in a new theory and model.

Game theory allows to incorporate the contradiction by explaining decision-making based on the analysis of the optimal strategies of actors shared and conflicting interests. It is a common method in political and environmental science and parallel game theory has been used in similar cases before (Mahmoudi et al., 2024; Alt & Eichengreen, 1989). Parallel game theory may therefore present new aspects to consider for analysing national security decisions and provide support to academics and decision-makers. This paper therefore wants to answer the research question:

Can parallel game theory provide insights into national security decision-making of governments related to military and environmental security?

This research aims to explain decisions on national security issues related to conflict and climate change by applying parallel game theory on interconnections between military and environmental security. These explanations will be tested using the Empirical Implications of Theoretical Models (EITM) method. It guides the research from the model to a statistical analysis of the results. The model is supposed to accumulate information from the literature to increase understanding and support of strategic orientation and cohesiveness of policies. It should have explanatory value for the historical progress on climate action and boost existing developments towards more environmental focus in national security decisions. Lastly, it can be an interesting evidence-based example of the interdisciplinary use of game theory outside

of the Empirical Game-Theoretic Analysis (EGTA). The new model will be tested using preexisting data from among others the IMF, the World Bank and the Uppsala Conflict Data Program. Following a regression analysis, the model could predict the relationship of the 'World Surface Temperature Change' and the military threat indicators to the environmental focus. However, much research and analysis are still necessary, and the practical use of the results should be taken with caution.

2. Literature Review

Several existing theories can inform and contribute to a new theory and model. These theories will later be applied to the content of the problem to establish a wider and a coherent framework. This section will be divided into one section on theories on security and the legitimacy of state power and one section on the relationship between environmental and military security before highlighting the gap in the literature.

Theory on State Security Provision

Based on Hobbes' theory, providing national security to citizens is the main function of states and a defining factor in international relations. Hobbes' concept of the state of nature argues that people accept state power to prevent anarchy on a national level (Armitage, 2006). As a theoretical point in time, before states were created, the state of nature assumes a rather negative nature of humans, where no actor can ever feel safe from another and a constant 'war of all against all' (Yurdusev, 2007). People compete over resources and power as humans seek their short-term gains and have no source for peaceful dispute resolution (Hobbes & Cropsey, 1971). The legitimacy of the state depends on the state's ability to "provide men with internal peace and protect them against the external enemies" (Yurdusev, 2007, p.422). If one accepts this as the purpose of a state, then the state ultimately has national security goals at its core.

According to realism, the state of nature continues at the international level. As the international sphere did not establish a higher authority to punish certain state behaviours, cooperation relies on trust that actors adhere to the law without means of enforcement (Mearsheimer,1994). This leads to the realist concept of the power struggle, as trust is very difficult to create (Viotti & Kauppi, 2009). Unlike individuals, state differences in power and the results of state formations are too extreme and prevent the emergence of a higher authority (Hobbes & Cropsey, 1971). Furthermore, Hobbes argues that anarchy on the international level does not lead to the same misery for individuals as anarchy without a national state

provides less need for change (Yurdusev, 2007). Hobbes' state of nature on the national stage is therefore the origin of the idea of the state of anarchy and realism on the international stage (Armitage, 2006; Yurdusev, 2007).

Realism defines security mostly as security from other people. "A state is thought to be secure if it can defend against or deter a hostile attack and prevent other states from compelling it to adjust its behaviour in significant ways or to sacrifice core political values" (p.1, Walt, 2017). To reach security, realists focus on military security but also recognise indirect effects of other policy fields. State power and therefore national security has been defined as "the sum of military, economic, technological, diplomatic and other capabilities at the disposal of the state" (Viotti & Kauppi, 2009, p.65). However, military security is relative and a state gaining power, increases the military threat to other states (Viotti & Kauppi, 2009). Therefore, states follow strategies to accumulate as much power over other actors as possible to reach the scarce good of national security as mentioned earlier in the international power struggle (Mearsheimer,1994). Current developments in conflict analysis such as agonistic peace also support the idea, that conflict never ceases to exist but only varies in intensity (Shinko, 2022; Hobbes & Cropsey, 1971). Therefore, concepts of the state of anarchy and realism still characterise international relations today in their focus on military security.

Environmental security is not included in the realist perspective of national security. From a realist perspective, more focus on environmental security can divert effort away from military security and threaten the existence of a state. Sustainability policies can take away governmental resources, increase economic costs, affect national independence in the production or consumption of goods and GDP in general (Cohn, 2016). At the same time, environmental security is a common good, impacted and used by the global community. The widely known problem of the tragedy of commons, in this case, explains how negative externalities of a pure military-focused security strategy are shared while everyone benefits from environmental security actions (Tadelis, 2013). The realist focus, assuming that states act solely out of their national interest, leads to the free-rider problem of environmental security effort as one potential explanation for limited environmental effort.

Environmental security is recognised in the concept of human security. Human security shifts the traditional state-centric view of security to individuals and communities. It expands the scope of security to include economic, food, health, environmental, personal, community and political security that directly impact people's lives (UNDP, 1994). It assumes that human rights and peace are interconnected and mutually reinforcing, emphasising the empowerment of the people. Human security is not state-centred but recognises aspects of security that

individuals would ask for from a legitimate government as in Hobbes' theory. Environmental threats are especially important since climate change and natural disasters increasingly pose direct threats to people's livelihoods, health, and overall well-being.

Hobbes does not mention environmental threats, but his theory includes different forms of cooperation to increase security. Security is one of the main functions of states whether to secure the people individually or from other states. Hobbes said in the state of nature even the most powerful people would not be safe, as others might join forces to overcome them (Yurdusev, 2007). This form of cooperation in Hobbes' state of nature without authority has not received much attention. To create a more nuanced understanding, both collective and individual security sources need to be recognised to understand global environmental security efforts.

The Relationship Between Environmental and Military Security

War has a significant impact on political action on environmental security. Zwijnenburg (2021) showed the impact of armed conflict leading to a lack of funding for environmental projects and a collapse of environmental governance (Figure 2). One example of this is the conflict in Ukraine, in 2022, leading to a new all-time high of world military spending, while investments in sustainability have been put on hold and emission targets got less ambitious (Tian et al. 2023; Harris, 2022). Furthermore, it is interesting that countries which are challenging the US hegemony are also the ones hesitant to cooperate on climate action (The Moscow Times, 2023; Camut et. al., 2023; Davydova, 2022). Military tensions seem to come at the cost of trust in political cooperation on environmental security.

However, there are also structural problems for global environmental efforts related to war. The war in Ukraine led to increased prices and impacted supply chains making it harder for many countries to reach sustainability goals (Conca & Beevers, 2018). Furthermore, while incentivising Western countries to invest in renewables, they also reopened coal-burning plants, and increased investment in oil and gas abroad to meet the immediate energy needs (Harris, 2022). Lastly, the production and use of military resources contribute to increasing environmental threats just as the following post-war reconstruction efforts (Harris, 2022; Vogler, 2024). When engaging in military security issues, these effects should be considered to understand national security decisions.

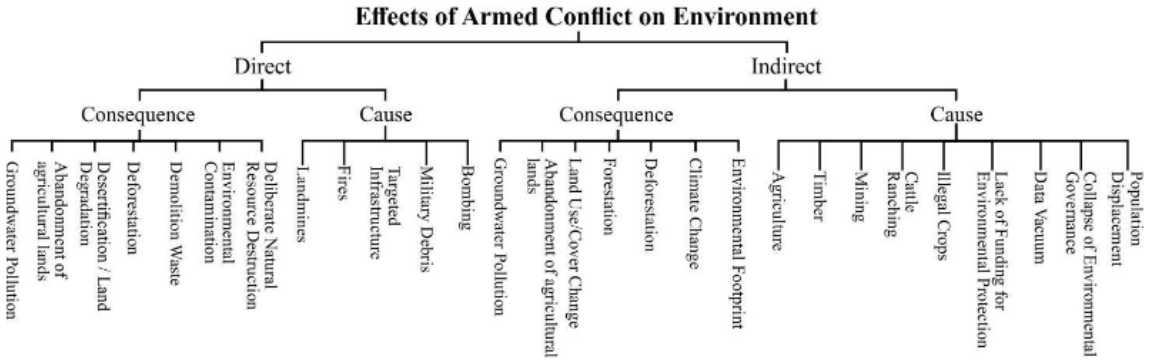


Figure 2: Effects of Armed Conflict on the Environment (Zwijnenburg, 2021)

The contradiction can be categorised as a clash between realist ideas and the tragedy of the commons. As a collective security issue, every state will benefit from environmental actions while only states who do act have the costs (Tørstad, 2020). In a previous paper, the author showed how the political focus on the relative benefits of realism in a hyper-globalised world leads to an extreme disregard for environmental safety (Kramer, 2022). States wanting to increase their relative gains are incentivised to defect from any environmental commitment.

A broader approach to understanding national security including environmental factors would suggest differently. Porfiriev's systems analysis views national security as a cluster of interconnected elements (1992). He found that the environmental dimension appeared to be the most important security dimension. This includes the immediate impacts of environmental security threats to the public and the impact of environmental security threats on national security. Porfiriev (1992) argues that the quality of life and health serve as both the main objective and the principal criterion of environmental security in a social system fitting well with the idea of state legitimacy of Hobbes.

While both military and environmental security are important, there is a change in relevance over time. Foreign Secretary Beckett said, "dangers that small island States and their populations faced [from climate change are today] 'no less serious than those faced by nations and peoples threatened by guns and bombs' " (Parry, 2007). This aligns with the premise of the paper, that advancing technology, resource usage and growing populations increased the human impact on the environment and the relevance of environmental security considerations. In the opposite direction, the usually environmentally ambitious EU shifts focus away from environmental issues to military security following the war in Ukraine (Weise, 2024; Manzanaro, 2024). The shifting importance of military and environmental security will be relevant to creating theories and models on the issue.

Lastly, there is hope for a positive effect of the increased interconnectedness of military and environmental security. Beckett also emphasized, "Climate change is a threat that can bring us together if we are wise enough to stop it from driving us apart" (Parry, 2007). Cooperation on environmental security can serve as a catalyst for peace and stability according to ecological peace research. It argues that environmental degradation and violence are a two-sided relationship: resource scarcity can lead to conflict, but conflict can also degrade the environment (Conca & Beevers, 2018). By breaking this cycle, the environment becomes a source of peace rather than only a resource to fight over (Conca & Beevers, 2018). This aspect of the relationship between environmental and military security shows hope for both a more environmental and military peace out of necessity.

Gap in Research

There have been attempts to connect different aspects of security but not yet a comprehensive model combining military and national security. Porfiriev (1992) analysed national security as a system of various security dimensions, but his model had a very limited impact. A different direction was chosen by Alt and Eichengreen (1989). In an example of NATO contributions and investment in the prevention of acid rain, they established environmental and military security as inherently linked issues, to which parallel game theory can present new insights. However, Alt and Eichengreen (1989) only touched upon the subject without establishing a full model.

Therefore, there is still a need for a relatively simple comprehensive model combining military and national security. Gellers wrote already in 2010 "The study of environmental security is currently hampered by the absence of a conceptual framework capable of articulating the various linkages and causal explanations that seek to establish a connection between the environment and security". He suggested "a comprehensive conceptual tool or typology capable of simultaneously categorising the source of the threat, the population threatened, the severity of the threat, the importance of the threat, and the causal mechanism linking the environment to the security issue". A slightly different request is made by Gilmore et al. (2018) who wrote that “synthesizing this knowledge into models that can provide predictive information on the onset and evolution of conflicts, as well as decision support on interventions and when to deploy them, would improve the uptake of research by decision-makers.[...] There is also the need for models and frameworks that help practitioners synthesize the academic results” (p.315). While the scope of this paper is too limited to fulfil all these functions, it will attempt to create an initial framework and model as a starting point

to further understand the interconnections and provide guidance based on academic literature and empirical data.

The choice of parallel game theory has been informed by the literature. Parallel game theory is uniquely fitting for its focus on modelling the decisions of common actors interacting across different issues and analysing different types of issue connections. As the interlinked nature between environmental and military security is the core aspect of this paper, parallel game theory is the perfect basis for the model. It has also been found that actors act more strategically when it comes to losses than to possible gains (Morone & Morone, 2016). Considering that national security is centred around the goal of preventing a loss, a game theory model will likely have a good chance of providing explanatory value. Furthermore, parallel game theory can deliver insights into the impacts of trust over different issues. States can either choose trust through sacrificing military security or sacrifice it for military security. As cooperation in the international state of nature is based on trust, this will be another important factor in choosing a parallel game model.

3. Theoretical Framework

Based on ideas from Hobbes and human security, this paper develops a new theoretical framework that is appropriate for the complex interdependent relationship between military and environmental security. Other than previous interpretations of Hobbes' ideas, which have focused more on the competition aspect, this paper will focus on the overall function of states as security providers. As security providers, states must address military security issues and human security issues such as environmental security. This will lead to a reinterpretation of Hobbes' state of nature, able to include the increasingly relevant impact of human action on the environment.

As established before, national security is a major goal of states, but this also involves human security. Human security is not state-centred but recognises aspects of security that individuals would ask for from a legitimate government as in Hobbes's theory. In Hobbes' state of nature, individuals agree on establishing a higher authority, the state, to overcome the state of nature (Armitage, 2006). Therefore, providing security legitimates national governments, while the international level is a source of instability. However, Hobbes also wrote that cooperation in the state of nature is possible when necessary to overcome a bigger common threat (Yurdusev, 2007). Actorless threats such as climate change could present such a necessity and ground for cooperation against common issues. The state can only fulfil its

function to provide security and create legitimacy when addressing all threats including human security aspects. Therefore, the integration of human security in the national security framework fits better with Hobbes' theory than a pure focus on military security.

Interestingly, the concept behind ecological peace also aligns with the author's interpretation of Hobbes' state of nature in the international realm (Conca & Beevers, 2018). While the individual agency in Hobbes' state of nature might suggest a negative outcome for global cooperation on climate change, the common threat originating from environmental degradation can initiate the joining of forces among the states (Kramer, 2020). This interpretation fits also very well with other past international threats such as nuclear weapons or the hole in the ozone layer (McGlinchey, 2017). The idea that states can put aside their differences to focus on common larger threats must be just as important for the new theory and model as the realist struggle for relative power. This reinterpretation of Hobbes' ideas guides the construction of a new theory and model to appropriately represent national security struggles.

4. Research Design and Methodological Justification

The paper follows a deductive approach starting with the combination of existing theories to a new theoretical framework through the translation into a game theory model to the empirical assessment of hypotheses as suggested by Munck (2001). For a more formal methodology, the paper combines game theory and the Empirical Implications of Theoretical Models (EITM) framework. The game theory background allows the development of a simple causal model with a high level of abstraction while the use of EITM increases the external validity (Munck, 2001).

Other methods such as Empirical game-theoretic analysis (EGTA) use data to develop theories. However, starting with data has a risk of finding significant results without an ontological basis. Starting with theory-based models, however, has the advantage of concentrating on relevant aspects of the theory and indicating more subtle impacts that can be generalized for future contexts as well. Or as Granato and Lo wrote, "The reliance on statistically significant results means nothing when the researcher makes little attempt to identify the precise origin of the parameters in question" (p. 5, 2010). This leads to the Empirical Implications of Theoretical Models (EITM) research framework. EITM allows a

higher focus on internal validity aligning with the aim of this research to increase understanding and test the theories but has lower external validity.

The external validity could be improved by the usage of diverse information from different disciplines and perspectives in the theory development. The examples of Ukraine and previous research on the relationship as well as the usage of established theories ensure that there is a wide theoretical and empirical basis for the formulation of the model. This is coherent with Munck's support for using game theory to accumulate knowledge to address the gaps in interdisciplinary research as mentioned by Gilmore et al. (2018).

To combine game theory and EITM, this paper used methodological individualism and positivism as philosophical foundations. Methodological individualism emphasises individual motivations and strategies rather than social factors to explain behaviour (Neck, 2022). Positivism is characterised by observing phenomena through objective means such as empirical data to establish causal relationships (Creswell & Creswell, 2022). Together, these concepts align on the premise that universal, observable truth and deductive reasoning can be used to find rational explanations that can improve the understanding of that (Creswell & Creswell, 2022). Furthermore, positivism's focus on empirical evidence can guide the validation process by emphasising the importance of quantitative data and rigorous testing to support the model's predictions aligning with EITM.

The Use of Game Theory

Game theory is used to analyse the case because it is an established methodology in international relations, military and environmental contexts. Originating in economics, it is a systematic approach to understanding and predicting conflict and cooperation (Tadelis, 2013). Game theory assumes that actors are rational and attempt to maximise their utility while considering the rules of the game (Munck, 2001; Tadelis, 2013). This way equilibria can be identified. Equilibria are stable outcomes that are not always optimal but can explain why an unfavourable outcome occurs (Munck, 2001). Therefore, game theory is "best suited to theory building, the integration of research on different substantive issues, and the cumulation of knowledge." (p. 174; Munck, 2001) while providing a coherent line of argumentation for the model.

According to Munck (2001), it is a common approach to use pre-existing game theory models as inspiration. This approach ensures that all necessary elements of a model are included (Munck, 2001). However, to avoid the common mistake of not sufficiently adjusting a

model to the complexity to uniqueness of the phenomena, the model will use inspirations from several games (Munck, 2001).

Empirical Implications of Theoretical Models (EITM) research framework

This second part of the research method uses the Empirical Implications of Theoretical Models (EITM) research framework to improve the external validity and test the results. EITM combines the benefits of strong theoretical foundations and established causal links with statistical testing using empirical data. It is a formal methodology to test models which includes three steps: “Unify Theoretical Mechanisms and Applied Statistical Concepts”, “Develop Behavioral (Formal) and Applied Statistical Analogues” and “Unify and Evaluate the Analogues” (Granato & Lo, 2010).

The first step is to Unify Theoretical Mechanisms and Applied Statistical Concepts. It has the goal to match theoretical mechanisms with appropriate statistical concepts. Theoretical mechanisms are closely related to the previously constructed game theory model while statistical Concepts can be for example persistence or nominal choice.

The second step in the EITM framework involves developing behavioural (formal) and applied statistical analogues. This means identifying specific, measurable quantities that represent theoretical concepts within the model. The goal is to create a bridge between the theoretical mechanisms and the statistical tools used to analyse them, ensuring that each concept in the model has a corresponding empirical analogue that can be tested and measured.

The final step in the EITM framework is to unify and evaluate the analogues. This involves selecting the appropriate statistical concept and its corresponding analogue to empirically test the theoretical relationship. The goal is to ensure that the chosen statistical tools accurately reflect and test the theoretical mechanisms, allowing for a robust evaluation of the model’s predictions.

Limitations

The research is limited by the scope of the thesis to capture the diversity of factors and interdisciplinary aspects of this thesis, the assumptions made in creating the theory and model, choice and availability of data as well as the limits of the statistical analysis in validity and reliability. Starting with the limitations in scope, this thesis leaves out many commonly discussed factors regarding environmental and military security. These include state form,

asymmetrical interactions and further security dimensions such as those mentioned in the human security framework. Military security in this research is also limited to international conflicts which also excludes the more researched topic of local resource conflicts which is very closely related to the topics studied in this paper. Their exclusion of further dimensions and their complex interactions with the chosen ones might limit the explanatory value of understanding national security decisions fully.

Leaving out factors such as state form could also impact the theoretical value and empirical applicability. Not only increased technological development human control over nature but also over society. Hobbs' theory of the legitimised state might not apply today specifically to states relying on surveillance technology and the control of the information flow. Theories such as the democratic peace theory argue that there are logical reasons, why some state forms are less concerned about their decisions' public support. This would counteract the theoretical framework of the state's dedication to state legitimacy.

The theories used as a foundation for the theoretical framework also rely on the assumption of rational choice. Human behaviour and political decisions are also impacted by cultural, institutional and political influences (Bekkers et. Al., 2017). Still, the experiment of the Traveler's dilemma shows an increased focus on rational strategy in cases of high risks which would be the case for national security decisions (Morone & Morone, 2016). However, the Traveler's dilemma is a manageable situation with clear rules and predictable outcomes. The limited ability and capacity of governments to find the best strategy for national security decisions also limits the explanatory value of this research.

The model created is also limited in its focus on state governments as the sole actors in a symmetric game. In a symmetric game, both actors have the same options, information and payoff. It is known that environmental change has an unequal impact on different states and some states are more prepared to mitigate environmental effects. This is reflected in the choice of data but not in the predicted strategies based on the model and might limit the fit between the prediction and the data.

The model also only includes 2 actors. The number of participants can be a relevant factor in parallel game theory. However, the impact is limited and a switch towards collective action as a framework would complicate the model. Still, this difference between the model and the international political reality limits the explanatory value of the paper.

Another assumption of the model is the availability of information. The difficulty in the choice of data showed the difficulty of this assumption. Information about military capabilities and intentions as well as about compliance with agreements is difficult to collect and validate. There is reason to believe, that the labelling of expenditures can be misleading and Trump's withdrawal from the Paris Agreement in 2020 emphasises the difficulty of judging the international environmental cooperation based on written agreements. Some governments may choose because of military security concerns not to implement the agreements and data on the compliance to the Paris agreement is still in development.

Furthermore, the environmental changes and prediction of threats can only be estimated. There might be a chance that estimations and tipping points are suddenly reached to the surprise of scientists and decision-makers. To include the unattainable knowledge about the impact of environmental change on national security, the use of risk levels to reach a tipping point can be useful.

The choice and availability of data also limit the statistic validation. As the relation between environmental and military security issues has been little researched, the data for the statistical analysis must be sourced from absolute and not relative indicators. This limits the choice of indicators for the focus variable to those reasonably similar enough to be put into relation. Furthermore, the specific information relevant to making the distinctions between the variables is often not available. Some indicators cannot be easily categorised as political effort such as the economic impact of a sustainability transition. For example, the availability of renewable energy can be due to natural geographic advantages or the intentional political effort to invest in renewable energy while data on the potential of renewable energy is also still in development or not available by countries such as the Global Solar Atlas (Resource Watch, 2018). Little diversity and incomplete data could limit the validity and cover more different forms of focus to capture the full impact.

Furthermore, this model is based almost exclusively on Western literature and theories which have a very distinct understanding of state sovereignty and functions. This might limit the significance and the external validity of the findings.

5. Using Game Theory to Turn the Theoretical Framework into a Model

As the research question suggests, parallel game theory will be the basis for the model, but the game of chicken and the brinkmanship game also offer inspiration.

Parallel Game Theory

Parallel games, as defined by Alt and Eichengreen (1989), are defined as two or more strategic interactions of common players, connecting at least two games. The relationship between the players is a common denominator and in inherently liked games, choices and outcomes of these games themselves can also be linked. Therefore, the costs and benefits of several interactions are usually combined into one game that summarises their effects and linkages. This way, parallel game theory can serve as guidance for the government.

In modelling the interdependence of environmental and military security, the topics of the games are Military Threat (M) and Environmental Threat (E) and state governments are the players. States make decisions to minimise the total National Security Threat (N) and fortify the legitimacy of the state according to the theoretical framework. Combining the two dimensions requires the addition of two security threats:

$$N = E + M$$

As explained in the literature review, there is an inherent negative connection between the ability to put effort into military or environmental security, so there needs to be a focus (f). The focus (f) of state effort can be divided among the dimensions of security. Focus symbolises the importance and priority given to the issue reflected for example in policy orientation, budget allocation or time spent in debate. Therefore, there is a focus on Military Security (f_M) and a focus on Environmental Security (f_E). In total, the focus should be 100%. Considering there are only 2 dimensions tested in this paper, the focus can be formulated as follows:

$$f_M = 1 - f_E$$

A higher focus on a dimension should lead to a lower current threat level. It will be included as a variable in the equations for Military Security Threat (M) and Environmental Security Threat (E):

$$E = -f_E$$
$$M = -f_M$$

For the sake of readability, and since f_M is mathematically not needed, this paper will write f_E as f:

$$M = -f_M$$
$$M = -(1 - f_E)$$

$$M = -(1 - f)$$
$$E = -f$$

To create possible positive and negative impacts of the focus, the deviation from an even focus on the two issues will be taken instead of the pure negative impact of focus.

$$E(f) = 0.5 - f$$

$$M(f) = 0.5 - (1 - f)$$

Furthermore, parallel games can have externalities. All states can benefit from one state's environmental focus and lose from one state's military focus. To further investigate this aspect of the interdependence of environmental and military security, the model will take inspiration from the game of chicken.

Game of Chicken

The game of chicken is one example of a game theory model that has also been widely used to explain the tragedy of the commons. As explained by Ristić and Madani (2019), it encompasses two players who are pictured as two car drivers on a collision course. Each player can hope the other will swerve to avoid a crash where both would have a high cost symbolised as -1000 in Table 1. The best absolute and relative outcome for both would be to go straight while the other one swerves so they can call the other driver a 'chicken'. This benefits and ridicule is reflected as a gain of 1 for the straight driver and a loss of 1 for the driver who swerved. If both players swerve, there is no gain or loss on either side. If the players focus only on absolute outcomes, they will likely shy away from the high costs of a possibility, but if the players focus only on relative gains, they have a dominant strategy not to swerve to secure higher gains than the other.

Game of Chicken	Swerve	Straight
Swerve	0/0	-1/+1
Straight	+1/-1	-1000/-1000

Table 1: Game of Chicken

The impact on the driver's gain by the other driver is an externality. To consider the impact of externalities in the equations, there needs to be a distinction between the player choices. For the paper, this is the Environmental Focus of countries a and b:

f_a: Environmental Focus of State a
f_b: Environmental Focus of State b

$$E_a(f_a) = 0.5 - f_a$$

$$M_a(f_a) = 0.5 - (1 - f_a)$$

$$E_b(f_b) = 0.5 - f_b$$

$$M_b(f_b) = 0.5 - (1 - f_b)$$

The goal of environmental security is related to the goal of avoiding a crash that both parties would like to prevent. The goal of military security is related to the goal of relative gains that the parties can try to gain if the other actor cooperates. However, while a crash can be avoided with one player only acting, environmental security can only be reached with global climate action. Therefore, an increase in prioritisation of absolute gains, will not eliminate all possible costs while the relative gains remain unchanged. This leads to the following model:

Environmental Focus (Absolute Benefits)	Max.	Min.
Max.	0/0	-501/-449
Min.	-499/ -501	-1000/-1000

Table 2: Environmental Focus (Absolute Benefits)

As before, the choice of maximal Environmental Focus for both will lead to no costs or benefits for either player, and minimal Environmental Focus for both will lead to the equivalent of a crash. However, one actor choosing minimum focus and one actor choosing maximum focus leads to half of the maximum possible damage of -500 each. This will be combined with the

relative benefits and losses of the original chicken game. Following the changes, in this version of the game, state governments have a dominant strategy to choose an Environmental Focus if they care about absolute gains (Table 2). In Table 3 you see that the relative payoff of the player with -499 is +2 because they have 2 less costs than the other player. If the players care about relative gains their choice would always be to minimise their Environmental Focus to have a higher payoff.

Military Focus (Relative Benefits)	Max.	Min.
Max.	0/0	-2/ +2
Min.	+2/-2	0/0

Table 3: Military Focus (Relative Benefits)

In the adjusted game of chicken, externalities are positive for environmental security and negative for military security. Any gain in military security for one state decreases military security for the other and both players can contribute positively to the common environmental security. This can be reflected in the model with the following equations:

$$E_a(f_a) = 0.5 - f_a + 0.5 - f_b$$

$$M_a(f_a) = 0.5 - (1 - f_a) - 0.5 + (1 - f_b)$$

$$E_b(f_b) = 0.5 - f_b + 0.5 - f_a$$

$$M_b(f_b) = 0.5 - (1 - f_b) - 0.5 + (1 - f_a)$$

As a common threat, $E_a(f_a)$ equals $E_b(f_b)$.

$$E_a(f_a) = E_b(f_b) = 1 - f_a - f_b$$
$$M_a(f_a) = -(1 - f_a) + (1 - f_b)$$
$$M_b(f_b) = -(1 - f_b) + (1 - f_a)$$

$$M_a(f_a) = f_a - f_b$$
$$M_b(f_b) = f_b - f_a$$

One aspect that is still undefined is the meaning of the total value of M, E and N. For this, the Brinkmanship game will offer ideas.

Brinkmanship Game

The brinkmanship game as explained by Haun and O'Hara (2022), investigates situations in which players try to benefit from free-riding while deliberately accepting increasing risks. The players have consecutive turns choosing between ending the game with a lower payoff than the other or taking a risk to receive nothing (Figure 3). With each turn, the payoff becomes more even, and higher for the choosing player, while the risk of receiving nothing increases. The game ends when a player chooses the lower payoff, or the risk has been realised. This way, the brinkmanship game adds uncertainty as a variable and combines the threat of total loss with relative gains in realism.

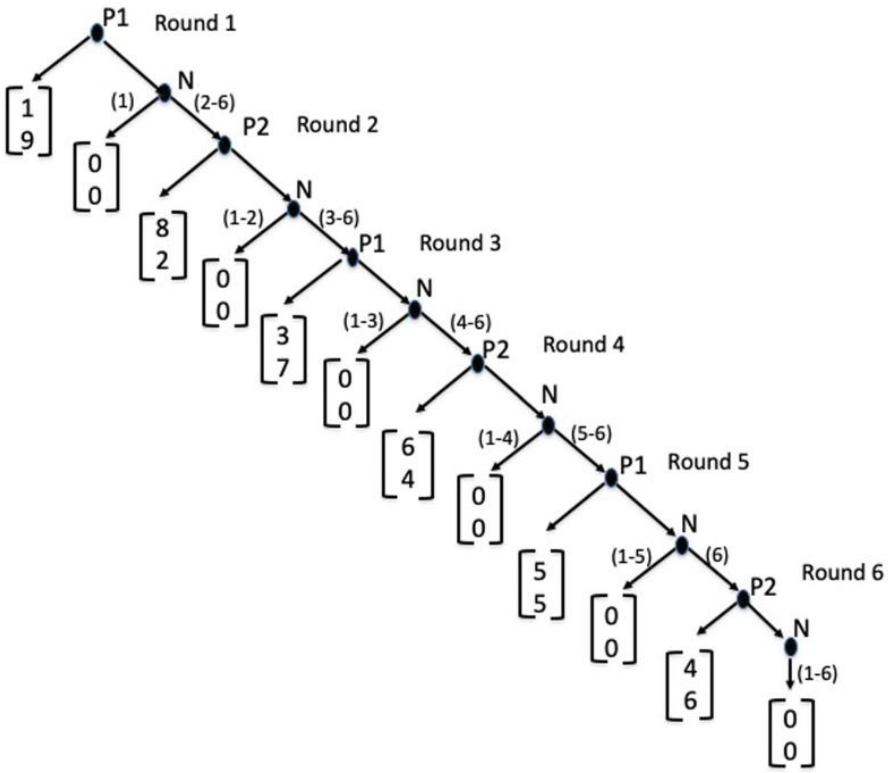


Figure 3: Example of a Brinkmanship Game (Haun & O'Hara, 2022)

The model for national security can take inspiration from the Brinkmanship game in aspects of time, payoff and defining the relationship between military or environmental security. The brinkmanship game addresses increasing risk for loss over time like the crash in the game of chicken or the environmental thread of the case. The risk of creating irreversible environmental

damage increases over time of focus on military security threats when environmental security threats such as greenhouse gases and plastic pollution accumulate. This can be incorporated by adding a timeline that allows for changes in the current level of threat.

E_0: Current Level of Environmental Threat
E_1: Expected Level of Environmental Threat

$$E_{a1}(f_a) = E_{b1}(f_b) = E_0 + 1 - f_a - f_b$$

M_0: Current Level of Military Threat
M_1: Expected level of Military Threat

$$M_{a1}(f_a) = M_{a0} + f_a - f_b$$
$$M_{b1}(f_b) = M_{b0} + f_b - f_a$$

Furthermore, the total level of threat is not necessarily a prediction but a level of risk. Coherent with the theoretical framework, neglecting one of the security dimensions does not lead to immediate consequences but rather an increase in the risk for the state to fail at providing security. By defining current levels of threat as risks, the national security threat level can be written as the sum of environmental and military risks:

$$N(f) = E + M - E * M$$

The Final Model

f_M: Focus on Military Security
f_E: Focus on Environmental Security

$$f = f_M = 1 - f_E$$

f_a: Environmental Focus of State a
f_b: Environmental Focus of State b

M: Military Security Threat

$0 < M < 1$

M_0: Current Level of Military Threat
M_1: Expected Level of Military Threat

$$M_{a1}(f_a) = M_{a0} + f_a - f_b$$
$$M_{b1}(f_b) = M_{b0} + f_b - f_a$$

E: Environmental Security Threat

$0 < E < 1$

E_0: Current Level of Environmental Threat
E_1: Expected Level of Environmental Threat

$$E_{a1}(f_a) = E_{b1}(f_b) = E_0 + 1 - f_a - f_b$$

N: National Security Threat

$$0 < N < 1$$

$$N(f) = E + M - E * M$$

6. Operationalisation of the Concepts for the Model

For the empirical validation of the model, all variables of the model need to be operationalised. The model uses variables for the concepts of Environmental security threat (E), Military security threat (M), National security threat (N) and focus (f). Furthermore, the environmental security threat (E) and the Military security threat (M) change over time. However, only E_0, M_0 and f and relevant indicators, as N, E_1 and M_1 are dependent on E_0, M_0 and f, and only have a theoretical value that cannot be observed or measured. The operationalisation of E_0, M_0 and f however, should provide further clarification on the meaning and the reasoning behind their concepts and possible indicators.

Dependent Variable

The model created on the interconnection between military and environmental security decisions is supposed to predict the focus (f) of national security efforts. It should reflect the allocation of resources, budget, time in debate and effectiveness and coherency of policies. However, the focus is not directly measurable through an established indicator and the data is limited to those indicators that are reasonably similar enough to be put into relation.

Two indicators that will be combined are the 'Environmental Performance Index' and the 'Global Militarisation Dataset'. The 'Environmental Performance Index' shows how well governments have been doing over time, on environmental security, including aspects independent of destruction of industry or local environmental destruction through war (Yale Center for Environmental Law & Policy, 2010, 2012, 2014, 2016, 2018). The 'Global Militarisation Dataset' is a comprehensive indicator of active military capabilities. The successful accumulation of military capacity can be seen as a substitute to measure actual military security performance outside of active conflict. The militarisation data set reflects among others the size and equipment of the military as well as military expenditure (Bayer & Hauk, 2023). Together, they will measure the state's efforts in relative performance.

Secondly, the budget allocated to environmental protection, or the military provides an alternative indicator with higher similarity. The budget allocated to environmental protection can be found in the data of the IMF (2022), while the military budget can be found in the data of the World Bank (2024). Together, they will measure the state's efforts in relative budget.

Independent Variables

The independent variables of the model are the Environmental Security Threat (E) and the Military Security Threat (M). For the Environmental Security Threat, the 'Global Climate Physical Risk Index' (GCPRI) (Guo et al., 2024) and the IMF dataset (2024b) on 'Annual Surface Temperature Change' can reflect the increasing Environmental Threat from climate change. The 'Annual Surface Temperature Change' data also provides information about the 'World Surface Temperature Change' which can indicate the more global systematic level of Environmental Threat, that specifically is a common threat to all states. All can be analysed in their impact on the focus.

The military security threat level is indicated by information on war activity over time, the share of the world GDP and the military spending of other countries through the world military budget as % of the world GDP. GDP is often used as a measure of power as it is

related to economic power but also a skilled labour force and modern equipment (Viotti & Kauppi, 2009). The relative power measured in a state's share of the world GDP should indicate the level of military threat according to theory. The data is available by the IMF (2024a). Data on war activity over time is provided by the Uppsala Conflict Data Program (UCDP) (Davies et al., 2024) and the data on military budget is provided by the World Bank (2024a). Again, as the data on the military budget includes average data for the world and as military security is a relative concept, it will also be used as an additional indicator.

Control Variable:

To control for alternative impacts, the statistical analysis will use 'GDP per Capita'. While the share of the world GDP is an independent variable, 'GDP per Capita' also proved to be one of the main predictors of the Environmental Performance Index. For this research, the total effort might be influenced by the GDP making it easier to mitigate environmental threats, but the relative focus should be independent of the 'GDP per Capita'. Therefore, 'GDP per Capita' should be used as a control variable (IMF, 2024b).

7. The EITM Framework

There are two mechanisms of the model: decision-making and dynamic change over time. For decision-making over time, the applied statistical concept of the focus (f) is the choice of a continuous variable. Furthermore, for the behavioural analogue, decision-making is related to utility maximisation and more specifically for this context: minimisation of the national security threat. The statistical analogue is regression analysis. This statistical method can model the relationship between the dependent variable f and the independent variables E_0 and M_0 to estimate how changes in these factors affect decision-making. Therefore, the method chosen is straightforward regression analysis.

The second mechanism would be dynamic change over time which could be matched with the applied statistical concept of persistence. For step 2, the behavioural analogue is a dynamic adjustment as states will adapt their strategies when E_0 and M_0 change and E_0 and M_0 change as they are influenced by past values of f. Fitting applied statistical analogues for this are a Time-Series Analysis and Autoregressive (AR) Models. They can analyse the temporal dynamics of the model, ensuring that the ongoing impact of decisions is appropriately reflected. However, this research is only an initial attempt at applying parallel game theory to the relationship between environmental and military security decisions. Therefore, the regression analysis will take full focus for now.

8. Multiple Regression Analysis

Several independent variables are relevant, the research will follow a multiple regression analysis. For this purpose, the relationship between independent and dependent variables will be clarified with the regression model. Furthermore, as the focus is not directly measurable through an established indicator, some variables will be combined. Then, the data is tested on statistical assumptions and compared to the parallel game theory model.

Formulating the Regression Model:

To formulate the regression model, the dependent variable f needs to be separated. f is dependent on the strategy to reach the minimum national security threat (N). Therefore, the calculation of the minimum level of N and the rearrangement of the equation to solve for f is the first step.

$$M_{a1}(f_a) = M_{a0} + f_a - f_b$$
$$M_{b1}(f_b) = M_{b0} + f_b - f_a$$

$$E_{a1}(f_a) = E_{b1}(f_b) = E_0 + 1 - f_a - f_b$$

$$N_a(f_a) = E_1 + M_{a1} - E_1 * M_{a1}$$
$$N_b(f_b) = E_1 + M_{b1} - E_1 * M_{b1}$$

Condition for an extreme: $N_a{}'(f_a) = 0$

$$N_a{}'(f_a) = E_1{}'(f_a) + M_{a1}{}'(f_a) - E_1(f_a) * M_{a1}{}'(f_a) - E_1{}'(f_a) * M_{a1}(f_a)$$

Computing the derivative:

$$E_{a1}(f_a) = E_0 + 1 - f_a - f_b$$
$$E_{a1}{}'(f_a) = -1$$

$$M_{a1}(f_a) = M_{a0} + f_a - f_b$$
$$M_{a1}{}'(f_a) = 1$$

$$N_a{}'(f_a) = -1 + 1 - (E_0 + 1 - f_a - f_b) + (M_{a0} + f_a - f_b)$$
$$N_a{}'(f_a) = -E_0 - 1 + f_a + f_b + M_{a0} + f_a - f_b$$
$$N_a{}'(f_a) = -E_0 - 1 + 2f_a + M_{a0}$$

Calculating the extreme points: $N_a'(f_a) = 0$

$$0 = -E_0 - 1 + 2f_a + M_{a0}$$
$$E_0 - M_{a0} + 1 = 2f_a$$
$$(E_0 - M_{a0} + 1)/2 = f_a$$

E_a and E_b, f_a and f_b, M_{b0} and M_{a0}, and N_a and N_b have the same values in a symmetric game. Therefore, the only dependent variable is f and E_0 and M_0 are the only independent variables. The regression model is:

$$f = (E_0 - M_0 + 1)/2$$

To formulate the final model, the error term ϵ is added.

$$f = (E_0 - M_0 + 1)/2 + \epsilon$$

Preparing the Data

There are 2 variables to be constructed as there are two versions determined to measure the focus: performance and budget. To combine military and Environmental Focus in one variable, when Environmental Focus is supposed to be the independent variable, the focus is the share of the combined effort. Effort in this case is measured either indirectly through performance or budget. The Environmental Focus based on environmental and military efforts can be represented by the following equation:

e_E= Environmental Effort
e_M= Military Effort

$$f_E = \frac{e_E}{e_M + e_E}$$

Before the calculation of the difference in performance, the GMI is divided by 5 to match the scale of the EPI. The new focus variables are calculated with the following equations:

$$EnvironmentalFocusPerformance = \frac{EPI}{EPI + \frac{GMI}{5}}$$

$$EnvironmentalFocusBudget = \frac{Expenditureonenvironmentprotection PercentofGDP}{Expenditureonenvironmentprotection PercentofGDP + MilitaryexpenditureofGDP}$$

Testing Assumptions for the Multiple Linear Regression

To ensure the validity and reliability of the multiple linear regression analysis, the data will be tested for the following characteristics:

- Linearity
- Independence
- Multivariate Normality
- Multicollinearity
- Homoscedasticity
- Normality of Residuals
- Influential Outliers

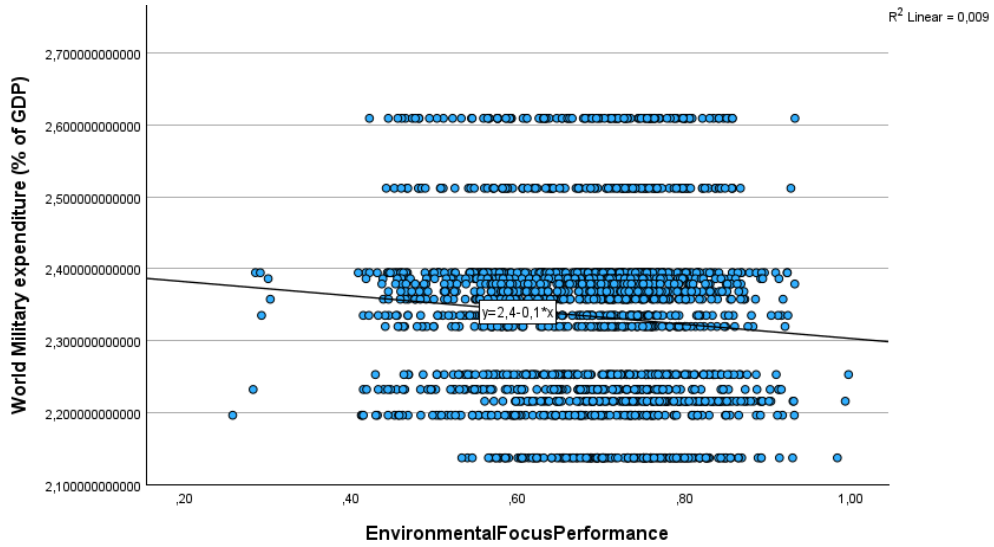
For the sake of clarity in the text, additional graphs will be shown in the appendix. Furthermore, the data includes 2 dichotomous variables which naturally cannot be tested for some assumptions.

1. Linearity:

Relationships of the independent variables to the environmental focus measured in performance are linear for:

- 'Global Climate Physical Risk Index'
- 'Surface Temperature Change'
- 'World Surface Temperature Change'

While other indicators don't form a line such as GDP per capita or GDP Share of the World, the 'World Military Expenditure' might show a pattern which is very difficult to recognise due to the limited variety in years as can be seen in Graph 1. Further use of this variable should be taken with caution.

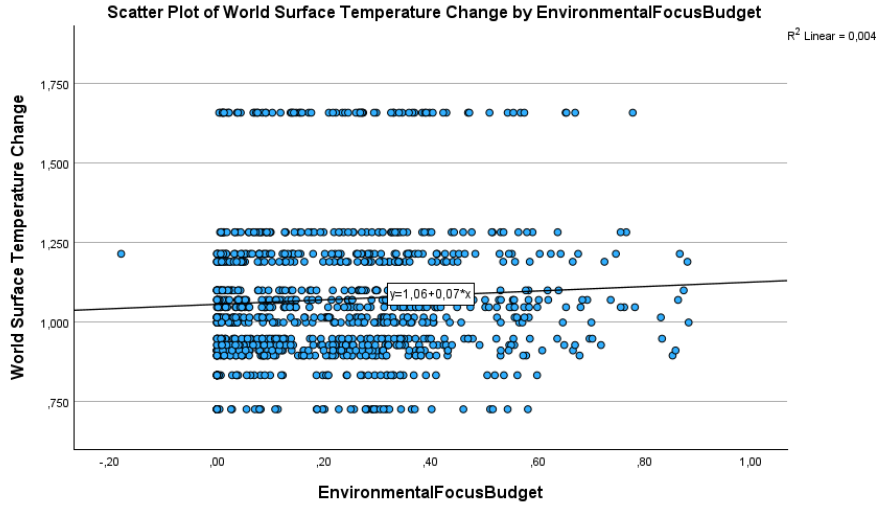


Graph 1: Scatterplot of the ‘World Military Expenditure (% of GDP)’ and the Environmental Focus measured in Performance

Relationships of the independent variables to the Environmental Focus measured in the Budget are linear for:

- ‘Global Climate Physical Risk Index’
- ‘Surface Temperature Change’

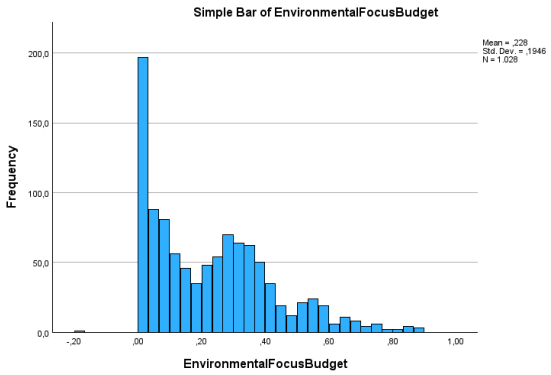
Again, the ‘GDP per Capita’ or ‘GDP Share of the World’ did not show a linear relationship but this time the ‘World Military Expenditure’ didn’t indicate a line either while the line for the world surface temperature is also less clear as can be seen in Graph 2. ‘World Military Expenditure’ and ‘World Surface Temperature Change’ will be taken with caution while ‘GDP per Capita’ and ‘GDP Share of the World’ will be excluded from further analysis.



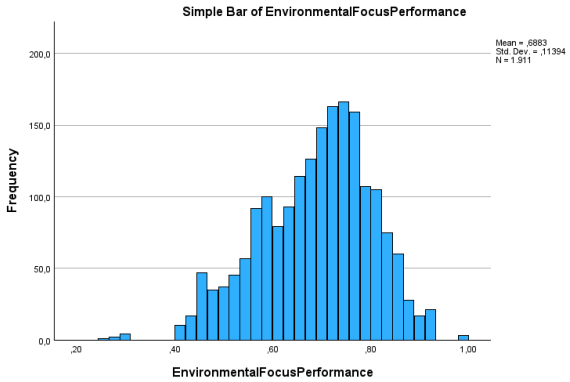
Graph 2: Scatterplot of ‘World Surface Temperature Change’ and Environmental Focus Measured in Budget

2. Independence:

It is important to analyse whether the data points are indeed independent of each other and do not show any pattern. Much of the data was missing especially for the expenditure on environmental protection with 1359 missing values. A few hundred values were also missing for the EPI, GMI and military expenditure. A common reason for missing values could be a lack of interest or capacity to provide the data by the respective state governments. This could indicate less focus on the area which has missing values. As more data is missing in the environmentally related indicators, it could be a pattern of missing variables for countries focusing on military security. Focus on military security also relates to a less cooperative attitude in sharing information which could amplify the problem. However, the Environmental Focus measured in budget shows a majority of more military-focused cases as can be seen in Graph 3. This does not count for the Environmental Focus measured in performance (Graph 4). However, since most data is missing for the budget which shows mostly military-focused cases, it is reasonable to assume that the cases are independent of each other.



Graph 3: Histogram Environmental Focus Measured in Budget

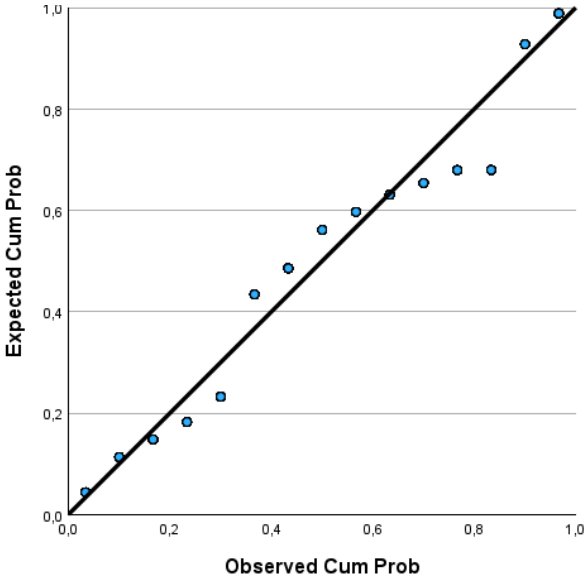


Graph 4: Histogram Environmental Focus Measured in Performance

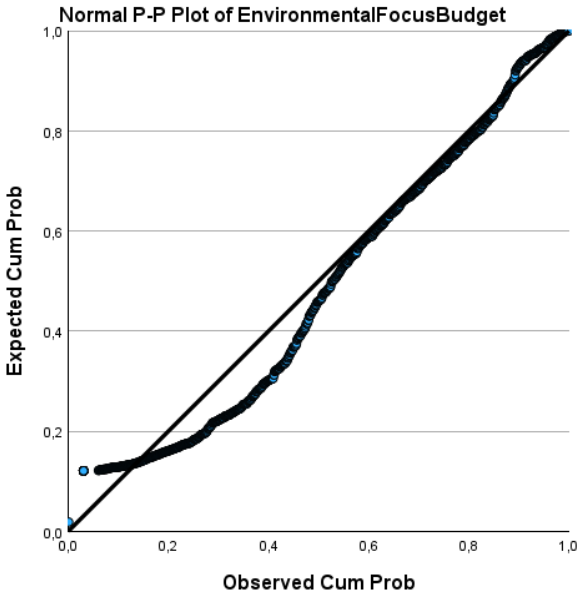
The data was not checked for a pattern by years, as the years have the same values for world military budget and world surface temperature. This leads to a general impact of the year as the environmental threat increases and the same variables impact all cases per year.

3. Multivariate Normality

To test the distribution of the residuals PP plots have been generated. The plots show an almost diagonal line for the Environmental Focus measured in performance, ‘World Surface Temperature Change’, the ‘Global Climate Risk Index’ and the ‘Surface Temperature Change’. Furthermore, the ‘World Military Expenditure’ and the Environmental Focus measured in budget could still be used if caution is given to the significance of the results as they still follow an almost diagonal line (Graph 5 and 6).



Graph 5: P-P Plot of World Military Expenditure (% of GDP)



Graph 6: P-P Plot of Environmental Focus Measured in Budget

4. Multicollinearity

To avoid high levels of intercorrelation of the independent variables, the Variance Inflation Factor (VIF) has been calculated. As Table 4 and 5 show, none of the VIF values is much higher than 1 neither for the Environmental Focus measured in budget nor performance. This means all variables have independent values in predicting the Environmental Focus.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	,745	,055		13,643	<,001		
	World Surface Temperature Change	,112	,012	,232	9,365	<,001	,837	1,195
	Global Climate Physical Risk Index (GCPRI)	-,002	,000	-,141	-6,107	<,001	,960	1,042
	Surface Temperature Change	-,011	,005	-,056	-2,287	,022	,862	1,160
	World Military expenditure (% of GDP)	-,054	,022	-,059	-2,489	,013	,908	1,101
	Directly in conflict	-,062	,018	-,080	-3,505	<,001	,991	1,009
	Supporting a conflict	-,102	,021	-,110	-4,806	<,001	,982	1,018

a. Dependent Variable: EnvironmentalFocusPerformance

Table 4: Analysis of the Variance Inflation Factor (VIF) for the Environmental Focus Measured in Performance

Coefficients[a]

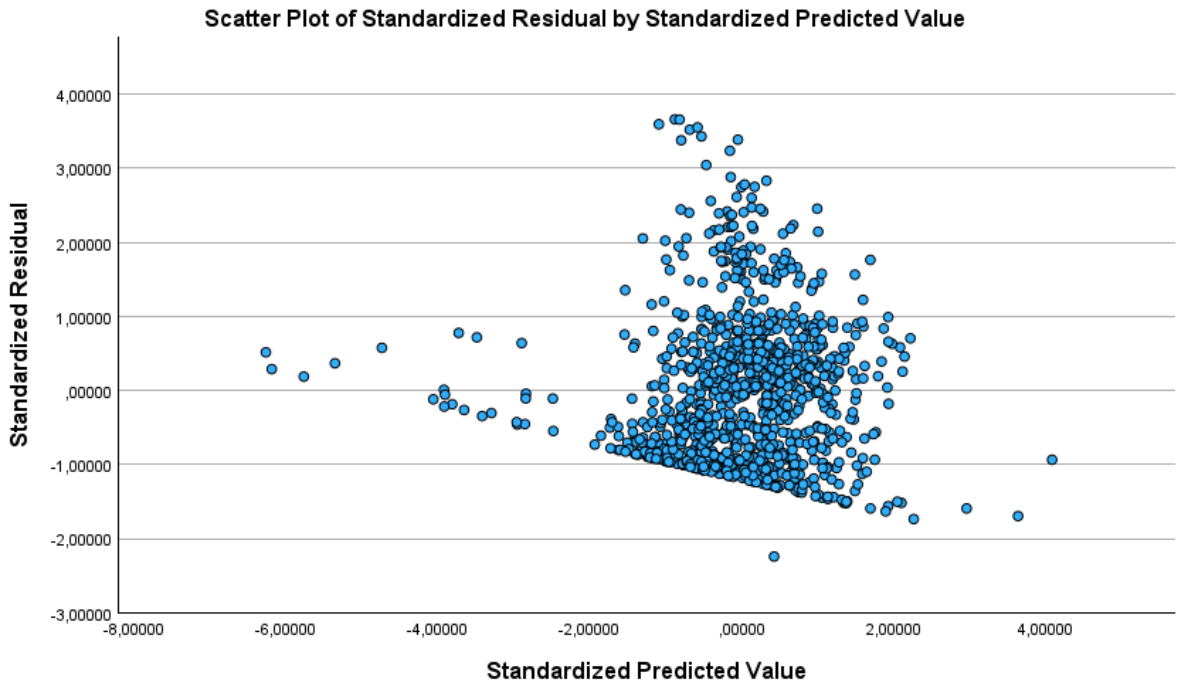
Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	,023	,138		,164	,870		
	World Surface Temperature Change	,019	,030	,021	,617	,537	,859	1,165
	Global Climate Physical Risk Index (GCPRI)	,003	,001	,117	3,669	<,001	,968	1,034
	Surface Temperature Change	,042	,011	,129	3,852	<,001	,877	1,141
	World Military expenditure (% of GDP)	,036	,054	,022	,664	,507	,876	1,142
	Directly in conflict	-,147	,055	-,083	-2,658	,008	,995	1,005
	Supporting a conflict	-,209	,055	-,119	-3,769	<,001	,988	1,012

a. Dependent Variable: EnvironmentalFocusBudget

Table 5: Analysis of the Variance Inflation Factor (VIF) for the Environmental Focus Measured in Budget

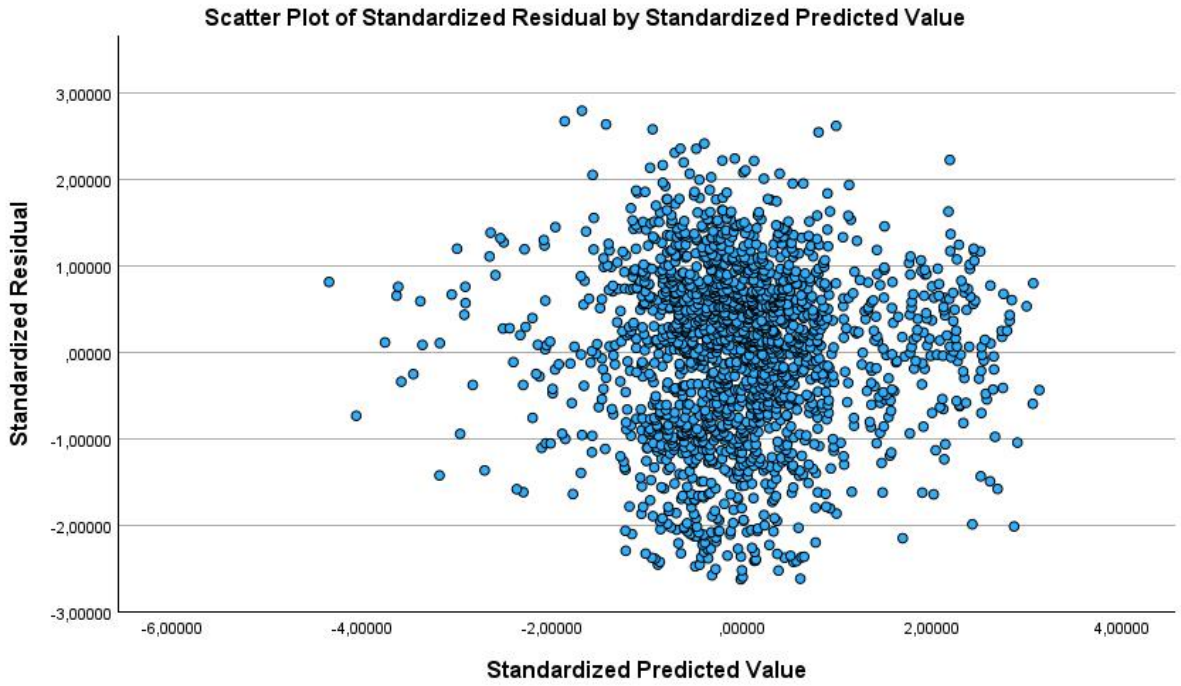
5. Homoscedacity

To test whether the residuals of the regression models are independent, they are plotted against the predicted values. The scatterplot for the budget-related focus (Graph 7), shows a clear non-random distribution. Together with the earlier doubts about the validity and reliability of the Environmental Focus measured in budget variable, it is reasonable to withdraw the variable from further analysis.



Graph 7: Scatterplot of the Standardized Residual and Standardized Predicted Value of the environmental focus measured in budget

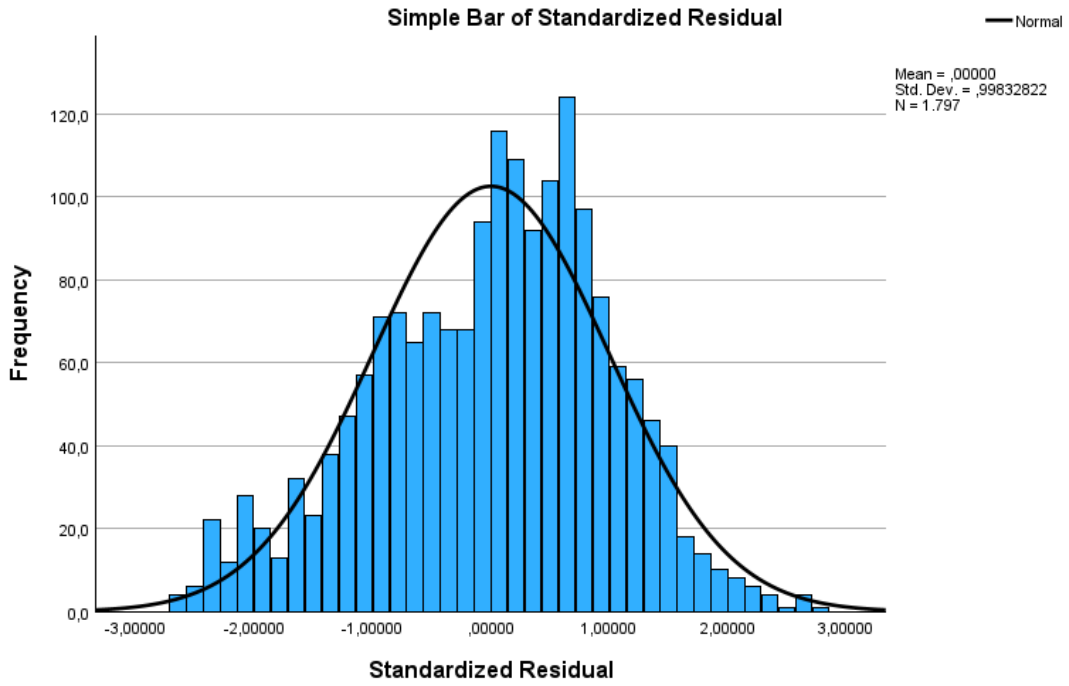
For the performance-related focus, the scatterplot shows an almost random pattern (Graph 8). This variable will still be useful for further analysis.



Graph 8: Scatterplot of the Standardized Residual and Standardized Predicted Value of the Environmental Focus Measured in Performance

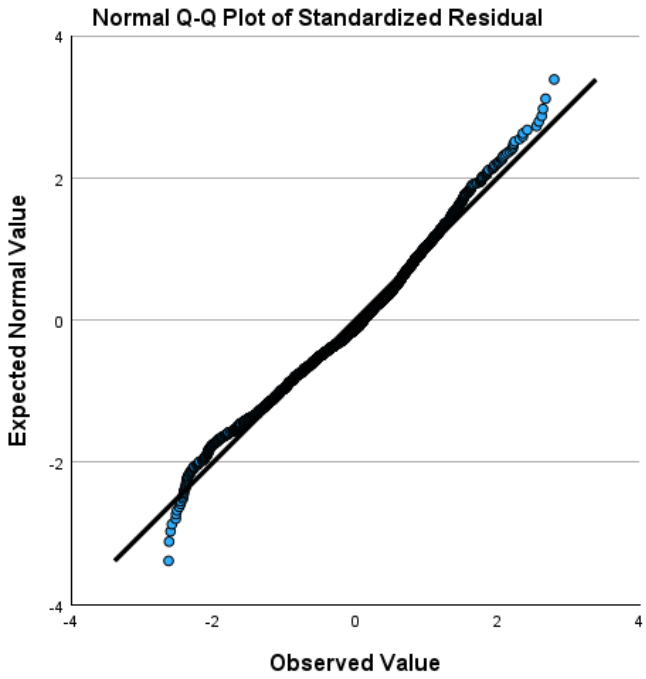
6. Normality of Residuals

To check the normality of the residuals, a histogram of the standardized residuals has been used. It shows a distribution close to normality but with a little step on the left of zero (Figure …). For further information, a Q-Q plot has been formed.



Graph 9: Histogram of the Standardised Residual

The Q-Q plot shows a very diagonal line with an exception for the extreme cases. Still, the regression model should provide value for most variables.



Graph 10: Q-Q Plot of the Standardised Residual

7. Influential Outliers

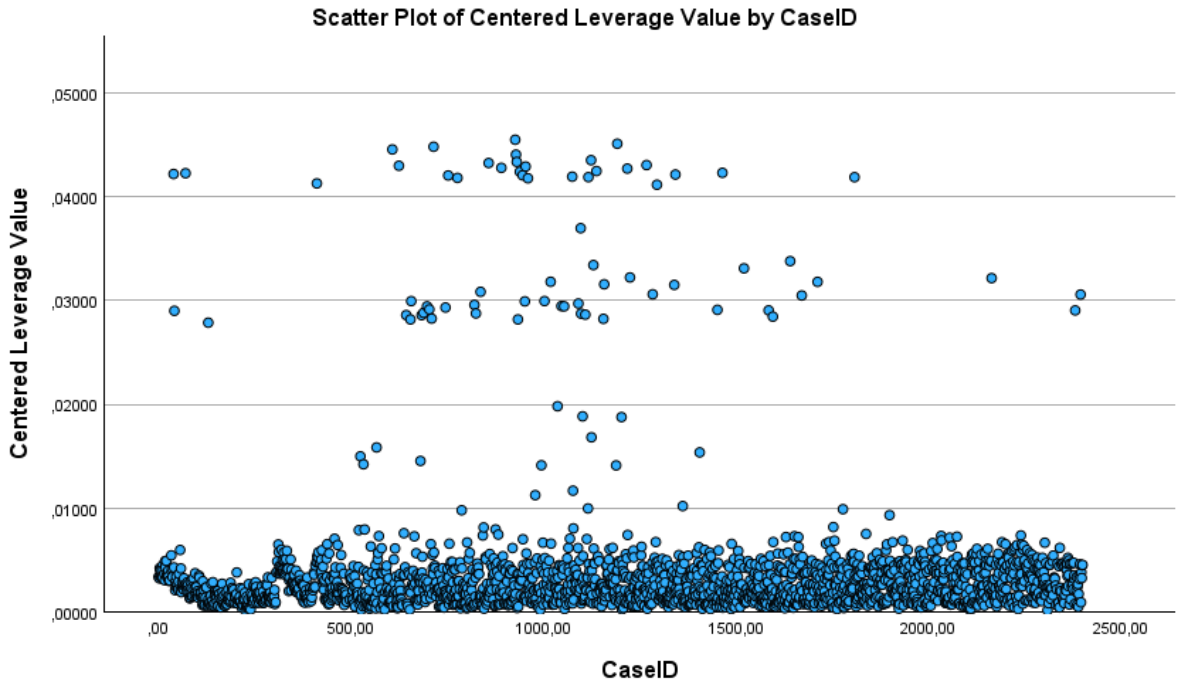
Especially since further from the normal distribution are the extreme cases, it is important to check for the influence of outliers. For this purpose, the centred leverage Value and Cook's Distance have been used (Table 6). Higher values than 4/n for Cook's Distance and 2p/n for the Cenred Leverage Value have been found for both. Looking at these, it becomes clear, that most of them are countries in conflict or supporting a state in conflict. This is even more clear for cases of high Cenred Leverage Value as the scatterplot of the centred leverage value shows 2 distinct lines fitting to the number of dummy variables (Graph 11). As the number of cases involved in a conflict is low, these outliers should therefore not be taken out, as they offer important information.

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	,5572	,7899	,6924	,03112	1797
Std. Predicted Value	-4,344	3,133	,000	1,000	1797
Standard Error of Predicted Value	,003	,022	,006	,003	1797
Adjusted Predicted Value	,5539	,7902	,6924	,03114	1797
Residual	-,27386	,29173	,00000	,10409	1797
Std. Residual	-2,627	2,798	,000	,998	1797
Stud. Residual	-2,628	2,842	,000	1,000	1797
Deleted Residual	-,27419	,30106	,00001	,10444	1797
Stud. Deleted Residual	-2,633	2,848	,000	1,000	1797
Mahal. Distance	,113	81,580	5,997	11,485	1797
Cook's Distance	,000	,037	,000	,001	1797
Centered Leverage Value	,000	,045	,003	,006	1797

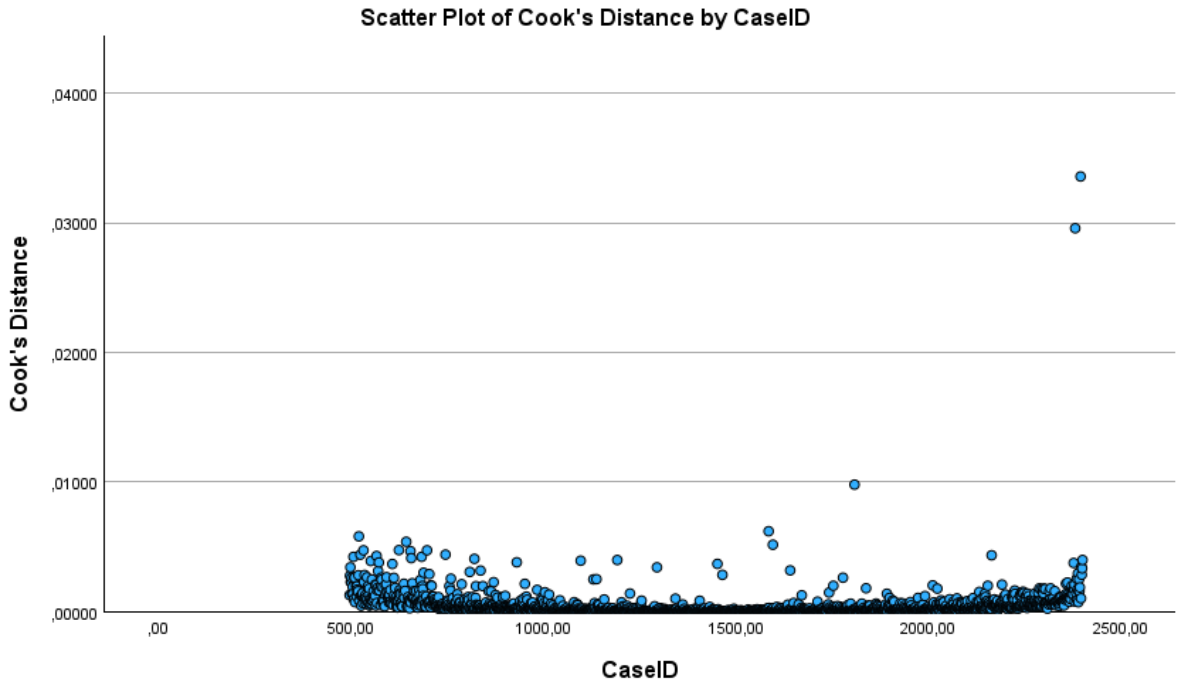
a. Dependent Variable: EnvironmentalFocusPerformance

Table 5: Cook's Distance and Cenred Leverage Value



Graph 11: Scatterplot of the Centred Leverage Value and Case ID

As Cook's distance is showing more distinct outliers (Graph 12), a second analysis will be done without these.



Graph 12: Scatterplot of the Cook's Distance and Case ID

To compare the regression model with and without the cases with a high Cook's distance, here are the two results:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	,731	,054		13,430	<,001
	Global Climate Physical Risk Index (GCPRI)	-,002	,000	-,139	-6,000	<,001
	Surface Temperature Change	-,009	,005	-,047	-1,930	,054
	World Surface Temperature Change	,114	,012	,237	9,557	<,001
	World Military expenditure (% of GDP)	-,050	,022	-,055	-2,313	,021
	Directly in conflict	-,099	,019	-,116	-5,096	<,001
	Supporting a conflict	-,105	,022	-,109	-4,762	<,001

a. Dependent Variable: EnvironmentalFocusPerformance

Table 6: Regression Model Without Outliers

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	,745	,055		13,643	<,001		
	World Surface Temperature Change	,112	,012	,232	9,365	<,001	,837	1,195
	Global Climate Physical Risk Index (GCPRI)	-,002	,000	-,141	-6,107	<,001	,960	1,042
	Surface Temperature Change	-,011	,005	-,056	-2,287	,022	,862	1,160
	World Military expenditure (% of GDP)	-,054	,022	-,059	-2,489	,013	,908	1,101
	Directly in conflict	-,062	,018	-,080	-3,505	<,001	,991	1,009
	Supporting a conflict	-,102	,021	-,110	-4,806	<,001	,982	1,018

a. Dependent Variable: EnvironmentalFocusPerformance

Table 7: Regression Model with all Data

With changes, the significance of the ‘Surface Temperature Change’ decreases just as the ‘World Military Expenditure’. However, it does not increase the significance of other values. The fact, that the outliers have mostly been related to conflict together with the fact, that no other effect is masked suggests keeping the cases included.

9. Results

The results of the statistical analysis can be used to falsify the theoretical model and underlying theory. For this purpose, the paper will look at the significance of the variables used in the analysis, the direction of their impact and the overlap of the relationships with the model in their specifics. Finally, the context and results of unused variables will be put in perspective.

The final regression model shows significant relationships for all used variables. Following the usual significance level in political science of 5%, the ‘World Surface Temperature Change’, the ‘Global Climate Physical Risk Index’, the ‘Surface Temperature Change’, the ‘World Military Expenditure’, and the dummy variables ‘Directly in Conflict’ and ‘Supporting a Conflict’ are significant. However, other than the ‘World Military Expenditure’ and the ‘Surface Temperature Change’ variable, the significance is even higher showing a high support of the results based on the data. It is interesting, that the significance of the state’s ‘Surface Temperature Change’ by state is lower than for the ‘World Surface Temperature Change’. This might be due to the high variance of ‘Surface Temperature Change’ while the ‘World Surface Temperature Change’ shows a more consistent increase indicating a threat and the necessity to increase Environmental Focus. Especially more ambitious environmental projects need longer to be implemented and cannot adjust to frequent local temperature changes. The significance of the ‘World Military Expenditure’ is lower but also may indicate the impact of changing alliances which make additional military expenditures for states less necessary if they are part of NATO as given in the example of Alt and Eichengreen (1989). This could contradict the realist assumption, that international organisations have no impact which has also been taken over, as the model only looks at states as actors in the international sphere. However, it also could show an alternative to the military security focus. The membership in an international military organisation in combination with lower military spending shows a departure from the military focus as the states must trust that other states will not attempt to attack them. This is included in the model as trust is also a factor in the decision for a security focus and aligns with the theoretical framework in its collaborative focus on bigger threats allowing further environmental effort. Trust would be undermined when used to gain power and military security goals. Overall, the significance of the variable shows the relevance of the subject, as it indicates real explanatory value and can be worth further analysis.

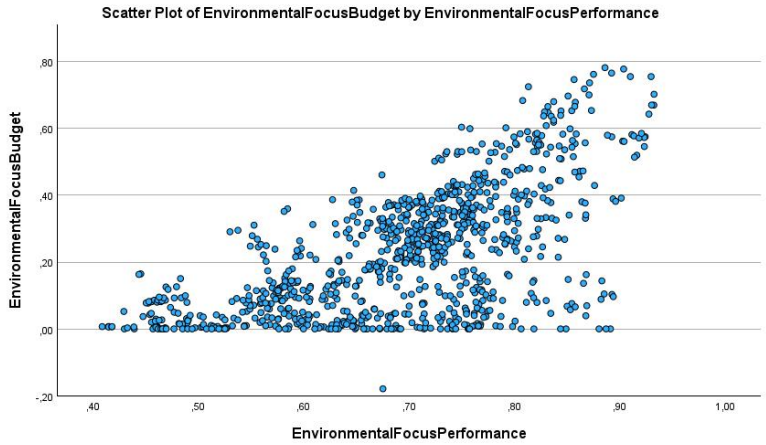
Looking at the direction of the impacts of the variables reveals some interesting relationships. Originally, ‘World Surface Temperature Change’, ‘Global Climate Physical Risk Index’ and ‘Surface Temperature Change’ have been used as variables to reflect the environmental threat level. These were expected to have a positive relation with the Environmental Focus variable. However, only the ‘World Surface Temperature Change’ does. This could hint at 2 insights: only international common risks are leading to an increased Environmental Focus, or the locally realised risks lead to further intrastate conflict as often researched under the term threat multiplier. The first aspect aligns with the, that states shy away from focusing more on the environment than other states in fear of losing military security. The individual impact of the global common security threat might be different but

does not lead to different Environmental Focuses because the other states would benefit from this. However, the global common security threat of the global temperature could lead to cooperation instead as predicted by the theory and model. The second aspect aligns with the ecological peace theory in the link between environmental and military threats. Local challenges such as a higher risk of environmental threat could lead to further local conflict if the circle of environmental damage and conflict Is not broken. However, it indicates that this is not often the case and reduces hopes that environmental risk would mostly lead to cooperation. The other variables show significant relationships according to the prediction of the model and support the validity of the theory behind it.

The comparison of detailed aspects of the relationships with the model did not many insights could be found. The many limitations of this research such as the limited scope and data don't allow serious conclusions. It is interesting, that the influence of the global environmental threat indicators that at this point only include the world surface temperature is just as big as the combined influence of the military threat indicators which include the 'World Military Expenditure', and the dummy variables 'Directly in Conflict' and 'Supporting a Conflict' just as the prediction of the model suggested: $f_a = (E_0 - M_{a0} + 1)/2$. However, this could very well change with the addition of further or better indicators. Furthermore, the prediction of the model suggests that the strategies of the actors do not depend on the other player but on their current threat levels E_0 and M_0. This hypothesis would support the decision-making of states regarding environmental security issues independent of the other actors and contradict some of the explanations given. However, the action of the other actor can impact future threat levels and thereby impact the state's decisions indirectly. But assuming a real-time adjustment of the focus so the difference between N_0 and N_1 is infinitesimally short does indicate an impact anyway. However, this would only be verifiable through a time series analysis. Still, states would not be fully blocked by the tragedy of the commons and freeriding but act on the environmental threat anyway.

Both, the Environmental Focus measured in budget as well as the GDP per capita have not been used in the final regression model. To understand the challenges with the Environmental Focus measured by budget, a scatterplot against the Environmental Focus measured in performance can help to see the reason behind it. If they would line up perfectly, they would provide almost the same information. However, Graph 13 shows that while there is a strong relation between both indicators, high environmental performance can also be reached with less relative budget. This could be due to international financial support for environmental security projects and could hint at a substitution rather than an additional impact of foreign environmental financing. But this topic would require further research. The fact that

GDP per capita does not have a linear relationship with the Environmental Focus shows that different to the EPI, the Environmental Focus does not depend on the financial resources of a government. There is no level of wealth at which states start to focus on environmental security, but the focus seems not to be linearly related to the GDP per capita.



Graph 13: Scatterplot of the Environmental Focus Measured in Budget and the Environmental Focus Measured in Performance

10. Discussion and Conclusion

The study found that the relationship between military and environmental security indeed is a significant factor in understanding political decision-making at the international level. The theory and statistical analysis could be improved but overall, the theory has explanatory value due to the significance and correct prediction of many variable relationships. Interestingly, the direction of the impact of the local surface temperature change and the 'Global Climate Physical Risk Index' has been wrong. Post hoc theorizing should be avoided but the addition of intrastate conflicts and struggles of local disasters could find answers to the discrepancy. This should be tested in an adjusted model. Finally, the budget does not seem to be a good indicator of environmental performance, even if the budget is a short-term adjustable factor related to Environmental Focus. The use of other data such as political attention could provide better results.

Most of the results could be explained with the theoretical framework while some assumptions on the operationalisation and limitations of the model need to be reevaluated. The main point is, that the model used individual data for the environmental threat. However, this seemingly does not lead to a higher environmental focus. Differently, local environmental threats lead to lower Environmental Focus. About the theoretical framework and especially the part originating from the ecological peace theory, this could mean, that cooperation on environmental security issues only works with knowledge and prevention of a threat. However,

existing challenges leave less room for Environmental Focus, as the military security threat might increase due to the weakening factor of the environmental threat. The weakening factor could be understood as the state losing legitimacy due to its lack of security provisions from the environmental threats which also lowers the military security. As Porfiriev (1992) found, that the environmental security dimension is also significantly weakening the military dimension. For the model, the inclusion of further indicators such as intrastate conflicts might make up for this, as well as the recognition of more complex interdependencies. The individual state's environmental threat should impact the focus, but this might be overshadowed by the additional military threat.

The parallel game theory model also showed a very rationality-driven normative perspective of what states should do to strengthen their legitimacy. The limitations in the explanatory value can also derive from the non-conformance of state governments with these theories. The model shows a rather ideal decision-making process which is not entirely transferable to real-life contexts where multiple additional factors as expressed in the limitations sections interfere. Still, the model can inspire further theories and decision-makers to increase their understanding of the interactions between military and environmental security threats.

One insight from the theory about parallel games also claimed that further contact points increase cooperation but also options for retaliation. This aligns with the example of NATO, where the organisation created an alternative to individual focus on military security. It would be interesting to analyse whether members or international military organisations show a higher Environmental Focus in the data.

It is relevant to notice, that due to the discrepancy between the model and the theory, the findings, that align with the prediction might have a different cause. It was expected that the relative threat was the main cause of the choice of focus. However, only the common part of the environmental threat had the predicted impact in the empirical analysis. This could be due to the mechanisms of the model and negotiation efforts leading to a global Environmental Focus based on the lowest common denominator. However, alternative explanations could not be ruled out as most data has been unfit to serve as control variables. Such uncertainties need to be tested in future research projects.

Overall, the application of parallel game theory to the problem could provide insights as it could identify and predict significant relationships between military threat, environmental threat and the focus variable. Furthermore, additional aspects of the analysis revealed starting

points for further research. However, as the first attempt at constructing a model and theoretical framework for this issue, many results are subject to change, as researchers and decision-makers are only beginning to pay attention to the interconnection of military and environmental security.

Still, the partial success of the model showed the value of using EITM and parallel game theory to investigate historical interdisciplinary decision-making and teach future decision-makers the context and relevance of this subject. Parallel game theory provided a great starting point for the accumulation of interdisciplinary information. Both theories such as realism and ecological peace theory and empirical observations such as the impact of the conflict in Ukraine have contributed to a useful theoretical framework and model. While EGTA could have captured the complexity of the interrelated dimensions of security more comprehensively, the analysis using EITM proved to be able to find significant results as well while being able to falsify a theory and model rather than relying completely on post hoc theorizing. While the practical implementations also depend on further adjustment and improvement of the model and indicators, it supports strategic orientation and cohesiveness of policies by increasing the understanding of those connections.

11. Recommendations

As mentioned in sections, the current knowledge on the relationship between military and environmental security goals is very limited and this research is only a first step towards a more comprehensive theory and model, that can account for the changing reality of national security dimensions. Therefore, further research should be a priority over hasty action. The next step should probably be to test the dynamic change over time aspect of the model with a time series analysis. This would further clarify the value of the model and could indicate the need for further adjustment.

Furthermore, it would be useful to spend some time creating well-structured and tested indexes. Better Index scores can ease analysis and guide decision-makers in adjusting the focus of the relationship between military and environmental security. Furthermore, this could be extended to other security dimensions to allow a more detailed analysis of interconnections and better reliability of predictions. The relationship between military and environmental security should also be analysed in the context of intrastate conflict to prevent confusion and misidentification of significant relationships. More reliable index scores could be used to test the impact of Hofstede’s cultural dimensions, state form or geographical advantages on the

reliability of the model. This could add new dimensions to the model or specify in which context, it should be used.

Impact-wise, it should also be investigated, what the result of the increased environmental threat is. The idea, that there is an increasing priority to focus on another goal than military security could also be used as an excuse for short-term increased active conflict as states attempt to establish cooperation under their preferred framework. It is important to analyse whether an increased pressure to find peace could result in positive or negative peace.

Action-wise, the research indicates the importance of preventive action on environmental security. The NATO and other alternatives to state military focus could show a path of further collaboration on environmental security. However, a mandatory share of military expenditure by member states could hinder the benefits of the alternative. The goal of such organisations should be to pool resources for military security allowing overall less military focus.

12. References:

Acemoglu, D., Laibson, D., & List, J. (2018). Economics, EBook, Global Edition. Harlow, UNITED KINGDOM: Pearson Education, Limited.

Alt, J. E., & Eichengreen, B. (1989). Parallel and overlapping games: Theory and an application to the european gas trade. Economics & Politics, 1(2), 119-144.

Armitage, D. (2006). Hobbes and the foundations of modern international thought. Cambridge university press eBooks (pp. 219-235). Cambridge University Press. https://doi.org/10.1017/CBO9780511618376.013

Barkdull, J. (2017). Environmental policy and foreign policy. Oxford University Press. https://doi.org/10.1093/acrefore/9780190228637.013.365

Barnett, J. (2009). Environmental security. In R. Kitchin, & N. Thrift (Eds.), International encyclopedia of human geography (pp. 553-557). Elsevier. https://doi.org/10.1016/B978-008044910-4.00774-4

Bayer, M., & Hauk, S. (2023, *Global militarisation index 2023.* https://data.humdata.org/dataset/global-militarization-index.

Bekkers, V., Fenger, M., & Scholten, P. (2017). Four perspectives on the policy process. *Public policy in action* (). Edward Elgar Publishing Limited.

Camut, N., Weise, Z., Gavin, G., & Schonhardt, S. (2023). Putin trolls COP 28 with oil talks next door. https://www.politico.eu/article/russia-vladimir-putin-trolls-cop28-with-oil-talks-next-door-to-climate-summit/

Carrington, D. (2024, May 10,). 'Hopeless and broken': Why the world's top climate scientists are in despair. The Guardian (London) https://search.proquest.com/docview/3053039805

Climate change 2023 : Synthesis report of the IPCC sixth assessment report (AR6). (2023, https://library.wur.nl/WebQuery/groenekennis/2323374

Cohn, T. H. (2016). Global Political Economy Theory and Practice [1 Online-Ressource (449 Seiten)](7th ed ed.). doi:10.4324/9781315659695

Conca, K., & Beevers, M. D. (2018). Environmental pathways to peace. Routledge handbook of environmental conflict and peacebuilding (1st ed., pp. 54-72). Routledge. https://doi.org/10.4324/9781315473772-5

Creswell, J.W., & Creswell, J.D. (2022). Research design: Qualitative, quantitative, and mixed methods approaches (6th ed.). Sage.

Davies, S., Engström, G., Pettersson, T., & Öberg, M. (2024). Organized violence 1989–2023, and the prevalence of organized crime groups. *Journal of Peace Research, 61*(4), 673–693. https://doi.org/10.1177/00223433241262912

Davydova, A. (2023). How russia's war is impacting the global environmental agenda. Carnegie Politika, https://carnegieendowment.org/politika/88773

Rio+20 DW special - interview with severn cullis-suzuki. DW News (Director). (2012, 19.06.).[Video/DVD] YouTube.

Gellers, J. C. (2010). Climate change and environmental security: Bringing realism back in. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1695816

Gilmore, E. A., Herzer Risi, L., Tennant, E., & Buhaug, H. (2018). Bridging research and policy on climate change and conflict. Current Climate Change Reports, 4(4), 313-319. https://doi.org/10.1007/s40641-018-0119-9

Goodman, S., & Kertysova, K. (2022). NATO: An unexpected driver of climate action? https://www.nato.int/docu/review/articles/2022/02/01/nato-an-unexpected-driver-of-climate-action/index.html

Granato, J., & Lo, M. (2010). The empirical implications of theoretical models (EITM): A framework for methodological unification. *Politica Y Gobierno, 17*

Grantham Research Institute. (2022). What is the UN framework convention on climate change (UNFCCC)? https://www.lse.ac.uk/granthaminstitute/explainers/what-is-the-un-framework-convention-on-climate-change-unfccc/

Guo, K., Ji, Q., & Zhang, D. (2024). *Climate physical risk index (CPRI)*. figshare. https://doi.org/10.6084/m9.figshare.25562229

Harris, D. (2022). How the war in ukraine derails future climate negotiations: Can we put ourselves back on track for COP27? Oxford Policy Management, https://www.opml.co.uk/blog/how-war-ukraine-derails-future-climate-negotiations-back-track-cop27

Haun, P., & O'Hara, M. (2022). The brinkmanship game: Bargaining under the mutual risk of escalation*. Journal of Political Science Education, 18(3), 379-389. https://doi.org/10.1080/15512169.2022.2036615

Hobbes, T., & Cropsey, J. (1971). A dialogue between a philosopher and a student of the common laws of england

IMF. (2024a). GDP based on PPP, share of world. https://www.imf.org/external/datamapper/PPPSH@WEO/OEMDC/ADVEC/WEOWORLD

IMF. (2024b). Annual surface temperature change. https://climatedata.imf.org/datasets/4063314923d74187be9596f10d034914_0/about

IMF. (2022, *Climate change indicators. [environmental protection expenditures], . .* Retrieved 20.08.2024, from https://climatedata.imf.org/pages/access-data

Kivimaa, P., & Sivonen, M. H. (2021). Interplay between low-carbon energy transitions and national security: An analysis of policy integration and coherence in estonia, finland and scotland. Energy Research & Social Science, 75, 102024. https://doi.org/10.1016/j.erss.2021.102024

Kramer, N. (2022). *International climate policy considerations - A game theory approach*

Mahmoudi, A., Sadeghi, M., Deng, X., & Mardani, A. (2024). A sustainable approach for exploiting cross-border nonrenewable resources using hybrid game theory and ordinal

priority approach. Resources Policy, 88, 104310. https://doi.org/10.1016/j.resourpol.2023.104310

Manzanaro, S. S. (2024). EU leaders want to make food security top priority for 2024-2029 strategic agenda. https://www.euractiv.com/section/agriculture-food/news/eu-leaders-want-to-make-food-security-top-priority-for-2024-2029-strategic-agenda/

Mcfarlane, S., & Volcovici, V. (2023). Insight: World's war on greenhouse gas emissions has a military blind spot. https://www.reuters.com/business/environment/worlds-war-greenhouse-gas-emissions-has-military-blind-spot-2023-07-10/

McGlinchey, S. (2017). International relations. http://www.e-ir.info/

Mearsheimer, J. J. (1994). The false promise of international institutions. International Security, 19(3), 5-49. https://doi.org/10.2307/2539078

Morone, A., & Morone, P. (2016). The focal point in the traveller's dilemma: An experimental study. *Bulletin of Economic Research, 68*, 123–132. https://doi.org/10.1111/boer.12086

Munck, G. L. (2001). Game theory and comparative politics: New perspectives and old concerns. World Politics, 53(2), 173-204. https://doi.org/10.1353/wp.2001.0005

The Moscow Times (2023, Dec 12,). 5 things russia said at COP28. https://www.emis.com/php/search/doc?pc=RU&dcid=801457161&primo=1

Neck R. (2021). Methodological Individualism: Still a Useful Methodology for the Social Sciences?. *Atlantic economic journal : AEJ*, *49*(4), 349–361. https://doi.org/10.1007/s11293-022-09740-x

New dimensions of human security. (1994). Human development report 1994 (pp. 22-46). United Nations Development Programme. https://doi.org/10.18356/213f0e70-en

OSCE. (n.a.). Climate change. https://www.osce.org/oceea/446296

Parry, E. J. (2007). The greatest threat to global security: Climate change is not merely an environmental problem. UN Chronicle, 44(2), 20.

Porfiriev, B. N. (1992). The environmental dimension of national-security - a test of systems-analysis methods. Environmental Management, 16(6), 735-742. https://doi.org/10.1007/BF02645663

Ravenhill, J. (2020). Global political economy (6th ed.). Oxford University Press. https://doi.org/https://doi.org/10.1093/hepl/9780198820642.001.0001

Resource Watch. (2018, *Global solar atlas.* https://www.resourcewatch.org. Retrieved 31.08.24, from http://globalsolaratlas.info/

Ristić, B., & Madani, K. (2019). A game theory warning to blind drivers playing chicken with public goods. *Water Resources Research, 55*(3), 2000–2013. https://doi.org/10.1029/2018WR023575

Shinko, R. E. (2008). Agonistic peace: A postmodern reading. Millennium, 36(3), 473-491. https://doi.org/10.1177/03058298080360030501

Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O., & Ludwig, C. (2015). The trajectory of the anthropocene: The great acceleration. The Anthropocene Review, 2(1), 81-98. https://doi.org/10.1177/2053019614564785

Steven Tadelis. (2013). *Game theory*. Princeton University Press.

Tian, N., da Silva, D. L., Beraud-Sudreau, L., Liang, X., Scarazzato, L., & Assis, A. (2023). Developments in military expenditure and the effects of the war in ukraine. Defence and Peace Economics, 34(5), 547-562. https://doi.org/10.1080/10242694.2023.2221877

Tørstad, V. H. (2020). Participation, ambition and compliance: Can the paris agreement solve the effectiveness trilemma? Environmental Politics, 29(5), 761-780. https://doi.org/10.1080/09644016.2019.1710322

Viotti, P. R., & Kauppi, M. V. (2009). International relations and world politics: Security, economy, identity. (No Title),

Vogler, A. (2024). On (in-)secure grounds: How military forces interact with global environmental change. Journal of Global Security Studies, 9(1), ogad026. https://doi.org/10.1093/jogss/ogad026

Walt, S. M. (2017). Realism and Security. In: Oxford University Press.

Weise, Z. (2024). Bullets not bees: EU ditches green focus ahead of june election. https://www.politico.eu/article/leaked-eu-priority-list-reveals-absence-climate-change-focus/

Weir, D. (2020). How does war damage the environment? *Conflict and Environment Observatory,* https://ceobs.org/how-does-war-damage-the-environment/

The World Bank Group. (2024b, *GDP per capita (current US$).* Retrieved 20.08.2024, from https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?end=2023&start=1960&view=chart&year=1971

The World Bank Group. (2024a, *Military expenditure (% of GDP).* 20.08.24. https://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS?view=chart

Yale Center for Environmental Law & Policy. (2010). *Environmental Performance Index 2000-2010*. Retrieved from https://sedac.ciesin.columbia.edu/data/collection/epi/sets/browse

Yale Center for Environmental Law & Policy. (2012). *Environmental Performance Index 2012*. Retrieved from https://sedac.ciesin.columbia.edu/data/collection/epi/sets/browse

Yale Center for Environmental Law & Policy. (2014). *Environmental Performance Index 2014*. Retrieved from https://sedac.ciesin.columbia.edu/data/collection/epi/sets/browse

Yale Center for Environmental Law & Policy. (2016). *Environmental Performance Index 2016*. Retrieved from https://sedac.ciesin.columbia.edu/data/collection/epi/sets/browse

Yale Center for Environmental Law & Policy. (2018). *Environmental Performance Index 2018*. Retrieved from https://sedac.ciesin.columbia.edu/data/collection/epi/sets/browse

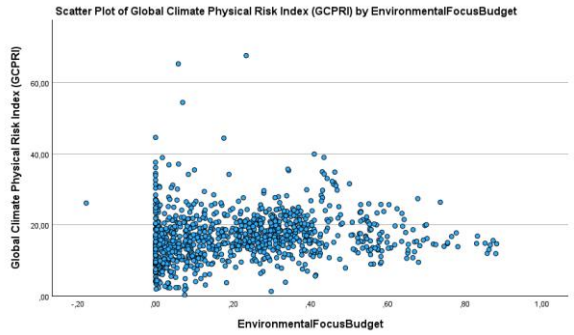
Yurdusev, A. (2007). Thomas hobbes and international relations: An assessment. ODTÜ Gelişme Dergisi, 34(2), 413-432. http://www.idealonline.com.tr/IdealOnline/lookAtPublications/paperDetail.xhtml?uId=42645

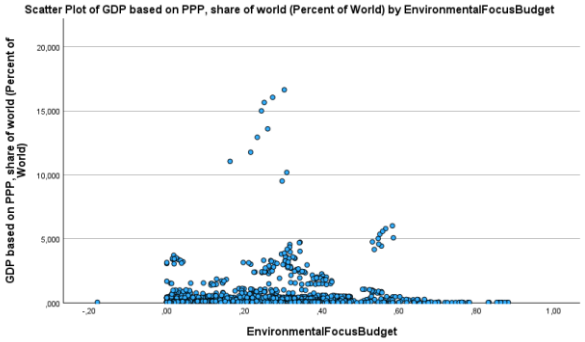
Zwijnenburg, W. (2021). Data-driven environmental decision-making and action in armed conflict. International Committee of the Red Cross, https://blogs.icrc.org/law-and-policy/2021/06/01/data-driven-environmental-decision-making-armed-conflict/

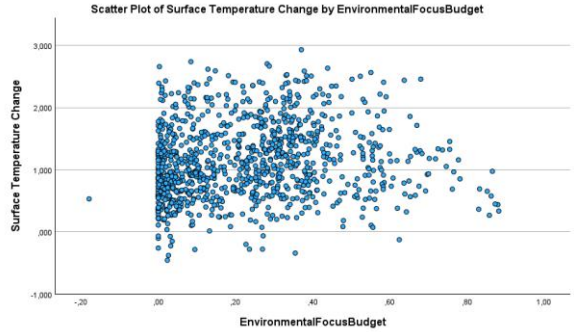
13. Appendix

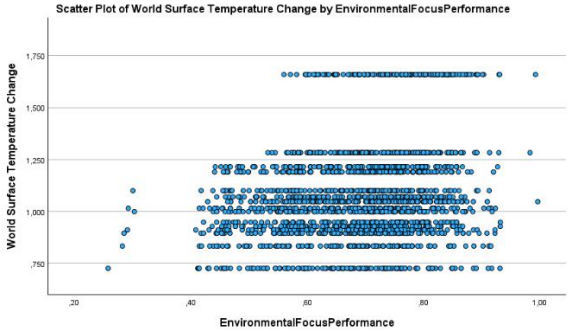
Graphs and tables from the statistical analysis:

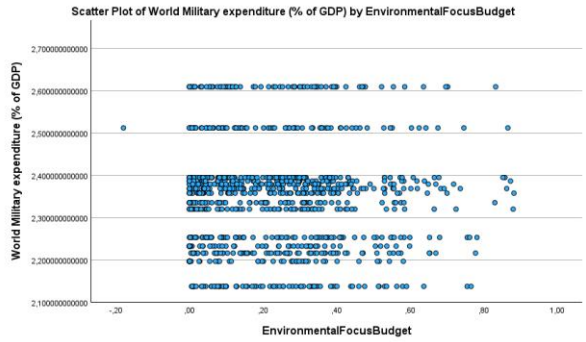
<u>Graphs from the linearity analysis:</u>

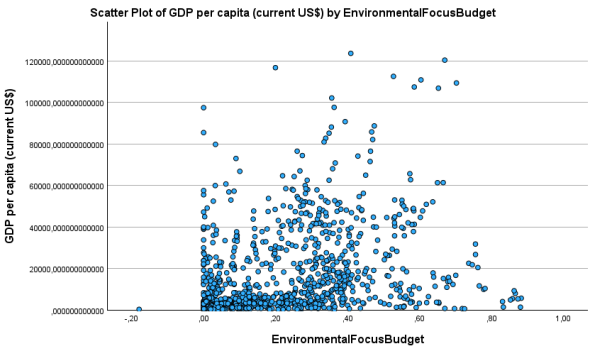


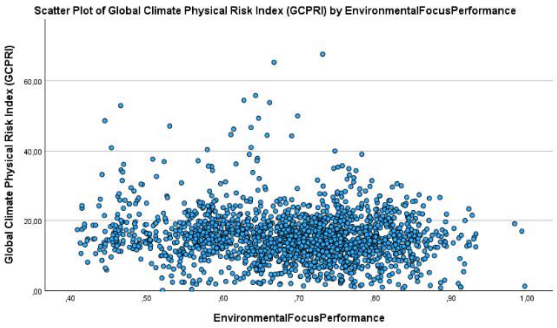


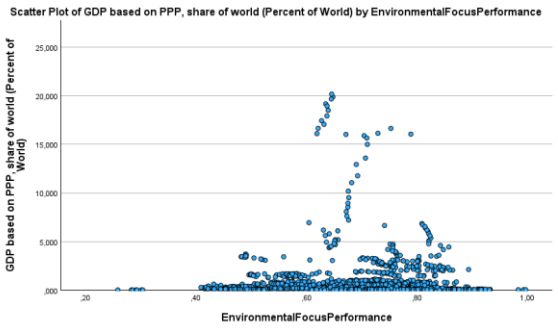


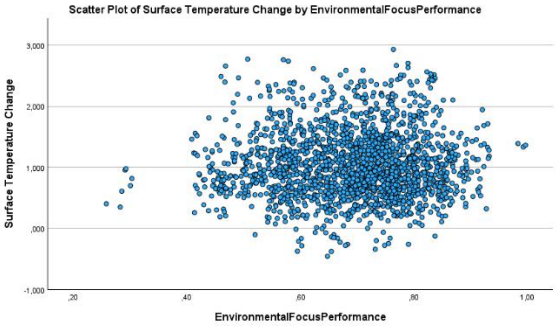


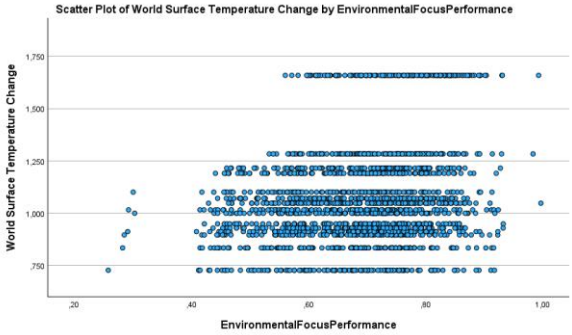


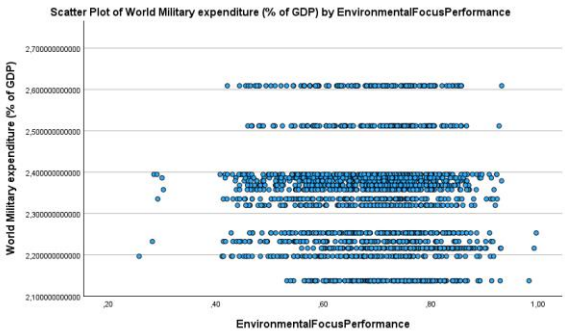


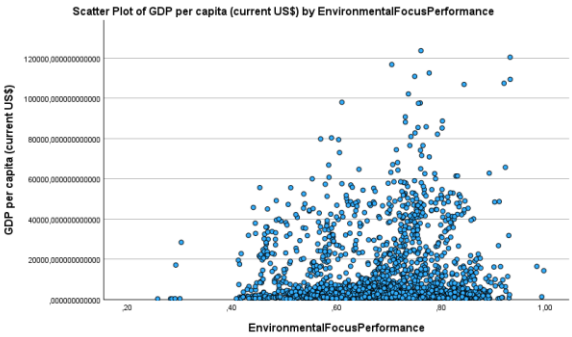

Scatter Plot of Global Climate Physical Risk Index (GCPRI) by EnvironmentalFocusPerformance
Global Climate Physical Risk Index (GCPRI)
60,00
40,00
20,00
,00
,40
,50
,60
,70
,80
,90
1,00
EnvironmentalFocusPerformance


Scatter Plot of GDP based on PPP, share of world (Percent of World) by EnvironmentalFocusPerformance
GDP based on PPP, share of world (Percent of World)
25,000
20,000
15,000
10,000
5,000
,000
,20
,40
,60
,80
1,00
EnvironmentalFocusPerformance

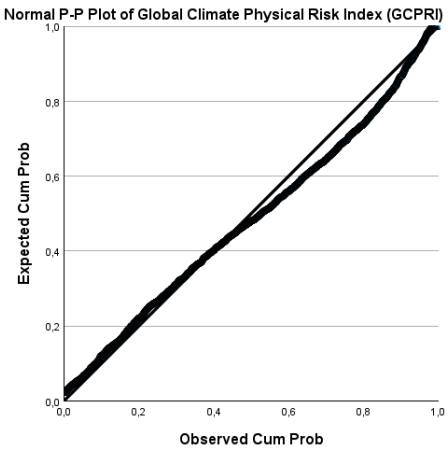

Scatter Plot of Surface Temperature Change by EnvironmentalFocusPerformance
Surface Temperature Change
3,000
2,000
1,000
,000
-1,000
,20
,40
,60
,80
1,00
EnvironmentalFocusPerformance

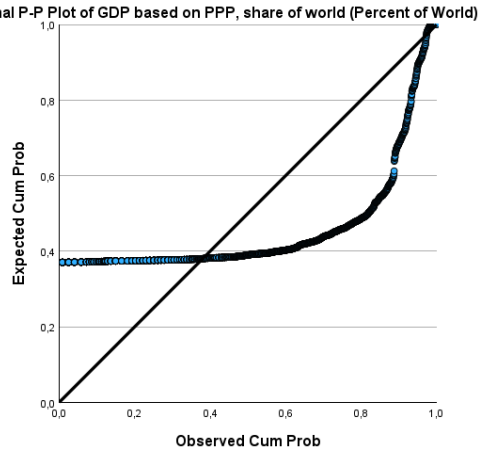

Scatter Plot of World Surface Temperature Change by EnvironmentalFocusPerformance
World Surface Temperature Change
1,750
1,500
1,250
1,000
,750
,20
,40
,60
,80
1,00
EnvironmentalFocusPerformance

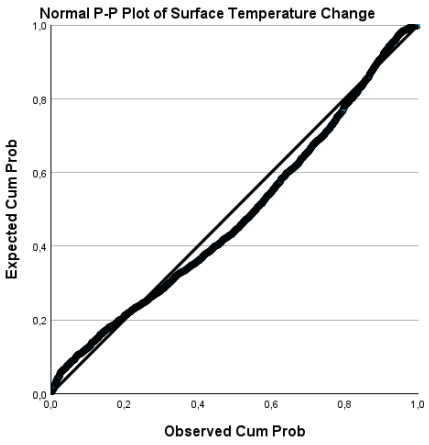

Scatter Plot of World Military expenditure (% of GDP) by EnvironmentalFocusPerformance
World Military expenditure (% of GDP)
2,700000000000
2,600000000000
2,500000000000
2,400000000000
2,300000000000
2,200000000000
2,100000000000
,20
,40
,60
,80
1,00
EnvironmentalFocusPerformance

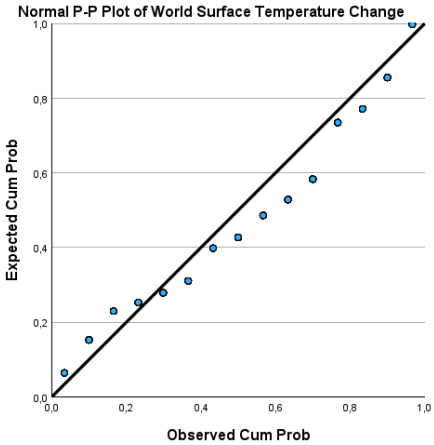

Scatter Plot of GDP per capita (current US$) by EnvironmentalFocusPerformance
GDP per capita (current US$)
120000,000000000000
100000,000000000000
80000,000000000000
60000,000000000000
40000,000000000000
20000,000000000000
,000000000000
,20
,40
,60
,80
1,00
EnvironmentalFocusPerformance

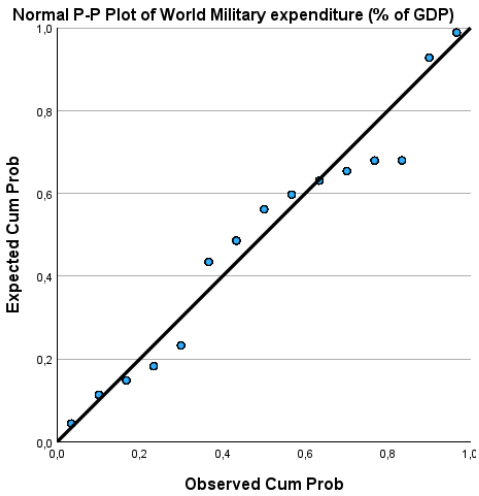
Graphs to Check Multivariate Normality

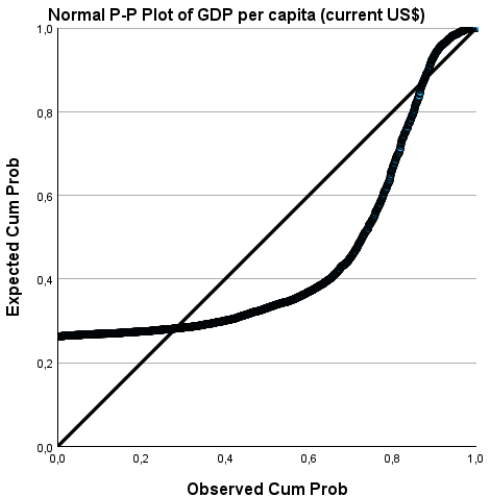


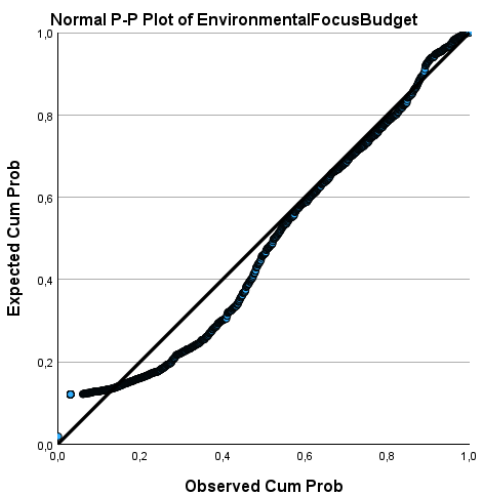


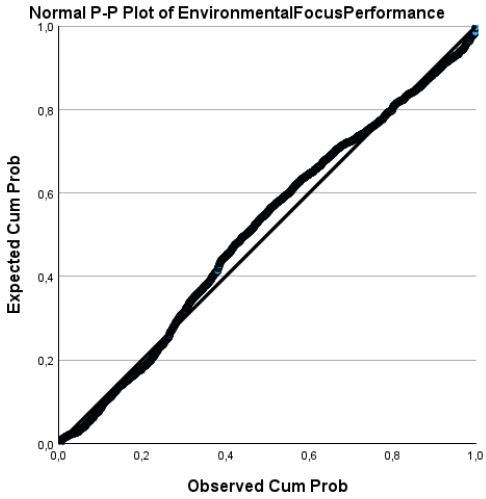









Normal P-P Plot of EnvironmentalFocusBudget
Expected Cum Prob
Observed Cum Prob
0,0
0,2
0,4
0,6
0,8
1,0


Normal P-P Plot of EnvironmentalFocusPerformance
Expected Cum Prob
Observed Cum Prob
0,0
0,2
0,4
0,6
0,8
1,0