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CULTURAL MODERATION IN ESG PERFORMANCE AND THE ENVIRONMENTAL  
KUZNETS CURVE: A CROSS-COUNTRY PERSPECTIVE

Master's Thesis

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I have written this Research paper/Bachelor Thesis independently. Any ideas or data taken from other authors or other sources have been fully referenced.

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**Abstract**

This study investigates how culture moderates the relationship between Environmental, Social, and Governance (ESG) performance and the Environmental Kuznets Curve (EKC) across countries. Leveraging a novel dataset and integrating Hofstede's cultural dimensions, we analyse how cultural factors influence the ESG-EKC dynamic. To address potential endogeneity concerns, we employ rigorous econometric methods, including multi-stage regression approaches, to isolate the causal effect of ESG on environmental degradation. Our findings reveal that cultural values significantly moderate the impact of ESG performance on environmental degradation. This offers valuable insights for countries to tailor sustainable practices to their specific cultural contexts. By examining the interplay between culture, corporate governance, and environmental economics, this research contributes a comprehensive cross-sectional perspective to the literature.

## 1. Introduction

### 1.1. Background

The world today is facing unprecedented, interconnected environmental challenges in areas such as climate change, pollution, biodiversity loss, and resource depletion (Gonzalez-Perez & Leonard, 2017). These challenges pose serious threats to the well-being of current and future generations, and require urgent and coordinated actions from governments, businesses, and civil society. According to the United Nations General Assembly 1987, in the Report of the World Commission on Environment and Development, p. 41, “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. While this attempt to delineate sustainable development might not be the initial or flawless one, it is arguably among the most frequently cited and discussed descriptions in the pertinent scholarly works (Purcel, 2020). In his 1798 work “Essay on the Principle of Population,” Malthus, and Meadows and colleagues in their 1972 report “The Limits to Growth,” both highlight comparable concerns regarding the unsustainable rise in population and economic growth driven by industrialization, contrasted with the declining trajectory of natural resources. These two studies are fundamental pillars in the development of environmental and energy economics as an autonomous field (Basiago, 1998).

However, finding effective solutions is not a simple task, as it involves balancing the trade-offs between economic development and environmental quality. Concurrently, the Environmental Kuznets Curve (hereafter EKC) hypothesis proposes an inverted U-shaped relationship between environmental degradation and economic growth, suggesting that as an economy grows, environmental degradation initially increases and then decreases after a certain income level is reached (Simon Kuznets, 1955). However, the role of culture in moderating the relationship between Environmental, Social, and Governance (hereafter ESG) performance and the EKC remains underexplored.

Cultural dimensions, such as those proposed by Hofstede (1980), provide a framework for understanding the impact of societal values on organizational behaviour and environmental policies. This thesis posits that cultural factors significantly influence the efficacy of ESG initiatives and, consequently, the trajectory of the EKC across countries. By examining the moderating effect of culture, this research aims to provide a nuanced understanding of how cultural values shape the relationship between corporate governance, economic development, and environmental outcomes (Hofstede, 1980).

This cross-country analysis seeks to fill the gap in literature by integrating the sovereign ESG index developed by Jiang, Feng, and Yang (2022) with Hofstede’s cultural dimensions to

assess their combined effect on the EKC. The findings of this study have the potential to inform policymakers and business leaders on tailoring ESG strategies to align with cultural contexts, thereby enhancing their effectiveness in achieving environmental sustainability (Jiang et al., 2022).

## **1.2. Research Problem**

Despite the growing importance of ESG performance in driving sustainable economic growth, there is a lack of understanding of how cultural factors influence this relationship. The EKC hypothesizes a non-linear relationship between economic development and environmental degradation, but the moderating role of culture on this curve has not been thoroughly explored. This research problem is significant because it addresses the gap in knowledge regarding the influence of the way of life of people (cultural dimensions) on the capacity of ESG practices and their impact on the EKC. By investigating this problem, the study aims to provide insights that could lead to more culturally informed ESG strategies, contributing to more effective environmental policies and sustainable development outcomes.

## **1.3. Research Questions**

These questions aim to dissect the complex relationship between culture, ESG performance, and environmental outcomes, providing a clear direction for my research. I have made them concise and well targeted to guide the focus of my study in determining what I am seeking to find out:

1. How do cultural dimensions influence the relationship between a country's ESG performance and its position on the Environmental Kuznets Curve?
2. To what extent do Hofstede's cultural dimensions predict variations in the EKC turning points among countries with differing ESG ratings?
3. Are there specific cultural factors that significantly moderate the impact of ESG initiatives on environmental degradation?
4. How does the integration of cultural considerations into ESG strategies affect the trajectory of environmental sustainability in different economic contexts?
5. Can a cross-country analysis reveal patterns in how cultural moderation affects the capacity of ESG performance in reducing environmental degradation?

## **1.4. Research Hypothesis**

The research hypotheses for my thesis are quite clear, testable statements that reflect the predictions I have about the relationships between the variables I am studying. Based on my research questions, here are some of my research hypotheses:

1. We hope to confirm the EKC hypothesis. So, we first hypothesize that there's a positive relationship between GDP and CO2 emissions in the initial stage. As economies develop, CO2 emissions tend to decrease due to factors like increased technological advancement.
2. Then secondly, we state that there's a negative relationship between ESG and CO2 emissions as GDP increases.
3. There is a significant interaction effect between cultural dimensions and ESG practices on environmental quality. In other words, the impact of ESG practices on environmental pollution varies depending on a country's specific cultural context.

### **1.5. Objectives**

1. To investigate the moderating effect of cultural dimensions on the relationship between ESG performance and environment quality across different countries.
2. To analyse the extent to which Hofstede's cultural dimensions can predict variations in the EKC turning points among countries with varying ESG ratings.
3. To identify specific cultural factors that significantly influence the impact of ESG initiatives on environmental degradation.
4. To assess the integration of cultural considerations into ESG strategies and its effect on the trajectory of environmental sustainability in diverse economic contexts.
5. To conduct a cross-country analysis to uncover patterns in how cultural moderation affects the efficacy of ESG performance in reducing environmental degradation.

### **1.6. Significance of Study**

The significance of this thesis lies in its potential to enhance our understanding of how cultural factors influence the potency of ESG performance in addressing environmental degradation. As nations strive to balance economic growth with environmental sustainability, the EKC provides a framework for understanding this relationship. However, the EKC does not account for cultural influences, which can significantly alter the effectiveness of ESG initiatives.

By integrating cultural dimensions into the analysis of ESG performance and the EKC, this research offers a more holistic view of sustainable development. The findings could provide valuable insights for policymakers and business leaders, enabling them to tailor ESG strategies to specific cultural contexts, thereby improving environmental outcomes. Furthermore, this study contributes to academic discourse by filling a critical gap in the

literature and setting a precedent for future research in the field of environmental economics and cross-cultural management (Jiang et al., 2022; Simon Kuznets, 1955).



Figure 1. Culture on ESG-EKC Dynamic

### 1.7. Structure Of the Thesis

This thesis is structured to systematically explore the intricate relationship between cultural values and ESG performance within the framework of the EKC. The introduction chapter sets the stage for a comprehensive cross-country analysis, laying out the theoretical frameworks and empirical approaches that guide the study. The subsequent chapters are organized as follows:

- **Literature Review:** This section explores the existing body of research on ESG-EKC relationship, and the role of culture in economic behaviours. It critically examines previous findings and identifies gaps that this study aims to address.
- **Methodology:** In this section, we go into the details of the approaches employed. We describe the econometric models and data sources, which includes the innovative sovereign ESG index and Hofstede's cultural dimensions. To ensure data reliability, we employ statistical analyses, including seasonality tests, normality tests, and correlation tests. Furthermore, the regression models are explained here, providing intuition into their construction. Overall, I justify the chosen methodologies and their alignment with the underlying hypotheses.

- **Empirical Evidence:** This chapter begins by validating the EKC hypothesis using visual representations. Then it presents the correlation and regression analyses conducted. It interprets the results in the context of cultural moderation on the ESG-EKC relationship and verifies if the evidence confirms our hypotheses.
- **Discussion:** This section interprets the findings, discussing the implications of cultural values on environmental degradation and the potential for countries to align sustainable practices with their cultural identities.
- **Conclusion:** The thesis concludes with a synthesis of the research findings, highlighting the contribution to the literature and suggesting avenues for future research.

Each chapter builds upon the previous, to reach a refined understanding of how cultural factors can be integrated into ESG strategies to foster environmental sustainability. The structure is designed to guide the reader through a logical progression of ideas, ultimately demonstrating the significance of cultural moderation in the ESG-EKC dynamic across different countries.

**Keywords:** Cultural Moderation, ESG Performance, Environmental Kuznets Curve, Cross-Sectional Analysis, Corporate Governance, Environmental Economics, Corporate Social Responsibility, Cultural Dimensions, Econometric Analysis, Environmental Degradation

**CERCS:** S180 Economics, econometrics, economic theory, economic systems, economic policy

## **2. Literature Review**

### **2.1. Introduction To the Literature Review**

The relationship between culture and economic practices is an area of growing interest. This literature review seeks to explore the moderating role of cultural dimensions on ESG performance and its subsequent impact on EKC trajectories. The concept of the EKC, first proposed by Grossman and Krueger (1991), suggests an inverted U-shaped relationship between environmental degradation and economic development. Yet, the impact of cultural dimensions on this association remains insufficiently investigated. To bridge this gap, this review draws upon the seminal work of Hofstede (1980), who identified key cultural dimensions that shape societal behaviours and values.

Jiang, Feng, and Yang (2019) introduced a new way to measure sovereign ESG indices, which this study uses to explore the EKC across different cultural contexts. By combining these perspectives, the review aims to understand if cultural values can predict EKC turning points in countries with varying ESG ratings. By examining the intersection of culture, corporate governance, and environmental economics, this literature review aims to contribute to a more refined understanding of sustainable development practices. It underscores the importance of considering cultural factors in the formulation of ESG strategies and the pursuit of environmental sustainability.

Thematic Organization of The Literature Review:

The literature review is structured as follows: It will first explore the theoretical relevance of the EKC and discuss the empirical evidence supporting and contesting its validity. It will then summarize the current understanding of ESG-EKC dynamics and their significance in environmental economics. We will be summarizing the methods used by Jiang and co. in their paper as its the main source of our sovereign ESG data. Following this, the review will introduce Hofstede's cultural dimensions as a theoretical framework for analysing the cultural moderation of ESG impacts. Finally, it will integrate the findings from various cross-country analyses, highlighting the role of culture in shaping environmental sustainability efforts.

### **2.2. The Environmental Kuznets Curve Hypothesis**

Brock and Taylor (2010) reviewed previous theories, like Stokey (1998), to connect the EKC hypothesis with the Solow model. They took the basic ideas from Solow's (1956) famous economic growth model and added environmental pollution into the main formula of the Cobb-Douglas production function. This led them to create a new model, called the Green Solow model. This model offers a way to understand why pollution and economic growth might form

a bell-shaped curve. It suggests that the same things that drive economic growth, like the law of diminishing returns and new technology, also shape this pollution-growth pattern (Brock & Taylor, 2010). Kijima and others (2010) describe the Green Solow model as a macroeconomic model that divides total production between consumption and spending on reducing pollution. In short, the Green Solow model is a straightforward dynamic model that provides a solid basis for the EKC hypothesis and a way to test how emissions per person might come together over time.

Other numerous investigations indicate a persistent correlation between environmental deterioration and economic development. Consequently, the enduring nature of the EKC appears to be dominant, reinforcing the notion that the EKC represents a trend that becomes noticeable over an extended timeframe, especially considering that the impacts of ecological policies emerge years after they are put into action (Purcel, 2020). It's reassuring to observe that the bell-curve relationship between pollution and economic growth often appears in certain developing and transitional countries. This might defy the common belief that it's tougher for these nations, as opposed to developed ones, to achieve the ideal growth rate that would lead to a reduction in pollution levels, essentially resulting in a curve that bends upwards. In general, this could imply that less financially endowed countries have the potential to enhance their environmental conditions by steering clear of the errors committed by wealthier nations, and possibly reverse the direction of pollution trends to benefit the environment even at a reduced income threshold (Dinda, 2004; Munasinghe, 1999; Wang et al., 2023).

International trade is another key reason behind the EKC. When trade makes an economy bigger, it often leads to more pollution, making trade a possible reason for harming the environment when other factors stay the same. However, many experts believe that trade itself isn't the main reason for environmental harm (Jones & Manuelli, 1995). Trade can also help the environment by what's called the composition effect and the technique effect. This means that when a country gets richer from trade, it can make stricter environmental rules that lead to new ways to cut down on pollution. The idea is that as one country makes less of the goods that cause a lot of pollution, another country might start making more of them through international trade (Dinda, 2004). These changes are based on two ideas:

- Displacement Hypothesis
- Pollution Haven Hypothesis

Displacement Hypothesis:

Under certain circumstances, the pollution intensive industries migrate from countries with stronger environmental regulations to those with weaker regulations (Copeland & Taylor,

1995). A good example is when nations that export more factory-made products usually use more energy (Suri & Chapman, 1998). Less wealthy countries often end up exporting more goods that cause pollution, while wealthier countries tend to import them. The bell-shaped curves we see might come from shifts in what countries are best at making. So, poorer countries usually make more goods that pollute and use lots of materials, but richer countries focus on making goods that are cleaner and based more on services, even though the way people use things doesn't really change (Jänicke et al., 1997; Stern et al., 1996). This only happens when the environmental impact is just moved from one country to another instead of being lessened. This matches what the Displacement Hypothesis says. According to this hypothesis, when countries start trading more freely, industries that pollute a lot grow faster in developing countries because developed countries have tougher environmental laws (Harrison, 1996; Tobey, 2001).

#### Pollution Haven Hypothesis:

If it becomes easier to trade, it might be bad for the environment if companies that pollute a lot go to places with less strict rules. This idea is known as the Pollution Haven Hypothesis (PHH). The PHH talks about how big companies that make a lot of pollution might move to countries where the environmental laws aren't as tough. The PHH says that having lower standards for the environment can be an advantage for a country, leading to changes in who trades what. Basically, the PHH is a theory that says countries with strict laws will end up sending away all the industries that pollute, and the countries that aren't as rich will take them in (Dinda, 2004).

#### Criticisms and Controversies of the EKC:

Over a decade ago, Moses Abramovitz wrote an essay titled "The Welfare Interpretation of National Income and Product," which was part of a series that also paid tribute to another notable economist from Stanford. Abramovitz argued that we should really question the idea that changes in how well society is doing can be estimated by looking at how fast the economy is growing. He suggested that we need to think more about what it means when the national income grows over time and called for more research that can make our understanding stronger. Abramovitz's point is important because it goes against the common thought that a growing economy means everyone's lives are getting better. He says we need to study and understand better how economic growth and the well-being of society are connected. This doubt is key because it challenges the idea of using economic growth as the only way to measure if society is doing better, which is important when thinking about the EKC hypothesis since it uses economic growth as a major indicator.

Another criticism of the EKC hypothesis is that it does not account for the heterogeneity and diversity of countries in terms of their culture, institutions, policies, and innovation, which may affect the environmental impact of economic growth and the turning point and slope of the EKC (David I Stern, 2004). For example, different countries may have different levels of environmental awareness, concern, responsibility, and action, depending on their historical, geographical, economic, and political contexts (Tisdell, 2001). Different countries may also have different institutional quality, governance structure, and policy framework, which may influence their environmental regulation, enforcement, and compliance (Barrett & Graddy, 2000). Different countries may also have different technological capabilities, innovation potentials, and diffusion patterns, which may affect their environmental efficiency, productivity, and competitiveness (Grossman & Helpman, 1991).

Also, the EKC hypothesis does not account for the multidimensional and complex nature of environmental quality, which may not be adequately captured by a single or a few indicators of environmental degradation, and which may have different relationships with economic development (Dasgupta et al., 2002). For example, different indicators of environmental degradation may reflect different aspects of environmental quality, such as local or global, stock or flow, reversible or irreversible, and visible or invisible (Panayotou, 1997). Different indicators of environmental degradation may also have different impacts on human health, well-being, and welfare, such as morbidity, mortality, productivity, and happiness (Pearce & Atkinson, 1998). Different indicators of environmental degradation may also have different responses to economic development, such as income elasticity, scale effect, composition effect, and technique effect (Copeland & Taylor, 2004).

Finally, there is the fact that it does not account for the dynamic and nonlinear nature of the relationship between economic development and environmental quality, which may depend on various factors, such as the time horizon, the functional form, the income distribution, the technological change, and the environmental thresholds (Galeotti et al., 2006). For example, the relationship between economic development and environmental quality may change over time, as the economy undergoes structural changes, the environment undergoes natural fluctuations, and the society undergoes demographic transitions (Brock & Taylor, 2005). The relationship between economic development and environmental quality may also depend on the functional form, as different specifications may yield different results, such as linear, quadratic, cubic, logarithmic, or exponential (Dinda, 2004). The relationship between economic development and environmental quality may also depend on the income distribution,

as different levels of inequality may affect the demand and supply of environmental quality, as well as the political economy of environmental policy (Magnani, 2000).

### 2.3. Macro-Level ESG Ratings

In the pursuit of understanding ESG performance across nations, an exploration of the intricate relationship between cultural dynamics, economic indicators, and sustainability outcomes becomes imperative. Measuring and comparing ESG performance at the country-level is not a straightforward task, as it involves multiple data sources, methodologies, standards, and frameworks. Our analysis embarks on this journey by examining how national culture moderates the relationship between ESG ratings and economic patterns, leveraging insights from Jiang, Feng, and Yang's seminal study on sovereign ESG indices and Hofstede's cultural dimensions data. Jiang, Feng, and Yang's paper introduces a comprehensive framework for evaluating ESG performance across countries, leveraging a sophisticated set of indicators. However, a critical examination of their methodology reveals a notable absence of direct adjustment for cultural dimensions in their ratings derivation process.

Considerations:

The paper used about 63 sovereign indicators from the World Bank Database to calculate the ESG scores of countries. This could imply that there is a high probability that their results may have some correlations with Hofstede's cultural dimensions data I plan to use for this study since the indicators may overlap at some sovereign cultural level. This is understandable as some indicators are usually adjusted for cultural differences among nations.

A correlation matrix showing close to zero correlations between ESG ratings and cultural dimensions would provide strong suggestive evidence that cultural adjustments might be incorporated into the ESG rating methodology. The negative correlation between ESG ratings and Power Distance Index (pdi) might imply that companies in cultures with stricter hierarchies (higher pdi) tend to have lower ESG ratings. The positive correlation between ESG ratings and Individualism (idv) could suggest that companies in more individualistic cultures prioritize aspects captured in ESG ratings (environmental, social, and governance practices).

However, it's important to acknowledge the limitations of correlation analysis and consider other factors that could influence the observed relationships. It's important to remember that correlation doesn't equal causation. These relationships could be due to other factors, and the strength of the correlations might not be significant.

Therefore, upon reviewing the paper's methodology further and the descriptions of the indicators within the World Bank Database as utilized by Yang et al., none of the 63 indicators exhibit parallels with the data from Hofstede's cultural dimensions.

In conclusion, our analysis offers a compelling rationale for incorporating Hofstede's cultural considerations into the evaluation of ESG performance across countries. By leveraging insights from both Jiang, Feng, and Yang's study and Hofstede's cultural dimensions data, we aim to enrich our understanding of how national culture shapes sustainability outcomes. In doing so, we pave the way for more refined and effective strategies for promoting global sustainability and responsible governance practices.

#### **2.4. The ESG-EKC Dynamic**

There isn't a vast amount of research directly exploring the connection between the EKC and ESG practices so the idea of ESG factors brings a fresh perspective to the story of the EKC. It is suggested that pollution levels may rise initially with economic growth but eventually decline as countries become wealthier and prioritize environmental regulations (Cherniwchan et al., 2017). This concept is relevant since we are considering how stricter environmental regulations driven by ESG practices could influence the EKC. ESG performance looks at more than just how much a company or country is growing economically. It also considers how committed they are to taking care of the environment, making sure society is doing well, and running things in a fair and responsible way.

Paying more attention to the environmental side of ESG might help move things faster towards the part of the EKC where things get better for the environment. There is a positive association between EKC trajectories and Corporate Social Responsibility (CSR), which overlaps with ESG principles, indicating that companies with strong ESG practices tend to have better environmental outcomes (Kraus et al., 2020). If companies and countries focus on using more renewable energy, cutting down pollution, and using resources wisely, they might be able to grow without hurting the planet. ESG goals can lead to new, cleaner technologies and smarter use of resources. This doesn't just help the environment; it also makes companies more competitive over time.

But there are still some tough parts as we are still working on the best ways to measure ESG performance. Without good ways to track it, it's hard to say for sure how ESG actions affect the EKC. Also, not everyone agrees on the EKC. It doesn't work the same for all types of pollution or in every country. Plus, the point where pollution starts to go down because of growth is not always clear and can be different for each environmental issue.

The relationship between EKC and ESG is an emerging area of research. However, studies suggest a positive correlation between strong ESG practices and improved environmental performance (Kraus et al., 2020).

## **2.5. Theoretical Framework**

The theoretical framework of this thesis is grounded in the interplay between cultural values and ESG performance within the context of the EKC. This framework draws upon the seminal work of Hofstede (1980), who identified six cultural dimensions that influence societal behaviours and values. These dimensions are utilized to understand how culture can moderate the relationship between ESG performance and environmental degradation as depicted by the EKC. The EKC posits that economic development initially leads to environmental degradation, but after reaching a certain level of income per capita, the trend reverses, suggesting that economic growth leads to environmental improvements. The theoretical framework of this thesis proposes that cultural dimensions, such as uncertainty avoidance and others, significantly influence this relationship.

By integrating Hofstede's cultural dimensions with the EKC, this thesis aims to provide a novel perspective on the role of culture in environmental economics. It hypothesizes that cultural values not only affect economic behaviours but also moderate the impact of ESG performance on environmental outcomes. This approach allows for a more nuanced understanding of the ESG-EKC dynamic and offers insights into how countries can tailor sustainable practices to their cultural contexts.

### **Cultural Effects on the ESG-EKC Dynamic:**

Environmental economics studies the interaction between human economic activity and the environment. While economic models often assume rational actors maximizing utility, culture plays a significant role in shaping environmental attitudes, behaviours, and policy preferences (Tol, 2018).

Cultural values influence how individuals and societies perceive the environment. Societies with strong values of individualism may prioritize personal gain over environmental protection, while collectivistic cultures may emphasize resource conservation for future generations (Hofstede, 2001). Additionally, cultural worldviews that emphasize interconnectedness with nature (e.g., some indigenous cultures) may lead to more sustainable practices.

Culture also shapes consumption patterns, impacting environmental impact. Societies with high levels of materialism tend to prioritize the acquisition of goods, leading to increased

resource use and waste generation (Layard, 2005). Cultural norms around conspicuous consumption can further exacerbate this issue. Conversely, cultures promoting frugality and resourcefulness can contribute to lower environmental footprints.

Furthermore, cultural values influence public support for environmental policies. Societies with high risk tolerance and a focus on short-term economic gains may be less receptive to policies with long-term environmental benefits, especially if they involve economic costs (Dunlap et al., 2000). Conversely, cultures emphasizing long-term sustainability and environmental stewardship are more likely to support stricter environmental regulations.

The way the EKC hypothesis leads to sustainable growth could be shaped by a country's culture. The hypothesis targets dimensions that have a more theoretically sound connection to environmental attitudes and policy adoption. It is however important to note that there are studies that have some mixed findings. In 2015, Lanis found mixed correlations between a country's uncertainty avoidance and its corporate ESG performance in a master thesis titled "Moderating the relationship between ESG performance and tax avoidance". It also found that power distance index has a significant moderating role for the environmental score and the social score, but not for the governmental score. However, it highlights the importance of other cultural dimensions like individualism and power distance. Here's a simpler explanation of how cultural traits might change the link between ESG performance and EKC trends:

#### Uncertainty Avoidance:

In cultures that don't like risks and want things to stay the same, people might not want to try new ESG ways that could shake things up. These societies might be less open to the changes and innovations required by stringent ESG practices. Or these types of countries may be strict on their ESG policies and strategies which may influence their ESG practices positively (Ogundajo et al., 2022). Alternatively, in cultures that are okay with change, there might be more support for new cleantech ideas, which could help move along the EKC.

#### Individualism vs. Collectivism:

In cultures that value individual success, people might use more stuff, which can hurt the environment. But in cultures that care about the community, there might be a stronger push to look after the environment. This can affect how quickly people take up ESG values and change the EKC's path (Hofstede, 2001).

#### Power Distance:

In places where society is set up with clear ranks, if only the top people make rules about the environment, others might not follow them as much. But in places where everyone works together on these rules, ESG efforts might work better to make things better for the environment.

Long-Term vs. Short-Term Orientation:

Cultures that think about the future might be more willing to start using sustainable methods, even if they cost more at first. This is good for the environment over time. But cultures that want quick wins might put off making things better for the environment.

The other two dimensions:

Indulgence vs. Restraint dimension might be relevant for consumer behaviour related to resource consumption, but its direct link to ESG policy and EKC patterns is less clear. Masculinity vs. Femininity, while potentially influencing societal priorities (economic growth vs. environmental protection), its impact on ESG adoption might be less direct compared to the chosen dimensions. Studies have found moderating effect on only the social score on the ESG performance metric (Maas, n.d.).

The studies reviewed in this paper suggest a correlation, not necessarily causation. Other factors like economic development, political stability, and resource dependence can also influence ESG policies. It is important to get the cultural details right. If ESG rules fit well with how a country's culture works, they're more likely to make a difference. For example, in cultures that focus on the individual, it might work better to talk about how ESG can help people's health or money, instead of just saying it's good for the earth. The mix of culture, ESG, and EKC is quite tricky and dynamic. We'll need more studies to really understand these links and find the best ways to reach sustainable growth with strong ESG actions that consider different cultures.

## **2.6. Variable Definitions and Operationalization**

Defining and Measuring ESG Performance:

In our study, the operationalization of a key variable, ESG performance, was informed by the comprehensive measurement framework presented in the paper "New Measurement of Sovereign ESG Index" by Jiang, Feng, Chang, and Yang (Year). This study adopts a multi-dimensional perspective on ESG performance, considering the distinct aspects of environmental responsibility, social inclusivity, and governance quality. ESG performance is operationalized as the sovereign ESG index developed by Jiang et al., which incorporates a meticulous and context-specific measurement approach. This operationalization ensures a

holistic representation of a country's commitment to sustainability, aligning with widely accepted principles in the field. The sovereign ESG index incorporates specific indicators and sub-indices that capture diverse dimensions of ESG performance, such as carbon emissions, social equity, and governance transparency (Jiang et al., 2022). Each of these dimensions is meticulously defined and measured, providing a robust foundation for our analysis.

By adopting the sovereign ESG index as our operationalization of ESG performance, our study benefits from a standardized and well-defined metric, enabling cross-country comparisons and a nuanced exploration of the relationship between ESG performance and other macroeconomic variables. This approach aligns with the current advancements in the field of sustainability research and ensures the robustness of our findings.

Environmental Indicators:

The choice of CO<sub>2</sub> emissions per capita and GDP per capita (PPP-adjusted) as our environmental indicators stems from their significance in assessing the environmental impact relative to economic development, and the adjustment for purchasing power parity (PPP) ensures a more accurate comparison of economic outputs across countries. Our utilization of CO<sub>2</sub> emissions per capita as a key environmental indicator allows us to gauge the carbon footprint of individual citizens in each country. By expressing emissions on a per capita basis, we aim to account for population differences and provide a normalized measure of a country's environmental impact. This metric is crucial for understanding the environmental efficiency of economic activities and provides insights into the sustainability of a nation's development trajectory.

The choice of GDP per capita, adjusted for purchasing power parity, as a key economic indicator aligns with our goal to analyse the relationship between economic development and environmental impact. PPP adjustment accounts for differences in price levels and allows for a more accurate comparison of economic outputs, particularly in assessing the real value of goods and services produced by a country. This ensures that our analysis captures a more nuanced understanding of the economic conditions across diverse global regions.

However, we also consider using CO<sub>2</sub> intensity. CO<sub>2</sub> intensity is a measure of how much CO<sub>2</sub> is emitted for each unit of economic output. It reflects how efficiently a country or region uses energy and resources to produce goods and services. By using CO<sub>2</sub> intensity as the y-axis, we can compare the environmental performance of different countries or regions with different levels of income and development (Hannesson, 2022). If we use CO<sub>2</sub> per capita as the y-axis, we might overlook the fact that some countries or regions have higher or lower emissions because of their population size, not because of their energy efficiency or

technology. CO<sub>2</sub> intensity can also show us the potential for reducing emissions by improving energy efficiency or switching to cleaner sources of energy (Koilo, 2019). For example, if a country or region has a high CO<sub>2</sub> intensity, it means that it can lower its emissions by producing the same amount of output with less energy or less carbon-intensive energy. On the other hand, if a country or region has a low CO<sub>2</sub> intensity, it means that it is already using energy and resources efficiently and may have less room for further improvement. Therefore, CO<sub>2</sub> intensity can help us understand the trade-offs and opportunities for achieving carbon neutrality.

#### Operationalizing Cultural Dimensions:

To operationalize cultural dimensions, I will define and measure the aspects of culture that are relevant for this specific research. Culture is a complex and dynamic phenomenon that influences human behaviour, values, beliefs, and preferences in various ways. However, culture is often treated as a static and homogeneous variable that can be easily categorized and quantified. This can lead to oversimplification and stereotyping of cultural differences and similarities and neglect the diversity and variability within and across cultural groups. Therefore, operationalizing cultural dimensions requires a careful and critical approach that considers the context, purpose, and limitations of the study or project (Kwantes & Glazer, 2017).

One of the most widely used frameworks for operationalizing cultural dimensions is Hofstede's cultural dimensions theory, which identifies six dimensions of national culture: power distance, individualism-collectivism, masculinity-femininity, uncertainty avoidance, long-term orientation, and indulgence-restraint. Hofstede's theory is based on a large-scale survey of employees from different countries working for the same multinational corporation, IBM, in the 1970s and 1980s. Hofstede's theory provides a quantitative and comparative measure of cultural values and practices across countries, and has been applied to various fields and disciplines, such as management, communication, education, and design (Kriegel, n.d.).

However, Hofstede's theory also has some limitations and criticisms, such as the validity and reliability of the data, the generalizability and applicability of the results, the assumption of national culture as a homogeneous and stable entity, and the neglect of other dimensions and levels of culture, such as regional, organizational, and individual culture. Therefore, Hofstede's theory should not be used uncritically or exclusively, but rather as a starting point or a reference for further exploration and analysis of cultural dimensions (Cambardella et al., 2020).

The data on cultural dimensions used in this study was sourced from the official Hofstede Insights website, which provides comprehensive information on national culture dimensions based on Geert Hofstede's research. The data were used to test the relationship between the Kuznets curve and the ESG performance of the countries, as well as to control for the possible confounding effects of cultural factors on the dependent and independent variables. The data were also used to compare the cultural profiles of different countries and regions, and to identify the similarities and differences in their values and behaviours.

## **2.7. Identification Of the Research Gap**

The examination of the existing literature on the ESG-EKC dynamics has revealed a notable research gap. While the EKC posits an inverted U-shaped relationship between environmental degradation and economic development (Grossman & Helpman, 1991), the moderating role of cultural factors within this framework remains underexplored.

Hofstede's (1980) cultural dimensions provide a theoretical basis for understanding the influence of culture on economic behaviours. However, the integration of these dimensions into the ESG-EKC dynamic has not been thoroughly investigated. Recent studies, such as those by Jiang, Feng, and Yang (2019), have begun to explore the impact of ESG performance on environmental outcomes, yet they do not adequately address the cultural context.

This thesis aims to fill this gap by examining how cultural values, as defined by Hofstede's dimensions, moderate the relationship between ESG performance and the EKC across various countries. The research will employ a novel dataset from Jiang, Feng, and Yang's "New measurement of sovereign ESG index," integrating it with Hofstede's cultural dimensions to assess the ESG-EKC dynamic in a cross-cultural context.

By identifying this research gap, the thesis underscores the importance of cultural considerations in environmental economics and corporate governance. It sets the stage for a comprehensive cross-sectional analysis that could provide valuable insights into tailoring sustainable practices to cultural contexts, thereby enhancing the efficacy of ESG strategies in promoting environmental sustainability.

### 3. Methodology

#### 3.1. Overview Of the Research Method

The research method employed in this study is designed to investigate the moderating effects of cultural dimensions on the relationship between ESG performance and their EKC patterns. This section provides an overview of the methodological approach, including the rationale behind the chosen methods, the data collection procedures, and the analysis techniques.

The study adopts a cross-sectional research design, utilizing a novel dataset that combines sovereign ESG indices with Hofstede's cultural dimensions. This design allows for the examination of the ESG-EKC relationship across different countries at a specific point in time which we have selected to be the year 2018.

About Our Year of Study:

Hofstede's cultural dimensions, which often serve as a proxy for cultural values, are relatively stable over time. Yearly data might not capture significant changes in uncertainty avoidance or other cultural dimensions. Also, ESG data collection and reporting practices are still evolving. While becoming more widely available, reliable historical ESG data for multiple countries might not be readily accessible for every year.

Furthermore, 2018 was likely chosen because it was a year relatively free from major global events that could significantly impact CO<sub>2</sub> emissions, such as natural disasters, financial crises, or pandemics like COVID-19. These events can introduce noise into the data and obscure the relationship between the variables of interest. And 2018 is not so far in the past that the data becomes outdated. It likely offers a reasonably recent snapshot of the relationships between sovereign ESG performance, national culture, and CO<sub>2</sub> emissions.

However, we must acknowledge a potential limitation of cross-sectional analysis which is the fact that causality cannot be established. This design shows correlations between variables at a single point in time. If reliable yearly data for culture and ESG were accessible, a panel data analysis could be a more robust approach to capture change over time. But even with these limitations, the cross-sectional analysis focusing on 2018 offers valuable insights into the potential moderating effect of culture on the ESG-EKC relationship. It paves the way for future research using panel data or other techniques to further explore this complex dynamic.

Data Collection:

Data for ESG performance is sourced from Jiang, Feng, and Yang's "New measurement of sovereign ESG index" while cultural dimensions are derived from Hofstede's publicly

available national culture statistics. Additional economic and environmental data are collected from reputable databases such as the World Bank and the Global Footprint Network. Overall, they are:

- “CO2 Emissions Metric Tons Per Capita” as CO2 variable;
- “Gross Domestic Product Per Capita (PPP-Adjusted)” as GDP variable;
- “Average Mean Surface Air Temperature” as TEMP variable;
- “New measurement of sovereign ESG index” indices as ESG variable;
- Hofstede’s Six Cultural Dimensions as culture variables.

Data Transformation:

Also, some form of statistical analysis will also be done to ascertain the normality, seasonality and correlation of the data.

Normality Test:

To assess the distribution of the ESG scores and cultural dimensions, ensuring that the assumptions of parametric statistical tests are met. As part of the data analysis, normality tests such as the Shapiro-Wilk or Kolmogorov-Smirnov tests will be conducted on the ESG scores, cultural dimensions scores, and GDP data. Should these tests indicate a departure from normality, data transformations, such as taking the natural logarithm of GDP values, will be considered to meet the assumptions necessary for parametric statistical analysis. This step ensures that the subsequent econometric models, such as regression analyses, are based on data that meet the necessary statistical assumptions for valid inference.

Correlation Tests:

To explore the relationships between ESG scores and cultural dimensions, ensuring that the indicators used in calculating the ESG scores were not adjusted for culture and are distinct constructs. The correlation test is a statistical method used to measure the strength and direction of the relationship between two continuous variables. In the context of my study, this test will be applied to examine the association between ESG scores and Hofstede’s cultural dimensions scores.

### **3.2. Data Visualization**

Visualizing Seasonality and Normality:

First, we check if our data changes with the seasons. We do this by breaking down the data on GDP and CO2 emissions into three parts: trend, seasonal, and the rest. We can show these parts using decomposition charts. For example, a line chart can show the trend, and other

small charts can show the seasonal and leftover parts. By looking at these charts, we can spot patterns that come back at certain times of the year.

Then, we look at the data to see if it spreads out in a normal way, like a bell shape. We use histograms and boxplots for this. Histograms show how the data points are spread out, and box plots show us the data's range and any points that stand out. If the data is not spread out normally, we can change it by using the logarithm of GDP and CO2 emissions. This can make the data look more normal. We can check if this worked by looking at the histograms and boxplots before and after we changed the data.

**EKC Hypothesis (A Visual Confirmation):**

We investigate the EKC hypothesis by making a chart that shows data from 1989 to 2022. This chart puts CO2 emissions on the vertical line and GDP on the horizontal line. We group the data in three-year chunks to see the big trends and smooth out any short-term changes. This chart helps us see how the economy's growth and pollution levels are linked in different places, especially in Europe and Australia.

The EKC hypothesis says we should see a bell-shaped curve on this chart. It means that countries with less money make less pollution. As these countries get richer, they make more pollution because of more factories and work. But after they reach a certain point, they start to make less pollution because they have better rules for the environment and better technology. This should make the top part of the bell curve go down.

We expect to see this bell curve for most countries in Europe and Australia because they have strong economies and strict rules for the environment. But if we don't see a bell curve for some countries, like China, it means they don't follow the EKC idea. China's economy has grown fast, which might have made their pollution go up a lot, even more than what the EKC thought would happen at high income levels.

### **3.3. Data Source Description**

This study utilizes a combination of data sources to investigate the moderating effects of cultural dimensions on the relationship between ESG performance and the Environmental Kuznets Curve (EKC). This study consists of 3 major components: Sovereign ESG Index, Environmental Quality, and Cultural Dimension

#### **3.3.1. Sovereign ESG Index:**

Jiang, Feng, and Yang in their paper, outlined a methodology to measure the sovereign ESG index of countries worldwide. The sovereign ESG index is constructed using a novel methodology that merges 63 diverse indicators divided into three categories based on how they

relate to ESG: environmental sustainability, social inclusivity, and governance effectiveness. Within the environmental dimension, the sovereign ESG index considers factors like carbon intensity, renewable energy adoption, and environmental policies. This allows us to gauge a country's efforts and effectiveness in addressing environmental challenges. The social dimension encompasses indicators related to social inclusivity, education, and income distribution. By incorporating these variables, our study aims to capture the social impact of a country's policies and practices, ensuring a more comprehensive understanding of ESG performance. Governance quality is a critical aspect of ESG performance. The sovereign ESG index includes indicators that assess government effectiveness, regulatory quality, and corruption perception, providing insights into the governance practices of each country (Jiang et al., 2022).

The study looks at data from 171 countries from 1990 to 2020 as a sample from which to calculate a sovereign ESG index. It followed the basic principle of systematicity, after balancing the significance and availability of indicators, using the World Bank's standards to remove any indicators that don't have enough good data. In the end, the study picks out 63 of these indicators to make up the country's ESG score. To make the calculations easier to understand, I have divided the methods used in the paper into 3 categories:

Indicator Normalization:

This step involves standardizing the various indicators used to measure the ESG index to ensure comparability. Normalization adjusts the data to a common scale without distorting differences in the ranges of values. The paper then adjusts the indicators to a common scale, even though they are different in nature and measurement units. It uses a process called min-max normalization, which adjusts the data within certain limits (Patro & Sahu, 2015). The method used for this must be consistent and not affected by whether the indicator's effect is good or bad. The paper sorts the indicators into groups based on their influence on ESG scores, labelling them as either positive or negative. The way these groups are decided is based on the author's judgment. For indicators that have a good impact (1), and negative impact (2), the paper uses the following formula:

$$p = \frac{x - x_{min}}{x_{max} - x_{min}} \quad (1) \qquad p = \frac{x_{min} - x}{x_{min} - x_{max}} \quad (2)$$

Entropy Weight Method:

The entropy weight method is used to determine the weight of each indicator. It is a technique that considers the degree of variation in each indicator's values. If an indicator varies greatly across countries, it is given more weight, as it provides more information (Jin et al.,

2020). So, after getting the data ready and making sure all the indicators are on the same scale, the paper figures out how much weight to give each indicator. It uses the entropy weight method, which is a fair way to decide the weights without any personal opinions (Benedetto et al., 2016; Jin et al., 2020). This method calculates the weights based on how much unique information each indicator provides, known as information entropy. This approach is better because it doesn't rely on people's opinions or other methods that might miss out on some information, as well as the lack of information caused by principal component analysis (Zhao et al., 2018). The paper follows a specific process, mentioned by Liu et al. in 2017, to calculate the entropy value for each indicator:

$$entropy_k = - \frac{1}{\ln(q)} \sum_i \sum_j s_{ijk} \ln (s_{ijk})$$

Kernel Density Estimation (KDE):

This is a non-parametric way to estimate the probability density function of a random variable. KDE is a way to guess the shape of a probability distribution for a set of data points by using kernel function (Kamalov, 2020). In the context of the ESG index, kernel density estimation could be used to analyse the distribution and density of the index scores across different countries or over time. The paper uses a type called Gaussian KDE to look at how the ESG scores are spread out across different economic areas in the world. It assumes that the data points are all random but follow the same pattern, and it uses a parameter called the bandwidth to fine-tune the estimation. The exact formula used for KDE in this study typically involves applying the Gaussian function to each data point, considering the bandwidth, to create a smooth estimate of the probability distribution:

$$\hat{f}(x) = \frac{1}{nb} \sum_{i=1}^n K\left(\frac{x - x_i}{b}\right)$$

These steps are part of a comprehensive approach to accurately reflect the status and evolution of global sovereign ESG development, providing important data for further studies related to ESG development and indicator system design. If we were to replicate the calculations from scratch ourselves, we would most certainly arrive at the same results and figures because we would be using the same indicators and data Jiang and co. obtained from the World Bank Database for the study.

### 3.3.2. Environmental Indicators (e.g., CO2 Emissions, Average Temperature):

In our analysis of environmental indicators, particularly CO2 emissions per capita, average temperature, and GDP per capita (PPP-adjusted). The intuition behind including temperature is the fact that colder countries typically require more energy for heating, which

might involve burning fossil fuels like coal, leading to higher CO<sub>2</sub> emissions. Conversely, warmer countries might require more energy for cooling, which can also contribute to emissions. Also, some industrial processes are temperature dependent. Warmer temperatures might indirectly increase emissions through higher industrial activity. We relied on data sourced from the World Bank database. So, by including temperature, we control for the direct effect of temperature on CO<sub>2</sub> emissions, ensuring the observed relationship between ESG performance and CO<sub>2</sub> emissions is not simply due to temperature differences.

However, it is crucial to acknowledge certain limitations. Data availability and reporting practices may vary across countries, potentially introducing biases. If we had data on heating and cooling degree days instead of average temperature, it might have been a more precise measure of energy demand related to temperature and potentially had a stronger association with CO<sub>2</sub> emissions. Also, there were a few ‘na’ values within the time periods for most countries.

### **3.3.3. Cultural Dimensions Data (Hofstede's Insights):**

In our examination of cultural dimensions, we incorporated data from Hofstede's cultural dimensions theory, a widely acknowledged framework for comprehending cultural variations across countries (Hofstede et al., 2010). The data, obtained from Hofstede Insights, provided valuable insights into how cultural factors may influence various aspects of societal behaviour, including environmental attitudes and practices.

Initially, our analysis encompassed four out of Hofstede's six cultural dimensions, comprising the Power Distance Index (PDI), Individualism vs. Collectivism (IDV), Uncertainty Avoidance Index (UAI), and Long-Term Orientation vs. Short-Term Normative Orientation (LTO). This is because our we aim to focus on aspects that are strongly linked to how people think about the environment and how likely they are to support environmental policies. These dimensions offer different understanding of cultural variations that may influence environmental values, decision-making, and behaviours. This multi-dimensional approach allows for a more comprehensive understanding of the complex interplay between cultural factors and environmental outcomes.

### **3.4. Data Analysis Procedures**

The analysis will begin by testing for seasonality in our data. If the presence of seasonality is significant, then we apply techniques like differencing, seasonal adjustment, and explicitly subtracting the seasonal component from observations. We also test for

heteroscedasticity to ensure residuals of the independent variables have equal variance. Next, we investigate the normality of our data to check for skewness.

Hierarchical multiple regression models will be developed to test the hypotheses and quantify the relationships between the variables. These models will allow for the assessment of the impact of cultural dimensions on the ESG-EKC relationship while controlling for other relevant factors. The regression analysis will include checks for multicollinearity, heteroscedasticity, and model specification to ensure accurate and reliable results.

### **3.5. Model Specification**

#### **3.5.1. Hierarchical Regression Model:**

Hierarchical regression is a statistical method where you add groups of related variables, likely predictors, into the analysis one group at a time. Each group is a step in the analysis. The order in which you add these groups should be based on the focus of one's research. The first group you add can have control variables, which are factors you don't want to change. Researchers use these to take out their effect so they can focus on how the other variables relate to the result they're studying (Fein et al., 2022). Often, we want to find out if adding new variables to our analysis makes our model better at explaining the changes in the dependent variable. In other words, we check if these new variables help us understand more about why the dependent variable changes the way it does (Lankau & Scandura, 2002).

This study employed this step-by-step hierarchical regression using 2 different approaches to see if a country's culture affects the link between its environmental and economic performance:

- 3-Step Model Approach and
- 2SLS Model Approach

#### **3.5.2. The 3-Step Regression Model:**

In this approach, we will start by looking at how a country's income relates to its CO2 pollution. This is to check a well-known theory (the EKC hypothesis). Next, we add each country's environmental score (ESG rating) and average temperature (to control for the direct effect of temperature on CO2 emissions) to see if it changes the pollution pattern. Lastly, we include a measure of how much a country doesn't like uncertainty (cultural dimension) to see if it changes the way the environmental score affects pollution. We added a last special calculation to see if the impact of ESG on CO2 emissions changes when UAI levels are

different. This method is based on the rules for how interactive terms work, as explained by Baron and Kenny in 1986.

$$\text{MODEL 1: } y_{LOG\_CO2} = \alpha_{INTERCEPT} + \beta_1 x_{LOG\_GDP} + \beta_2 x_{LOG\_GDP}^2 + \varepsilon$$

$$\text{MODEL 2: } y_{LOG\_CO2} = \alpha_{INTERCEPT} + \beta_1 x_{LOG\_GDP} + \beta_2 x_{LOG\_GDP}^2 + \beta_3 z_{ESG} + \beta_4 w_{TEMP} + \varepsilon$$

$$\text{MODEL 3: } y_{LOG\_CO2} = \alpha_{INTERCEPT} + \beta_1 x_{LOG\_GDP} + \beta_2 x_{LOG\_GDP}^2 + \beta_3 z_{ESG} + \beta_4 w_{TEMP} + \beta_5 v_{UAI} + \beta_6 (z_{ESG} * v_{UAI}) + \varepsilon$$

#### Cultural Dimension Selection:

To ensure we have a parsimonious model, we use one cultural dimension in the model. This way, we can concentrate on the key variables that really help us see how the factors in our model are connected. To identify the most relevant cultural dimension, we used the results of a correlation matrix of the cultural dimensions and ESG ratings which showed that with a value of -0.01, UAI was the least correlated with ESG ratings. Perfect correlation would have been 1, -0.01 is quite far from 1.

Choosing just one cultural dimension for our analysis can make sense, especially when you think about how Hofstede's dimensions are created. Hofstede came up with six cultural dimensions by using factor analysis, which is a way to find hidden factors that account for the differences in a group of variables. Since these dimensions (or factors) don't have much to do with each other, using just one in our model usually won't cause problems by leaving out the rest.

#### Justifications For The 3-Step Approach:

- **Comprehensive Analysis:** This model allows us to explore the relationships between culture, ESG practices, and CO2 emissions within the EKC framework.
  - The interaction term captures how the cultural dimension might moderate the effectiveness of ESG practices in reducing CO2 emissions. This provides a richer understanding compared to simpler models.
- **Focus on Interaction Effect:** This approach is well-suited since we are particularly interested in understanding how cultural context influences the relationship between ESG and CO2 emissions.

#### Limitations To The 3-Step Approach:

- **Endogeneity Problem:** Culture doesn't change much over the years so it can be thought as an institution. On the other hand, ESG could be an endogenous variable in the

regression because of reverse causality with CO2. The 2-step approach can be constructed using all culture and other variables as instruments for the ESG variable.

- **Multicollinearity Concerns:** There might be multicollinearity among the cultural dimension variables and the interaction term. Although, the correlation matrix shows low level of correlation between ESG and the dimension (UAI) used in the model, we can't be certain of others as they seem to have high correlation with ESG.
- **Potential Complexity:** An interaction term itself doesn't have a direct coefficient. It represents how the effect of one variable on the dependent variable changes depending on the value of another variable. Interpreting interaction terms can be more challenging compared to simpler models.

**3.5.3. Two-Stage Least Square Regression Model (2SLS):**

Next, we consider looking at a simpler 2-step model approach. This decision is based on the well-established body of research demonstrating that cultural dimensions significantly impact the level of ESG practices adopted by companies within a specific country. Analysing this relationship first allows for a clear understanding of the cultural foundation for ESG adoption. We investigate how ESG ratings relate to environmental quality, measured by factors like CO2 emissions. The 2SLS regression addresses potential endogeneity by incorporating instrumental variables. By using cultural dimensions as instruments, we can estimate the effect of ESG on CO2 emissions while mitigating the bias caused by the potential endogeneity issues that plagued the 3-step approach. This multi-dimensional approach allows for a simpler understanding of the complex interplay between cultural factors and environmental outcomes. Also, GDP, GDP squared, and average temperature were included as a control variable to account for its direct influence. By examining this relationship, we could assess whether companies with strong ESG practices (higher ratings) contribute to improved environmental outcomes. Thereby looking more like this:



Figure 2. 2SLS Culture-ESG Dynamic on EKC

$$\text{MODEL 1: } y_{ESG} = \alpha_{INTCPT} + \beta_1 x_{IDV} + \beta_2 x_{PDI} + \beta_3 x_{UAI} + \beta_4 x_{LTO} + \beta_5 x_{MAS} + \beta_6 x_{IVR} + \varepsilon$$

$$\text{MODEL 2: } y_{LOG\_CO2} = \alpha_{INTCPT} + \beta_1 z_{ESG} + \beta_2 x_{LOG\_GDP} + \beta_3 x_{LOG\_GDP}^2 + \beta_4 w_{TEMP} + \varepsilon$$

#### Justifications For The 2SLS Approach:

- Focus on Sequential Relationships: It may make more sense to investigate how cultural dimensions directly influence a company's ESG performance (reflected in ESG ratings). This might be due to values, regulations, or social pressures within a particular culture.
- Addresses potential endogeneity issues: This is the key advantage of 2SLS. It can handle situations where the explanatory variable might be correlated with the error term, leading to biased estimates in a standard regression.
- Reduced Complexity: This approach avoids the complexities of interaction terms, making it easier to understand the direct effects. Separating the analysis can make this research more accessible to readers unfamiliar with complex interaction effects.

#### Limitations To The 2SLS Approach:

- Less efficient estimates: Compared to a standard regression under no endogeneity, 2SLS can sometimes lead to less efficient estimates (higher standard errors) due to the two-stage nature of the procedure.
- Limited Insight into Interaction Effects: The two-step model doesn't capture how culture might directly influence the relationship between ESG and CO2 emissions within the EKC framework.

#### Robustness Check (2SLS Approach):

- Is there a significant negative relationship between ESG score and CO2 Emissions, and do the chosen instrumental variables help to isolate this effect by addressing potential endogeneity?

### 4. Empirical Evidence

#### 4.1. Research Questions and Hypothesis

As outlined in the introduction chapter, this study aims to dissect the intricate relationship between culture, ESG performance, and environmental outcomes through a series of specific research questions and hypotheses. These research inquiries are tailored to guide the empirical analysis and shed light on the complex interplay between cultural dimensions and sustainability practices.

#### 4.2. Data Presentation - Descriptive Statistics, Tables, Figures

Data Description:

|       | YEAR | LOG_GDP | LOG_CO2 | ESG  | PDI    | IDV   | UAI    | LTO   |
|-------|------|---------|---------|------|--------|-------|--------|-------|
| COUNT | 2018 | 78      | 78      | 78   | 78     | 78    | 78     | 78    |
| MEAN  |      | 9.87    | 1.11    | 0.57 | 57.94  | 44.44 | 67.92  | 48.00 |
| STD   |      | 1.02    | 1.16    | 0.03 | 18.59  | 19.73 | 23.38  | 21.03 |
| MIN   |      | 7.65    | -2.19   | 0.50 | 11.00  | 6.00  | 8.00   | 13.00 |
| MAX   |      | 11.67   | 2.76    | 0.63 | 104.00 | 90.00 | 112.00 | 88.00 |

Table 1. Data Description

Normality Tests:

We check if we need to take logs of any of our variables. Taking the natural logarithm can help linearize the relationship and address potential heteroscedasticity (unequal variance) in the residuals. It can stabilize the variance and improve the linearity assumption and it is advised that if the data is continuous and has a wide range, we should consider taking the log to ensure a more symmetric distribution.

GDP, CO2 Emission, and ESG Histogram and Box Plot Charts:

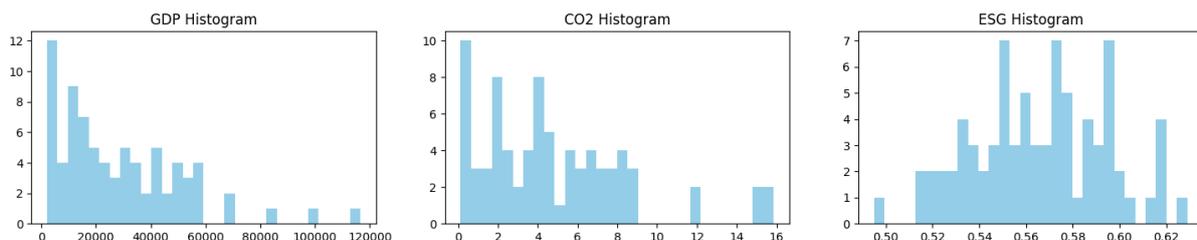


Figure 3.

### 4.3. Findings

Kuznets Curve Hypothesis:

The Kuznets curve is a hypothesis that suggests a relationship between economic development and income inequality. The Kuznets curve can be extended to include other indicators of development, such as environmental quality. For example, the EKC is a hypothesis that suggests a relationship between economic development and environmental degradation. According to this, as an economy grows, environmental degradation first increases and then decreases, forming an inverted U-shaped curve (Grossman & Krueger, 1995).

Charts comparing multiple countries are documented in the appendix of this paper:

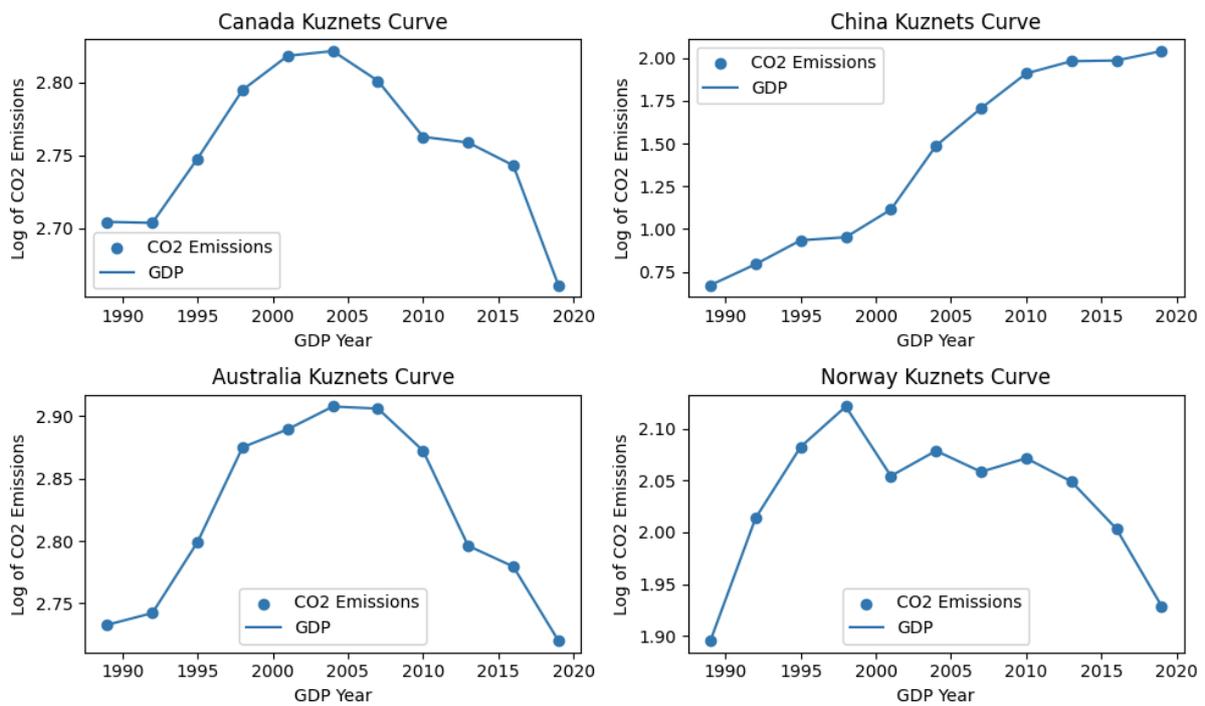


Figure 4. EKC Plot

Jiang, Feng, And Yang’s Esg Ratings Vs Hofstede’s Data:

Our analysis involving the use of a correlation matrix and regression analysis, offers compelling evidence to support the fact that the indicators used in calculating the ESG data were not adjusted for culture. Therefore, satisfying the credibility check of the sovereign ESG data used in this study.

The regression analysis, for instance, goes into the relationship between cultural dimensions and mean average ESG ratings. Significant coefficients associated with cultural variables such as Power Distance Index (PDI), Individualism (IDV), and other dimensions

underscore their influence on ESG performance. The strong correlations between these dimensions and ESG ratings, as revealed by the Pearson correlation tests and correlation matrix, further bolster this assertion. The correlation matrix can be found in the appendix of this paper.

Moreover, the absence of statistically significant coefficients for certain cultural dimensions in the regression analysis suggests that these dimensions were not adequately accounted for in the original ESG ratings derived by Jiang, Feng, and Yang. This limitation underscores the need to supplement their analysis with cultural considerations, as cultural dynamics play a pivotal role in shaping ESG performance across nations.

Our decision to integrate Hofstede's cultural dimensions data into our analysis serves to address this gap effectively. By incorporating cultural variables such as Power Distance, Individualism, Masculinity, Uncertainty Avoidance, Long-Term Orientation, and Indulgence, we aim to elucidate how national culture moderates the relationship between ESG ratings and EKC patterns.

Through our multidimensional approach, we seek to demonstrate that while the ESG ratings derived from Jiang, Feng, and Yang's paper provide valuable insights, they may not fully account for the dynamic influence of culture. By leveraging Hofstede's cultural dimensions data, we endeavour to provide a more comprehensive understanding of how national culture intersects with ESG performance and economic development trajectories.

#### 4.4. Regression Results

##### 4.4.1. 3-Step Regression Model:

Result (P-value < 0.05 \*):

| COEFFICIENTS            | MODEL 1   | MODEL 2   | MODEL 3   |
|-------------------------|-----------|-----------|-----------|
| STEP 1                  |           |           |           |
| Intercept               | -30.4453* | -17.5278* | -9.9380   |
| GDP (LOG)               | 5.5857*   | 4.4045*   | 4.6516*   |
| GDP (LOG) SQUARED       | -0.2395*  | -0.1686*  | -0.1824*  |
| STEP 2                  |           |           |           |
| ESG                     |           | -13.8406* | -28.1300* |
| TEMP                    |           | -0.0237*  | -0.0284*  |
| STEP 3                  |           |           |           |
| UAI                     |           |           | -1.1309*  |
| UAI * ESG               |           |           | 0.2183*   |
| MODEL FITNESS           |           |           |           |
| R <sup>2</sup>          | 0.847     | 0.889     | 0.903     |
| Adjusted R <sup>2</sup> | 0.842     | 0.883     | 0.895     |
| F-statistic             | 206.8     | 146.8     | 110.5     |
| AIC                     | 103.8     | 82.28     | 75.83     |
| BIC                     | 110.9     | 94.07     | 92.33     |

Table 2. 3-Step Model Result

Interpretation:

The results show that the first model confirms the EKC hypothesis, as the coefficient of GDP is positive with a value of 5.59, which means that 1% increase in GDP leads to 5.59%

increase in CO2 emissions, while the negative coefficient of GDP squared of -0.24 means that a further increase in GDP leads to 0.24% decrease in CO2 emissions. In the second block, we get a negative coefficient for ESG at -13.84, which means that 1 unit increase in ESG leads to 13.84% decrease in CO2 emissions. In the third block, we see a negative coefficient for uncertainty avoidance at -1.13, and this might indeed seem counterintuitive at first thought – countries with higher uncertainty avoidance having slightly lower CO2 emissions. However, it's important to consider studies that have found that countries with high uncertainty avoidance tend to have higher levels of corporate sustainability disclosure (a key ESG practice). It is suggested that stricter regulations and a risk-averse culture might drive this association (Ogundajo et al., 2022).

Finally, to the focus of our analysis, we see that the cultural interaction with ESG variables has a positive coefficient at 0.22, which means that UAI moderates the effect of ESG on CO2 such that higher levels of UAI reduce the negative impact of ESG on CO2. Here, UAI is the moderator and it is really important not to use the terms moderator and mediator interchangeably as there are many ways in which moderators and mediators differ (Baron & Kenny, 1986).

From Model 3:

$$Y_{LOG\_CO2} = \alpha_{INTERCEPT} + \beta_1 x_{LOG\_GDP} + \beta_2 x_{LOG\_GDP\_SQUARED} + \beta_3 z_{ESG} + \beta_4 w_{TEMP} + \beta_5 v_{UAI} + \beta_6 (z_{ESG} * v_{UAI}) + \varepsilon$$

$$\frac{\partial CO2}{\partial ESG} = \beta_3 + \beta_6 * UAI \quad \longrightarrow \quad \frac{\partial CO2}{\partial ESG} = -28.1300 + 0.2183 * UAI$$

If UAI is high, assume UAI = 1:  $\frac{\partial CO2}{\partial ESG} = -28.1300 + 0.2183 * 1 = -27.9117$

If UAI is low, assume UAI = 0:  $\frac{\partial CO2}{\partial ESG} = -28.1300 + 0.2183 * 0 = -28.1300$

Here's a practical scenario to explain it better:

- Imagine two hypothetical countries: Country A with high UAI and Country B with low UAI.
- Based on the negative coefficient for ESG, both countries would experience a reduction in CO2 emissions with stronger ESG performance.
- However, the positive interaction term suggests that this reduction in CO2 emissions would be lesser in Country A (high UAI) compared to Country B (low UAI).

Furthermore, all p-values are statistically significant, AIC and BIC become lower with each block and the R squared value becomes higher with each block, which means that the additional variables and the interaction term explain more variance in the model, as expected. From the diagram below, we can see that 88.9% of the variance in the data could be explained by the ESG-EKC dynamic model, but the model including culture as a mediator, explained even up to 90.3% of the variations.



Figure 5. Culture on ESG-EKC Dynamic Model Fitness

**4.4.2. 2SLS Regression Model:**

Result (P-value &lt; 0.05 \*):

| INDEPENDENT VARIABLES   | COEFFICIENTS |
|-------------------------|--------------|
| FIRST STAGE (ENDO=ESG)  |              |
| PDI                     | -0.0004*     |
| LTO                     | 0.0007*      |
| MAS                     | -0.0004*     |
| IVR                     | 0.0006*      |
| SECOND STAGE (ENDO=CO2) |              |
| ESG                     | -7.6956*     |
| GDP (LOG)               | 5.0601*      |
| GDP (LOG) SQUARED       | -0.2087*     |
| MODEL FITNESS           |              |
| R <sup>2</sup>          | 0.855        |
| Adjusted R <sup>2</sup> | 0.847        |

Table 3. 2SLS Model Result

Interpretation:

The first stage suggests that cultural dimensions, particularly PDI, LTO, MAS, and IVR, might influence a country's ESG practices to a moderate extent. Cultures with higher long-term orientation and indulgence seem to be associated with slightly better ESG practices, while cultures with higher power distance and masculinity seem to be associated with slightly worse ESG practices. The coefficients for UAI and IDV were not significant in this case.

In the second stage, the coefficient for ESG is negative (-32.2053) and statistically significant (p-value = 0.040). This suggests a negative relationship between ESG score and CO2 emissions. Countries with higher ESG scores tend to have lower CO2 emissions, as hypothesized. The 2SLS demonstrates that strong ESG practices (potentially influenced by cultural factors) are linked to lower environmental pollution, supporting the overall connection

between culture, ESG practices, and environmental quality. The interpretation remains the same as before (third model of the 3-step approach), with additional insights.

The F-statistic (27.87) is highly significant ( $p\text{-value} < 0.001$ ), indicating the overall model explains a statistically significant portion of the variation in CO<sub>2</sub> emissions. This suggests the combined effects of ESG, control variables, and potentially the instrumental variables are relevant.

#### **4.5. Conclusion**

From the 3-step model approach, first, I saw that richer countries pollute more, but only up to a point—after which, more wealth means less pollution. Then, when I looked at environmental scores, I found that better scores mean less pollution. And when I considered how much a country doesn't like uncertainty, I found that those countries tend to decrease the effect of better ESG practices on CO<sub>2</sub> Emissions likely because those countries may prioritize existing rules over new initiatives, even if the new ones are better for the environment. The numbers also backed this up, showing that my additions of variables at each level of the hierarchical regression model made my predictions more accurate, just as I thought they would.

The 2SLS approach provides a simpler view but doesn't capture the interaction effect. It highlights the influence of cultural dimensions on ESG practices (as instrumental variables) and the association between strong ESG practices with lower environmental pollution (step 2), supporting the EKC hypothesis.

However, we cannot directly compare the coefficients of the ESG variable from the 2SLS and 3-step approaches because the interaction effect is modelled differently in the 3-step approach. In conclusion, both the 2SLS and 3-step approaches highlight the importance of culture and ESG practices in environmental quality. The 3-step approach offers a more complete picture by capturing the interaction effect, but it requires further analysis with detailed cultural dimension information. Both approaches potentially face endogeneity issues (unobserved factors influencing ESG practices and pollution).

## 5. Discussion

### 5.1. Importance Of Findings

The importance of these analyses lies in their potential to improve the effectiveness of ESG practices in achieving environmental sustainability. The findings from the analysis using both the 2SLS and 3-step approaches hold significance for several reasons. By highlighting the practical implications of current approaches and emphasizing the need for cultural sensitivity and demonstrably positive environmental outcomes, these findings can guide all stakeholders towards a more robust and impactful path towards environmental well-being.

### 5.2. Hypothesis Tests

Main Hypothesis (based on the original 3-step approach):

1. EKC Hypothesis: We confirm the EKC hypothesis. First, there's a positive relationship between GDP and CO2 emissions in the initial stage. As economies develop, CO2 emissions decreases due to factors like increased green technological advancement.
2. ESG-EKC Dynamic: Secondly, there's a negative relationship between GDP and CO2 emissions as GDP increases. We track this by squaring the GDP variable and interpreting the sign and magnitude of its coefficient.
3. Culture Effect: There is a significant interaction effect between cultural dimensions and ESG practices on environmental quality. In other words, the impact of ESG practices on environmental pollution varies depending on a country's specific cultural context. Specifically, we found that uncertainty avoidance can make it harder for good company practices (ESG) to reduce CO2 emissions.

Robustness Analysis (based on the 2SLS approach):

- The coefficient for ESG is negative and statistically significant. This confirms that there is a significant negative relationship between ESG score and CO2 Emissions, after accounting for potential endogeneity issues.

### 5.3. Cultural Effects

Uncertainty Avoidance:

The statistically significant negative coefficient for UAI in the 3-step approach suggests a direct negative relationship between Uncertainty Avoidance and CO2 emissions. Countries with higher Uncertainty Avoidance might have lower CO2 emissions, potentially due to being stricter with their policies and environmental regulations. However, the interactive term found that strong ESG practices in these countries do not help mitigate risks associated with

environmental degradation. The conclusion that in countries with higher uncertainty avoidance (UAI), the influence of ESG practices on reducing CO<sub>2</sub> emissions is less pronounced can be understood through several socio-cultural, economic, and organizational perspectives.

In countries where people really like to play it safe and avoid risks, they usually like things to stay the same and be predictable. These places might not be too keen on making big changes or trying new things, especially when it comes to strict environmental rules. Because of this, they might take longer to start doing these good environmental actions, or they might not do them as well, which means they won't help reduce air pollution as much. In these countries, people are serious about following the rules they already have. This is good for making sure they do what the environmental laws say, but it can also make them not want to do extra good things for the environment that aren't required, especially if they think these things could shake things up or be a gamble.

Furthermore, starting good environmental habits usually costs money right away and needs long-term spending. In countries where people are careful and don't like taking chances, companies and the government might not want to spend this money because they're worried that they won't get it back. This means they might not be very quick or eager to start these good habits. Companies in these careful countries often stick to what they know works instead of trying out new and better ways to help the environment. This careful approach can make them slow to use new technologies that could really help cut down on air pollution.

Individualism vs. Collectivism:

Individualistic cultures emphasize personal achievement and responsibility. This could lead to a stronger sense of environmental stewardship, with individuals taking initiative to protect the environment. Also, individualistic cultures might be more receptive to market-based solutions for environmental issues, such as carbon pricing or green certifications. These solutions incentivize individuals to make environmentally conscious choices.

Power Distance:

Cultures with high power distance have a clear hierarchy and respect authority. This can lead to less emphasis on environmental concerns if not prioritized by leadership. Environmental regulations or initiatives might be less effective if not actively championed by powerful figures.

Long-Term vs. Short-Term Orientation:

Cultures with a strong long-term orientation emphasize future planning and delayed gratification. This translates well to environmental sustainability, as strong ESG practices often require long-term investments and sacrifices in the short term for long-term environmental

benefits. Companies in such cultures might be more willing to invest in sustainable practices because they value the future well-being of the planet and society.

Indulgence vs. Restraint:

Cultures that value indulgence encourage enjoyment of life and focus on well-being. This could translate to a concern for environmental quality, as a healthy environment is essential for a good quality of life. Companies in such cultures might be more responsive to consumer demands for sustainable products and services, leading to better ESG practices.

#### **5.4. Practical Implications**

Traditionally, environmental sustainability efforts have focused on technological advancements and regulations. This research highlights the importance of cultural aspects in shaping a nation's environmental approach. Understanding how cultural values influence ESG practices can help develop targeted strategies for different regions. The finding that uncertainty avoidance moderates the ESG-EKC relationship has some practical implications for policymakers, businesses, and researchers working towards environmental sustainability:

Policymakers:

This study demonstrates that cultural values, particularly uncertainty avoidance, play a crucial role in how countries respond to environmental challenges. Considering how comfortable a country is with uncertainty can make environmental policies work better. In places where people don't like uncertainty, leaders might focus on rules or rewards that support good ESG actions and environmental objectives. This could mean more teamwork and quicker cuts in emissions. Knowing what a culture values can shape environmental rules that people agree with more. For example, talking about lowering risks or the good things that will come in the long run might work better in places where people really want to avoid uncertainty.

Businesses:

Companies in countries where people prefer to avoid uncertainty can use their good ESG practices to stand out from the competition. In these places, both investors and customers might prefer companies that are strong on environmental issues. Making ESG a key part of a company's plan can improve its image and its ability to work in society. Customized Approaches to Being Green: Companies can adjust their green plans to fit the culture they're in. In places where people really want to avoid uncertainty, putting an emphasis on eco-friendly technology and being open about environmental efforts can be especially important. It reinforces the notion that environmental responsibility isn't just about ethics; it can lead to tangible benefits like reduced pollution and potentially lower environmental compliance costs.

Researchers:

This research shows that it's important to think about cultural aspects when looking at environmental issues. It suggests that future studies should investigate how different cultural beliefs might affect economic growth and green policies. Scientists can make better models that consider how culture affects the way people treat the environment. This could help make predictions more accurate and give policymakers better advice. The study also shows that being aware of how comfortable people are with uncertainty can help the environment. If we take culture into account, those who make policies, run businesses, and do research can come up with strategies that work well for various groups and help cut down CO2 emissions more effectively.

## 6. Conclusion

### 6.1. Summary Of Findings

This thesis investigated the potential moderating effect of uncertainty avoidance, representing national culture, on the relationship between ESG performance and CO2 emissions of countries, considering the EKC hypothesis. The interaction term between ESG and UAI was included in the third block of the 3-step model to assess whether the effect of ESG on CO2 varies depending on the level of UAI ('Interaction (Statistics)', 2023)(Wikipedia). The findings highlight the significance of cultural context in achieving environmental sustainability. Specifically, we found that uncertainty avoidance can make it harder for good company practices (ESG) to reduce CO2 emissions.

The second approach investigated the direct effect of culture on ESG ratings of countries and the relationship between ESG practices and environmental quality, using Cultural dimensions as instrumental variables, then GDP and Average Temperature as control variables. It found that there is a significant negative relationship between ESG score and CO2 emissions, and the instrumental variables (cultural dimensions) help to isolate this effect by addressing potential endogeneity.

### 6.2. Contribution To Existing Knowledge

Moderating Effect of Uncertainty Avoidance:

This study provides novel evidence for the moderating effect of uncertainty avoidance on the ESG-EKC dynamic. Existing research on the EKC hypothesis primarily focuses on economic factors. This thesis expands the current understanding by demonstrating that cultural values can significantly influence how economic development and ESG practices translate into CO2 emissions. By incorporating cultural dimensions, this thesis contributes to refining the EKC framework. Traditionally focused on economic development, the EKC model can now be expanded to account for the influence of cultural values on environmental outcomes. This allows for a more comprehensive understanding of the complex dynamics at play in achieving environmental sustainability.

Cultural Sensitivity in Environmental Strategies:

The findings highlight the importance of cultural sensitivity when designing environmental policies and business strategies. Considering cultural contexts, particularly uncertainty avoidance, allows for more targeted approaches that resonate better with different populations, potentially leading to greater cooperation and faster emission reductions.

Enhanced ESG Performance and Emissions Reduction:

The study reinforces the positive association between strong ESG performance and lower CO<sub>2</sub> emissions. This adds further evidence to the growing body of knowledge that demonstrates the environmental benefits of integrating ESG practices into corporate strategies.

Feature Selection:

The plotting of a correlation matrix to identify the most relevant cultural dimension (uncertainty avoidance) to include in the third block of the 3-step approach is a valuable contribution to ensure a parsimonious model. This approach demonstrates a data-driven method for selecting the most impactful cultural factor, potentially leading to more focused and efficient research efforts.

### **6.3. Limitations And Future Research**

Replication with larger and more diverse datasets is recommended for generalizability. We suggest using bigger and more varied sets of data to make sure our results apply to more situations. Our research helps us better understand how people's cultural beliefs influence the way they act towards the environment. This knowledge is useful for those making policies, companies, and global groups that are trying to create a greener world.

Limitations:

The study employs a cross-sectional design, which establishes a correlation between uncertainty avoidance, ESG performance, and CO<sub>2</sub> emissions at a single point in time. It cannot definitively determine the direction of causality. If we want to analyse the temporal dynamics and how the relationship between ESG scores, CO<sub>2</sub> emissions, and GDP changes over time, having only a single ESG value for each country might limit our ability to capture the temporal variations in ESG performance. Examining trends in ESG performance, CO<sub>2</sub> emissions, and potentially cultural dimensions (if they vary) over a period of years. Also, panel data analysis can account for unobserved country-specific factors that might influence the results. With specific techniques, panel data allows for exploring causal relationships between variables to a greater extent than a cross-sectional analysis.

The limitations of the temperature data variable used is acknowledged. The analysis might not fully capture the complex relationship between temperature and CO<sub>2</sub> emissions. Ideally, the data should consider factors like temperature variation throughout the year or specific industry-related energy consumption patterns influenced by temperature. The study might also be limited by the availability and quality of data for sovereign ESG performance,

Hofstede's cultural dimensions, and CO2 emissions. Data inconsistencies or missing values could affect the analysis.

Future Research:

While the study highlights the role of uncertainty avoidance, other cultural dimensions from Hofstede's framework or alternative cultural frameworks might also influence the ESG-EKC relationship. Further research could explore these possibilities. Replicate the study using different datasets and cultural frameworks to assess the generalizability of the findings. Explore how other cultural dimensions or regional variations interact with the ESG-EKC relationship. Utilize more comprehensive temperature data that considers seasonal variations or industry-specific energy consumption patterns to better understand the temperature-CO2 emissions relationship.

The part about limits of this cross-sectional analysis is a crucial point. Future research might employ longitudinal studies or causal inference techniques to explore these relationships further. Conduct longitudinal studies to investigate the causal relationships between uncertainty avoidance, ESG practices, and CO2 emissions over time. This would allow for a more robust understanding of cause-and-effect dynamics.

The study relies on national-level data, which might not capture the differences of cultural variations within countries. Future research could consider sub-national data to gain a deeper understanding of cultural influences at a more granular level. Employ qualitative research methods like interviews or focus groups to gain deeper insights into how cultural values influence environmental decision-making and policy preferences at individual and organizational levels. Design research to explore the specific psychological or behavioural mechanisms through which uncertainty avoidance strengthens the effect of ESG performance on CO2 emissions. This could involve investigating risk perception, trust in institutions, or long-term planning mindsets in different cultures.

By addressing these limitations and pursuing future research avenues, we can gain a more comprehensive understanding of the complex interplay between cultural values, economic development, environmental practices, and CO2 emissions. This knowledge can inform the development of more effective and culturally sensitive strategies for achieving long-term environmental sustainability.

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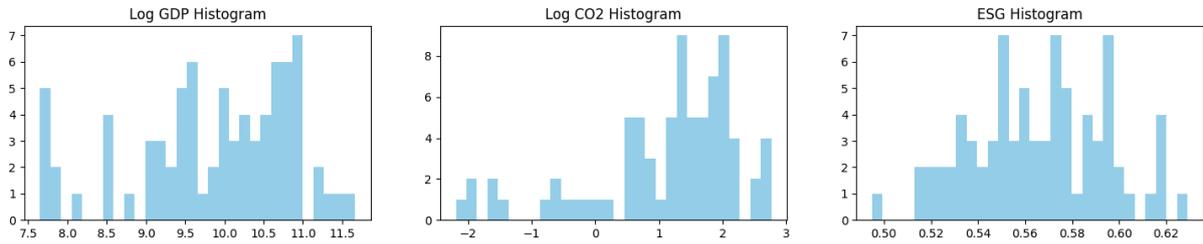
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**APPENDIX**

**Log\_GDP, Log\_CO2 Emission, and ESG Histogram and Box Plot Charts:**



**Skewness Results:**

|                            | <b>Skewness</b> | <b>P-value</b> |
|----------------------------|-----------------|----------------|
| <b>ESG</b>                 | -0.006          | 0.864          |
| <b>GDP</b>                 | 1.263           | 0.0            |
| <b>Log of GDP</b>          | -0.654          | 0.001          |
| <b>CO2 emission</b>        | 1.133           | 0.0            |
| <b>Log of CO2 emission</b> | -1.151          | 0.001          |

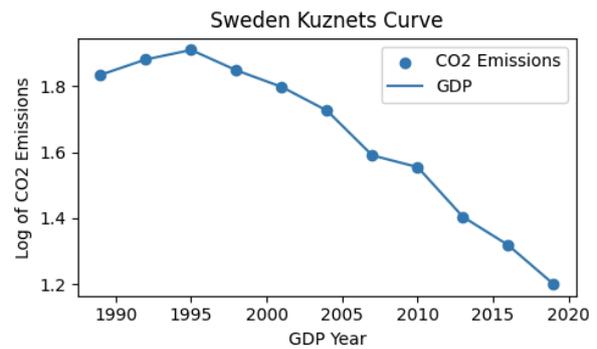
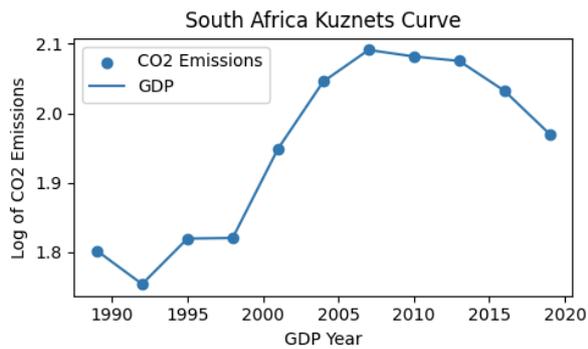
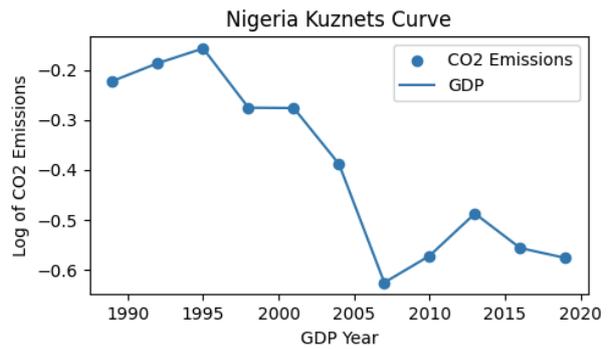
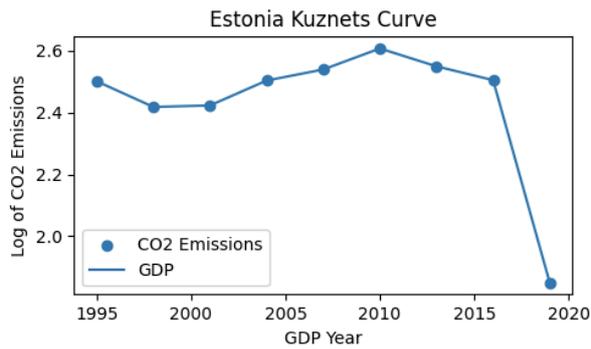
**Merged Dataset Description:**

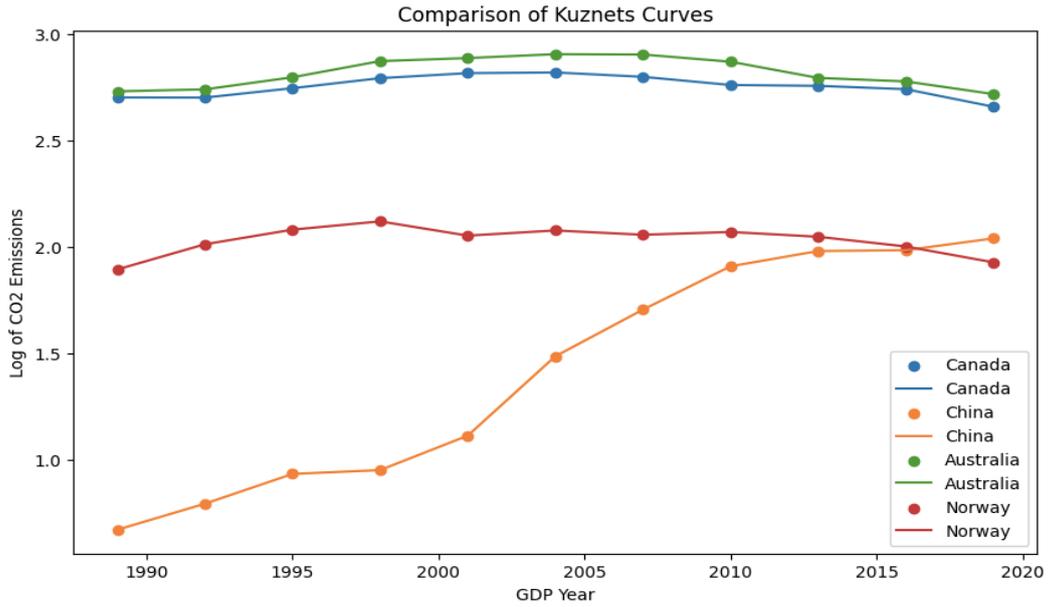
|              | <b>Year</b> | <b>log_gdp</b> | <b>log_co2</b> | <b>ESG</b> | <b>PDI</b> | <b>IDV</b> | <b>UAI</b> | <b>LTO</b> |
|--------------|-------------|----------------|----------------|------------|------------|------------|------------|------------|
| <b>COUNT</b> | 2018        | 78             | 78             | 78         | 78         | 78         | 78         | 78         |
| <b>MEAN</b>  |             | 9.87           | 1.11           | 0.57       | 57.94      | 44.44      | 67.92      | 48.00      |
| <b>STD</b>   |             | 1.02           | 1.16           | 0.03       | 18.59      | 19.73      | 23.38      | 21.03      |
| <b>MIN</b>   |             | 7.65           | -2.19          | 0.50       | 11.00      | 6.00       | 8.00       | 13.00      |
| <b>MAX</b>   |             | 11.67          | 2.76           | 0.63       | 104.00     | 90.00      | 112.00     | 88.00      |

**Correlation Matrix Between Cultural Dimensions and Sovereign ESG Data:**

|     | ESG   | PDI   | IDV   | UAI   | LTO   |
|-----|-------|-------|-------|-------|-------|
| ESG | 1.00  | -0.45 | 0.42  | -0.01 | 0.38  |
| PDI | -0.45 | 1.00  | -0.66 | 0.22  | -0.03 |
| IDV | 0.42  | -0.66 | 1.00  | -0.19 | 0.14  |
| UAI | -0.01 | 0.22  | -0.19 | 1.00  | -0.04 |
| LTO | 0.38  | -0.03 | 0.14  | -0.04 | 1.00  |

**Kuznet Curves Of More Countries:**





```
combined_df.describe().round(2)
```

|              | year   | gdp       | co2   | temp  | esg   | pdi    | idv   | mas   | uai    | lto   | ivr   | log_gdp | log_co2 | log_temp |
|--------------|--------|-----------|-------|-------|-------|--------|-------|-------|--------|-------|-------|---------|---------|----------|
| <b>count</b> | 78.0   | 78.00     | 78.00 | 78.00 | 78.00 | 78.00  | 78.00 | 78.00 | 78.00  | 78.00 | 78.00 | 78.00   | 78.00   | 77.00    |
| <b>mean</b>  | 2018.0 | 28906.38  | 4.78  | 16.84 | 0.57  | 57.94  | 44.44 | 48.53 | 68.17  | 44.53 | 45.51 | 9.87    | 1.11    | 2.72     |
| <b>std</b>   | 0.0    | 23467.92  | 3.77  | 7.81  | 0.03  | 18.59  | 19.73 | 15.96 | 19.95  | 21.05 | 20.19 | 1.02    | 1.16    | 0.54     |
| <b>min</b>   | 2018.0 | 2098.90   | 0.11  | -2.76 | 0.50  | 11.00  | 6.00  | 5.00  | 8.00   | 4.00  | 0.00  | 7.65    | -2.19   | 0.95     |
| <b>25%</b>   | 2018.0 | 11725.45  | 1.87  | 10.45 | 0.55  | 47.50  | 30.00 | 43.00 | 61.00  | 27.25 | 30.25 | 9.37    | 0.63    | 2.35     |
| <b>50%</b>   | 2018.0 | 23150.09  | 4.08  | 17.20 | 0.57  | 59.33  | 45.17 | 49.27 | 67.64  | 45.24 | 45.39 | 10.05   | 1.41    | 2.88     |
| <b>75%</b>   | 2018.0 | 42416.06  | 6.88  | 23.75 | 0.59  | 67.75  | 58.00 | 55.75 | 82.00  | 60.75 | 61.25 | 10.66   | 1.93    | 3.17     |
| <b>max</b>   | 2018.0 | 116498.51 | 15.87 | 29.43 | 0.63  | 104.00 | 90.00 | 95.00 | 112.00 | 88.00 | 97.00 | 11.67   | 2.76    | 3.38     |

```
combined_df['log_gdp'] = np.log(combined_df['gdp'])
combined_df['log_co2'] = np.log(combined_df['co2'])
combined_df['log_temp'] = np.log(combined_df['temp'])
combined_df.head().round(2)
```

/usr/local/lib/python3.11/site-packages/pandas/core/arraylike.py:396: RuntimeWarning: invalid value encountered in log  
 result = getattr(ufunc, method)(\*inputs, \*\*kwargs)

|          | country   | year   | gdp      | co2   | temp  | esg  | pdi   | idv   | mas   | uai   | lto  | ivr   | log_gdp | log_co2 | log_temp |
|----------|-----------|--------|----------|-------|-------|------|-------|-------|-------|-------|------|-------|---------|---------|----------|
| <b>0</b> | Albania   | 2018.0 | 13498.25 | 1.85  | 12.72 | 0.57 | 59.33 | 45.17 | 49.27 | 67.64 | 61.0 | 15.00 | 9.51    | 0.62    | 2.54     |
| <b>1</b> | Algeria   | 2018.0 | 12007.77 | 3.92  | 24.45 | 0.52 | 59.33 | 45.17 | 49.27 | 67.64 | 26.0 | 32.00 | 9.39    | 1.37    | 3.20     |
| <b>2</b> | Argentina | 2018.0 | 23294.10 | 3.98  | 15.51 | 0.55 | 49.00 | 46.00 | 56.00 | 86.00 | 20.0 | 62.00 | 10.06   | 1.38    | 2.74     |
| <b>3</b> | Armenia   | 2018.0 | 13549.52 | 2.01  | 6.22  | 0.56 | 59.33 | 45.17 | 49.27 | 67.64 | 61.0 | 45.39 | 9.51    | 0.70    | 1.83     |
| <b>4</b> | Australia | 2018.0 | 50251.34 | 15.87 | 23.08 | 0.56 | 38.00 | 90.00 | 61.00 | 51.00 | 21.0 | 71.00 | 10.82   | 2.76    | 3.14     |

```

... #merge all dataframes
dfs = [filtered_by_year_gdp_co2, filtered_by_year_temp, esg, cul]
combined_df = reduce(lambda left, right: pd.merge(left, right, on='country'), dfs)
for col in combined_df.columns[1:]:
    combined_df[col] = pd.to_numeric(combined_df[col], errors='coerce')

#sort values and reset index in-place
combined_df.sort_values('country', inplace=True)
combined_df.reset_index(drop=True, inplace=True)

#output
combined_df.head(5).reset_index(drop=True).round(2)

```

|   | country   | year   | gdp      | co2   | temp  | esg  | pdi   | idv   | mas   | uai   | lto  | ivr   |
|---|-----------|--------|----------|-------|-------|------|-------|-------|-------|-------|------|-------|
| 0 | Albania   | 2018.0 | 13498.25 | 1.85  | 12.72 | 0.57 | 59.33 | 45.17 | 49.27 | 67.64 | 61.0 | 15.00 |
| 1 | Algeria   | 2018.0 | 12007.77 | 3.92  | 24.45 | 0.52 | 59.33 | 45.17 | 49.27 | 67.64 | 26.0 | 32.00 |
| 2 | Argentina | 2018.0 | 23294.10 | 3.98  | 15.51 | 0.55 | 49.00 | 46.00 | 56.00 | 86.00 | 20.0 | 62.00 |
| 3 | Armenia   | 2018.0 | 13549.52 | 2.01  | 6.22  | 0.56 | 59.33 | 45.17 | 49.27 | 67.64 | 61.0 | 45.39 |
| 4 | Australia | 2018.0 | 50251.34 | 15.87 | 23.08 | 0.56 | 38.00 | 90.00 | 61.00 | 51.00 | 21.0 | 71.00 |

```

1... # Load and preprocess culture data
cul = pd.read_csv('culture.csv')
cul.replace(['#NULL!', ''], np.nan, inplace=True)
cul_numeric = cul.iloc[:, 1:]
cul_numeric = cul_numeric.apply(pd.to_numeric, errors='coerce')
cul_numeric.fillna(cul_numeric.mean(), inplace=True)
cul = pd.concat([cul.iloc[:, 0], cul_numeric], axis=1)

cul.head(5).reset_index(drop=True).round(2)

```

|   | country     | pdi   | idv   | mas   | uai   | lto   | ivr  |
|---|-------------|-------|-------|-------|-------|-------|------|
| 0 | Africa East | 64.00 | 27.00 | 41.00 | 52.00 | 32.00 | 40.0 |
| 1 | Africa West | 77.00 | 20.00 | 46.00 | 54.00 | 9.00  | 78.0 |
| 2 | Albania     | 59.33 | 45.17 | 49.27 | 67.64 | 61.00 | 15.0 |
| 3 | Algeria     | 59.33 | 45.17 | 49.27 | 67.64 | 26.00 | 32.0 |
| 4 | Andorra     | 59.33 | 45.17 | 49.27 | 67.64 | 45.49 | 65.0 |

```

1... filtered_by_year_gdp_co2 = filter_by_year(process_df(df), 2018)
filtered_by_year_gdp_co2.head(5).reset_index(drop=True).round(2)

```

|   | country    | year   | gdp              | co2               |
|---|------------|--------|------------------|-------------------|
| 0 | Argentina  | 2018.0 | 23294.0986752419 | 3.97565074444479  |
| 1 | Australia  | 2018.0 | 50251.3353381469 | 15.8657135218488  |
| 2 | Austria    | 2018.0 | 56937.944282984  | 7.14114021108032  |
| 3 | Bangladesh | 2018.0 | 5247.69469583125 | 0.586157624560863 |
| 4 | Belgium    | 2018.0 | 52530.5620821347 | 8.18436667928584  |

```

>... esg = pd.read_csv('esg.csv')
esg.replace('..', np.nan, inplace=True)
for column in esg.columns:
    if esg[column].dtype == np.float64 or esg[column].dtype == np.int64:
        esg[column].fillna(esg[column].mean(), inplace=True)

esg.head(5).reset_index(drop=True)

```

```

>...

```

|   | country     | esg   |
|---|-------------|-------|
| 0 | Sweden      | 0.629 |
| 1 | Iceland     | 0.620 |
| 2 | Norway      | 0.619 |
| 3 | Switzerland | 0.617 |
| 4 | Finland     | 0.616 |

```

>9... temp = pd.read_csv('temp.csv')
filtered_by_year_temp = temp[['country', '2018']]
filtered_by_year_temp.rename(columns={'2018': 'temp'}, inplace=True)
filtered_by_year_temp.head(5).reset_index(drop=True)

```

/var/folders/26/yt\_69wjn12d1w70sbcy xv3gw0000gn/T/ipykernel\_3  
A value is trying to be set on a copy of a slice from a Data

See the caveats in the documentation: <https://pandas.pydata.org/pandas-docs/stable/10min/boolean-indexing-a-view-versus-a-copy.html>

```

filtered_by_year_temp.rename(columns={'2018': 'temp'}, inplace=True)

```

```

>9...

```

|   | country         | temp  |
|---|-----------------|-------|
| 0 | Aruba (Neth.)   | 26.87 |
| 1 | Afghanistan     | 12.63 |
| 2 | Angola          | 23.19 |
| 3 | Anguilla (U.K.) | 26.50 |
| 4 | Albania         | 12.72 |

## Resümee

### KULTUURI ROLL KESKKONNA-, SOTSIAAL- JA VALITSEMISTAVADE NING KUZNETSI KESKKONNAKÕVERA SEOSE VAHENDAMISEL: RIIKIDEÜLENE PERSPEKTIIV

Franklin Izuchukwu Chukwuemeka

Meie planeet seisab silmitsi enneolematute keskkonnaprobleemidega, nagu kliimamuutused ja loodusressursside ammendumine. Säästva arengu saavutamiseks on tarvilik tasakaalustada majanduskasvu ja keskkonnakaitset. Keskkonna Kuznetsi kõver (environmental Kuznets curve, edaspidi EKC) kirjeldab mittelineaarset seost majanduskasvu ja keskkonnareostuse vahel: madala tulutaseme juures suureneb keskkonnareostus koos majanduskasvuga, kuid jõudes kõrgemale sissetulekute tasemele, hakkab reostus vähenema. EKC mudel ei arvesta seejuures aga kultuuriga, mis võib oluliselt mõjutada keskkonna-, sotsiaal- ja ärijuhtimistavade (Environmental, Social, Governance, ESG) tõhusust. Käesolev väitekirjandus uurib, kuidas kultuur mõjutab riigi ESG tegevuse ja keskkonna kvaliteedi vahelist seost. Vaatamata kasvavale huvile ESG vastu puudub selge arusaam sellest, kuidas kultuurilised tegurid kujundavad ESG mõju keskkonnaseisundi halvenemisele. EKC pakub küll üldise raamistikku, kuid kultuuri rolli selle seose kujundamisel on endiselt vähe uuritud.

Magistritöoga loodeti esmalt saada kinnitust keskkonna Kuznetsi kõvera hüpoteesile, kus per capita SKP ja CO<sub>2</sub> heitmete vahel on alguses positiivne, seejärel SKP edasise kasvamisel negatiivne seos. Lisaks oletame olulise koostoime efekti esinemist kultuurimõõdikute ja ESG praktikate vahel keskkonna kvaliteedi osas, s.t. ESG tavade omaksvõtmine on eeldatavalt vähem tõhus CO<sub>2</sub> heitmete vähendamisel kultuurides, kus suhtutakse sallivamalt ebakindluse tulevikus suhtes. Käesolev uuringu eesmärk on niisiis hinnata kultuuriliste aspektide integreerimise mõju ESG strateegiatesse.

Uurimuses rakendatakse riikideülest analüüsi, milleks kasutatakse riikide ESG indeksit, Hofstede'i kultuuridimensioonide andmeid ning Maailmapanga andmeid SKP ja CO<sub>2</sub> kohta 2018. aastast. Empiirilises analüüsis kasutati astmelist hierarhilist regressiooni, tuvastamaks kahe erineva lähenemisviisiga seda, kas riigi kultuur mõjutab riigi keskkonna- ja majandustulemuste vahelist seost. Esiteks kasutame 3-astmelise mudeli lähenemist, kus alustame sellest, kuidas riigi sissetulek on seotud CO<sub>2</sub> emissioonidega, kontrollimaks EKC hüpoteesi kehtivust. Seejärel lisame mudelisse riikide keskkonnahinnangu (ESG-reitingu) ja

keskmise temperatuuri näitajad (viimane aitab kontrollida temperatuuri otsest mõju CO<sub>2</sub>-heitele), nägemaks, kas see muudab saastamise mustreid. Lõpuks lisame mudelisse kultuurilise mõõdiku suhtumisest ebakindlusele antud riigis (kultuuris), et näha, kas viimane muudab ESG seost reostamisega.

Seejärel proovime kahe-etapilise vähimruutude meetodi lähenemist. Selle seose analüüsimine võimaldab esmalt selgelt mõista ESG praktikate kasutusele võtmise kultuurilist alust. Kasutades kultuuri mõõdikuid instrumentidena, saame hinnata ESG mõju CO<sub>2</sub> heitkogustele, vähendades samal ajal 3-etapilist lähenemist vaevanud võimalike endogeensuse probleemide põhjustatud hinnangute nihet.

Tulemused kinnitavad EKC hüpoteesi nii visuaalselt kui ka läbi korrelatsiooni- ja regressioonianalüüside. Tulemuste tõlgendamisel keskendub töö sellele, kuidas kultuur mõjutab ESG-EKC seost ja kas empiiriline tõendusmaterjal toetab püstitatud hüpoteese. Järgnenud diskussioonis analüüsitakse empiirilise analüüsi tulemusi, uurides kultuuri dimensioonide mõju keskkonna halvenemisele ja riikide potentsiaali viia jätkusuutlikke tavasid kooskõlla oma kultuurilise identiteediga.

Kokkuvõttes leidsime, et 3-etapilise mudeli lähenemise tulemuste põhjal võib ebakindluse vältimine raskendada heade ESG tavade abil CO<sub>2</sub> heitkoguste vähendamist. Lisaks leidsime 2SLS mudelis, et ESG skoori ja CO<sub>2</sub> heitkoguste vahel on oluline negatiivne seos ning instrumentmuutujad (kultuuri mõõdikud) aitavad seda mõju isoleerida ja tuvastada, lahendades 3-etapilisest mudelist tuleneva potentsiaalse endogeensuse. Need uurimistöö tulemused võivad anda poliitikakujundajatele ja ettevõtetele teavet ESG strateegiate kohandamiseks konkreetsete kultuuriliste kontekstidega, mis viib paremate keskkonnavalaste tulemusteni. See uurimus annab panuse ka akadeemilisse diskussusesse, käsitledes kirjanduses esinevat uurimislünka ja luues pretsedendi tulevastele keskkonnaökonomika ja kultuuridevahelise juhtimise uuringutele.

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