

CULTURALLY GREEN – AN INVESTIGATION INTO THE CULTURAL DETERMINANTS OF ENVIRONMENTAL PERFORMANCE

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ABSTRACT

The paper investigates the links between cultural dimensions and environmental performance at a national level, aiming to identify key aspects of this relationship, including information that could be useful for further research regarding a potential causal relation and that may enable a more effective and efficient culturally-adapted public policy design and implementation process. The research employs a quantitative methodological approach and uses data resulting from Hofstede's cultural model and the 2018 Environmental Performance Index as inputs, finding evidence supporting the hypothesis of a relevant influence operating between the cultural dimension of individualism (as cause) and environmental performance (as effect).

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Introduction

In the last couple of decades, environmental issues have become – despite isolated setbacks generated by shifts in vision at national administration level (most notably, the USA under Donald Trump) – increasingly visible on the political agenda and have galvanised civil and political powers into action.

This paper focuses on the connection between national cultural dimensions and environmental performance. For this purpose, we will rely on data originating in the works of Dutch sociologist Geert Hofstede and his collaborators (Hofstede, 1980a, 1980b, 2001, 2011; Hofstede et al., 2010) and in the 2018 Environmental Per-

formance Index (EPI) (Yale Center for Environmental Law & Policy, 2018). While the former set out what is perhaps the most complete and widely cited academic cultural model (Ferreira, Ribeiro Serra and Pinto, 2014), the latter has – even if in the presence of some criticism (Jones, 2007; Sřndergaard, 1994) – become “a standard bearer for comparing and tracking country performance” (Hsu and Zomer, 2016) in this field and provides a general overview regarding national status on environmental policy goals (Onel and Mukherjee, 2014), thus constituting an appropriate source for this study.

The EPI report is a yearly ranking produced by environmental research centres within Yale and Columbia universities (in collaboration with the World Economic Forum), which encompasses data on 180 countries and calculates their environmental performance score by taking into consideration 24 performance indicators across 10 categories that cover the topics of environmental health and ecosystem vitality (Yale Center for Environmental Law & Policy, 2018). As the report argues, these two fundamental dimensions of sustainable development, namely environmental health (which is positively influenced by economic growth and prosperity) and ecosystem vitality (which is negatively affected by industrialisation and urbanisation) have a tense relationship, and it is up to good governance to ensure a balance between them (Yale Center for Environmental Law & Policy, 2018). In this context, as an extensive analysis of the relevant literature reveals that national culture has a significant influence on public policy (Daniell, 2014), it is the express objective of this study to investigate the connections between national cultural dimensions and environmental performance, aiming to provide valuable inputs regarding the design and implementation of culturally adapted public policies that may more effectively and efficiently address environmental issues at a national level.

After analysing existing literature, the paper lays out, in distinct sections, the hypotheses of the study and the methodology that is to be used, including the test of six assumptions concerning the validity and reliability of the regression analysis performed. The last two sections, namely the Results and Discussion and the Conclusion sections, analyse the results of the research and put them in context with the findings of previous papers and, respectively, provide a short summary of the main findings.

1. Literature review

The concept of sustainable development is rooted in the 1987 Brundtland Report suggestively entitled *Our Future*, which defines it as that kind of “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987), and ever since then has been the subject of both academic and political debate regarding the ways in which present economic growth and long-term environmental protection should be approached.

Focusing on the functions of cultural characteristics for the sustainable development process, although academic research has devoted only limited attention to studying this topic, the existing research identifies relevant connections that warrant further analysis. More precisely, a study on 74 countries categorised in three regional sub-samples (Europe; Middle East and Africa; and Asia and Oceania) identifies the fact that the Hofstedian dimension of indulgence exhibits a negative effect on environmental performance in the case of the full 74-country sample, while long-term orientation, individualism and uncertainty avoidance affect one or more of the three sub-samples (Halkos and Zisiadou, 2018). Interestingly, besides the fact that these cultural influences are not present in all sub-samples or, with the exception of indulgence, in the full sample, the cultural dimensions of uncertainty avoidance and individualism induce different influences on environmental performance in Europe (negative) and Asia and Oceania (positive), and, respectively, Asia and Oceania (positive) and Middle East and Africa (negative) (Halkos and Zisiadou, 2018), suggesting that other factors interfere in this relationship. The existence of a national culture – environmental performance relationship

is also reported by Peng and Lin, who show that, along with economic development and national growth, culture plays a determinant role in shaping environmental performance (Peng and Lin, 2009).

Another highly relevant study is that of Onel and Mukherjee (2014), who focus on the relationship between cultural dimensions and environmental health performance within a sample of 67 countries, concluding that individualism and uncertainty avoidance exert a significant influence on environmental health, although the relationships weaken in a model in which human development variables (*i.e.* life expectancy at birth, education, and income) are introduced.

Similarly, the role of culture in environmental sustainability is highlighted by other research which shows that cultural and environmental sustainability measures are significantly multidimensionally related (Park et al., 2007), or that environmental sustainability cannot be analysed by focusing solely on economic causes, as national cultural dimensions exert a significant effect that must not be omitted (Husted, 2005).

As Packalén (2010) notices, the fact that cultural dimensions have played a limited role in the sustainability debate represents an obstacle to bringing about durable policies in the future. Sustainable development has an important cultural component that complements its technical, economic and legal characteristics (Packalén, 2010), as attributes of national culture were found to be related to a series of values, beliefs, practices and behaviours that are relevant in the context of sustainability. More precisely, performance-based cultures, *i.e.* those that value uncertainty avoidance, long-term orientation, institutional collectivism or low power distance, are positively correlated with the level of sustainability (Roy and Goll, 2014); the Hofstedian national cultural di-

mension of indulgence is positively related to social progress, with total social expenditure / GDP per capita acting as a transmission channel (Dan, 2017); while the level of individualism and power distance are related to corporate social responsibility (the former relationship is positive, *i.e.* reporting is more prevalent in countries with an individualistic culture, and the latter is negative, *i.e.* reporting is more prevalent in countries with a low power distance level) (Adnan et al., 2018). Moreover, one study aiming to understand sustainability in the context of international business has found that “cultures low in power distance and high in collectivism, femininity, and long-term orientation are likely to hold stronger beliefs about the importance of sustainability, and that cultures high in individualism, masculinity, short-term orientation, and uncertainty avoidance are likely to hold stronger beliefs about the inconvenience of sustainability” (Tata and Prasad, 2015), while cultures that emphasise gender equality are more likely to be involved in sustainable practices (Roy and Goll, 2014). The importance of culture for social responsibility and environmental performance in the corporate world is also highlighted by the significant negative effects on these variables induced by the dimensions of power distance and masculinity (Ringov and Zollo, 2007). Last but not least, culture is important in both the proliferation of sustainability-relevant institutions and the process of conformation to the pressures induced by such institutions (Caprar and Neville, 2012).

All this needs to be interpreted in the context of innovation and competitive advantage, as exhibited on a national level. To this end, we cite the findings of Guo, Wang, Wang and Zhang (2019), who, focusing on a China-centred case study, argue that environmental performance is a significant mediator between environmental and economic performance, with

subsequent managerial and policymaking implications for improving SME performance. Additionally, Chang et al. (2019) find a significant connection between a green organisational identity and green product development performance, thus adding another dimension to the discussion of environmental performance.

Our study departs from the manifestation of the national cultural dimensions as provided by the research of Hofstede and his collaborators (Hofstede, 1980a, 1980b, 2001, 2011; Hofstede et al., 2010), who have defined and measured six cultural dimensions on a national level that are suitable for international comparison. These dimensions are: (1) power distance, *i.e.* the degree to which the less powerful members of a society accept the uneven distribution of power; (2) individualism (as opposed to collectivism), *i.e.* the extent to which members of a given society are integrated into groups; (3) masculinity (as opposed to femininity), *i.e.* how cultures define their preferences, ranging from competition, achievement, heroism, ambition, assertiveness, and success that brings material rewards (masculine values) to cooperation, modesty, caring for the weak and more importance given to quality of life and building consensus (feminine values); (4) uncertainty avoidance, *i.e.* how tolerant members of society are of ambiguity and the unknown and how rigidly they define their codes of belief and behaviour; (5) long-term orientation (as opposed to short-term orientation), *i.e.* the prioritisation of future developments to the detriment of the links with the past and the traditional order; and (6) indulgence (as opposed to restraint), *i.e.* the “relatively free gratification of basic and natural human desires related to enjoying life and having fun” (Hofstede, 2011) in contrast with a restrained attitude that aims to control and regulate these desires through strict social norms.

The cultural dimensions of the Hofstede model are based on over 100,000 questionnaires applied to IBM employees from over 50 countries, thus permitting the analysis of cultural elements specific to each country and revealing correlations that ultimately allowed for the construction of a cultural dimensional index, with values for each dimension ranging from 0 to 100, that are suitable for cross-country comparison (Hofstede, 2011).

2. Presentation of hypotheses and methodological framework

The study aims to test six hypotheses, each linking one of Hofstede's cultural dimensions with environmental performance, as reported by the 2018 Environmental Performance Index. These hypotheses are as follows:

Hypothesis 1: The level of power distance in a country has a negative relationship to the level of environmental performance of that country.

According to Hofstede and his collaborators, power distance measures the degree to which less powerful members of a society accept the uneven distribution of power, being indicative of how societies approach and handle inequality (Hofstede, 2011). Departing from this definition and taking into account the inclusive character of environmental performance and the fact that societies in which power distance is high lack the capacity for debate which is necessary for improving environmental conditions (Hsu and Zomer, 2016), a negative relationship between power distance and the EPI score could exist.

Hypothesis 2: The level of individualism in a country has a positive relationship to the level of environmental performance of that country.

A closer examination of how the cultural dimension is constructed reveals that the “I” focus that characterises this cultural approach is fully compatible with an attitude promoting care for the environment, as long as there is a clear perception that the advantages of environmentally responsible behaviour (or the disadvantages generated by the lack thereof) directly impact the individual, even if a preference for a “loosely-knit social framework” (Hofstede, 1908a) is predominant. This is supported by the findings of Husted (2005), who argues that individualistic societies exhibit an increased capacity to deal with environmental issues. Hence, a positive relation between individualism and environmental performance is expected.

Hypothesis 3: The level of masculinity in a country has a negative relationship to the level of environmental performance of that country.

This hypothesis is based on the fact that societies characterised by the predominance of masculine values, emphasising competition, achievement, heroism and assertiveness at the expense of feminine values such as cooperation, the importance given to the quality of life and caring for the weak (Hofstede, 2011) are less likely to engage in behaviours that would favour environmental targets.

Hypothesis 4: The level of uncertainty avoidance in a country has a positive relationship to the level of environmental performance of that country.

According to Hofstede, societies classified as having a high degree of uncertainty avoidance feel uncomfortable with situations characterised by uncertainty and ambiguity, exhibiting a lack of tolerance towards unorthodox behaviour and ideas (Hofstede, 2011) and manifesting in a tendency to control the environment (Kale and Barnes, 1992). This suggests that uncer-

tainty avoidance could positively impact environmental performance, hence the formulation of hypothesis 4 in the above form.

Hypothesis 5: The level of long-term orientation in a country has a positive relationship to the level of environmental performance of that country.

The long-term orientation dimension is constructed by focusing on whether future developments are prioritised at the expense of the links with the past and the traditional order (Hofstede, 2011). Consequently, a society characterised by a high degree of long-term orientation will tend to be more pragmatic (Hofstede, 2011) and sacrifice present goals for future ones, thus being more likely to engage in behaviours and policies that favour environmental performance.

Hypothesis 6: The level of indulgence in a country has a negative relationship to the level of environmental performance of that country.

Indulgence is defined within the Hofstede cultural model as the “relatively free gratification of basic and natural human desires related to enjoying life and having fun” (Hofstede, 2011), as opposed to restraint, which is marked by a tendency to employ strict social norms in order to control and regulate desires (Hofstede, 2011). This preference of restrained societies (*i.e.* societies with a low level of indulgence) for the regulation and control of basic and natural human desires suggests the possibility of greater environmental performance in such societies, as hypothesised.

From a methodological perspective, the paper employs quantitative research methods in order to investigate the link between a country’s Sustainability Index score and its values according to Hofstede’s cultural dimensions, as provided in the 2018 Environmental Performance Index (Yale

Center for Environmental Law & Policy, 2018) and the papers of Geert Hofstede and his collaborators (Hofstede, 1980a, 1980b, 2001, 2011; Hofstede et al., 2010) respectively. More precisely, the research design takes epistemological recommendations into consideration to analyse both the effect size, as undertaken by means of a Pearson correlation analysis, and the probabilistic elements stemming from the regression analysis, namely the p values of the independent variables (*i.e.*, Hofstede's cultural dimension scores) (Fideler, 2010; Sullivan and Feinn, 2012; Greenland et al, 2016; Coe, 2002.). For the former, we will consider the following correlation intensity classification: values between 0.9 and 1 as corresponding to a very high correlation, between 0.7 and 0.89 to high correlation and between 0.5 and 0.69 to moderate correlation (Zady 2000; Asuero et al., 2006; Taylor, 1990). Levels below 0.5 will not be considered relevant. For the latter, a regression model has been used, with a considered confidence interval of $p \leq 0.05$. Indeed, the double condition is necessary, as the effect size helps understand the magnitude of the differences found, while statistical significance indicates whether the findings are likely to be attributed to chance (Sullivan and Feinn, 2012). Similar methodological approaches are present in other research papers dealing with the connection between cultural characteristics and various independent variables such as tax evasion (Richardson, 2008; Réthi, 2012), corruption (Seleim and Bontis, 2009) or competitiveness (Dan, 2018).

Regarding the dataset in relation to environmental performance, it must be mentioned that, in the context in which the 2018 Environmental Performance Index (EPI) research reports that there is a positive correlation between a country's EPI score and its wealth as investments in infrastructure are dependent on material prosperity (Yale

Center for Environmental Law & Policy, 2018), this paper takes into consideration only those countries with a GDP per capita greater than 15,000 USD as reported by EPI, a threshold that we deem sufficient to filter out those countries whose economic situation hinders the achievement of a minimal level of environment infrastructure investment, thus making the links between environmental sustainability and cultural characteristics harder to identify. Moreover, five countries with incomplete cultural profiles along Hofstede's dimensions were discarded, as the lack of available data would prevent the performance of a complete analysis. The remaining 49 countries are included in the analysis, as visible in Appendix A.

The reliability and validity of the regression analysis is analysed by checking whether six assumptions are met, as follows:

Assumption 1 – Lack of multicollinearity in the data: as indicated by the correlation levels shown in Appendix B, the independent variables are not highly correlated with each other. Also, this is supported by the Variance Inflation Factors ranging between 1.144 and 2.242, thus not indicating correlation levels that could be problematic.

Assumption 2 – No outliers that bias the model: the standardised residual values range between -2.076 and 1.978 and Cook's distance ranges between 0 and 0.135, thus indicating that this assumption is met.

Assumption 3 – Independence of residuals: the Durbin-Watson test reveals a value of 1.807, which is close to 2, thus indicating that this assumption is met.

Assumption 4 – Normal distribution of the residuals: the statistical significance values stemming from the Kolmogorov-Smirnov and Shapiro-Wilk tests are, respectively, 0.2 and 0.636 (above the 0.05 threshold),

suggesting that the normality requirements are met. This result is confirmed by the skewness and kurtosis values (whose ratios to the standard error are -0.29 and -0.99, respectively) and by the normal Q-Q plot, as depicted in Appendix C.

Assumption 5 – Homoscedasticity: the test performed by analysing the scatterplot of the residuals against the dependent variable (Appendix D) shows that this assumption is met.

Assumption 6 – The linearity of the relation between the independent variables and the dependent one: the graphs depicting the relationships between each independent variable and the dependent variable (i.e. the EPI score) suggests the validation of this assumption. The graphs are depicted in Appendix E. Moreover, this is confirmed by an inspection of the scatterplot of the residuals against the dependent variable (Appendix D).

Based on the validation of these assumptions, the analysis will employ a linear OLS regression model in order to analyse the probabilistic elements, in accordance with the double condition described before.

3. Results and discussion

As described in the methodology section, the researchers performed a double quantitative analysis in order to examine the potential effects induced by the manifestation of Hofstede's cultural dimensions on environmental performance.

Firstly, the paper investigates the effect size of the relationship between Hofstede's national cultural dimensions and environmental performance, as reported by the 2018 Environmental Performance Index (Yale Center for Environmental Law & Policy, 2018), by analysing the correspondent correlation levels. The results of this analysis, as shown in Table 1, reveal that the cultural dimensions of power distance and individualism exhibit a level of association that is greater than the threshold values considered. These levels are $r = -0.6267$ and $r = 0.6489$ respectively, indicating that power distance has a negative relationship with environmental performance, while individualism has a positive relationship with it.

Table 1. Correlation levels between the Environmental Performance Index score and Hofstede's cultural dimensions

Power distance	Individualism	Masculinity	Uncertainty avoidance	Long-term orientation	Indulgence
-0.6267	0.6489	-0.0318	-0.2564	0.2281	0.3423

Source: own calculations based on data from Hofstede (2001) and Hofstede, Hofstede and Minkov (2010).

It is, however, necessary for these effect sizes to be doubled by conclusive results stemming from the regression analysis. Consequently, we define the regression equation below.

(1)
where
is the sustainability score of country i ,
is the constant,
is the power distance score of country i ,
is the individualism score of country i ,

is the masculinity score of country i ,
is the uncertainty avoidance score of country i ,
is the long-term orientation score of country i ,
is the indulgence score of country i ,
, , , are the corresponding coefficients of each of the considered cultural dimensions,
is the error of the regression.

The characteristics of the regression are presented in Table 2.

Table 2. Regression analysis: Environmental Performance Index score (dependent variable) and Hofstede's cultural dimensions (independent variables):

	Power distance	Individualism	Masculinity	Uncertainty avoidance	Long-term orientation	Indulgence	Constant
Coefficient	-0.1202	0.1679	-0.0221	0.0429	0.1694	0.1769	48.4939
Standard Error	0.0611	0.0573	0.0428	0.0464	0.0482	0.0592	8.2756
t stat	-1.9669	2.9323	-0.5171	0.9239	3.5116	2.9867	5.8598
p-value	0.0558	0.0054	0.6078	0.3608	0.0011	0.0047	0.0000
	0.6228						

Source: Own calculations based on data from Hofstede (2001), Hofstede, Hofstede and Minkov (2010) and Yale Center for Environmental Law & Policy (2018)

Continuing with the analysis and focusing on the p-values of the variables, one can notice that those of the cultural dimensions of individualism, long-term orientation and indulgence fall within the required $p < 0.01$ interval. However, it is just in the case of individualism that these values are doubled by a relevant effect size, namely a $r = 0.6489$ correlation level with the environmental performance value, thus fulfilling both the required conditions. An important step towards further analysis aimed at determining the existence of a potential causal relation between the two variables is in place, with the level of individualism positively influencing environmental performance, a result which validates our second hypothesis. The other five hypotheses, on the other hand, are not confirmed by the statistical analysis undertaken.

These findings are partially in line with the conclusions of previous studies. More precisely, Halkos and Zisiadou (2018) conclude that individualism positively affects environmental performance in the Asia and Oceania sample, which is consistent with the findings that we report for the entire 49-country sample that was analysed. Also, Onel and Mukherjee (2014) report that individualism has a significant effect on environmental health, which is positively related to environmental performance, as per the construction of the latter, while Husted (2005) shows that individualism positively influences the ability to ad-

dress environmental issues. On the other hand, our results are not consistent with some of the findings of previous research, namely those concluding that environmental performance is influenced by power distance (Peng and Lin, 2009; Park et al., 2007), masculinity (Peng and Lin, 2009; Park et al., 2007) and indulgence (Halkos and Zisiadou, 2018). These dissimilarities in results may be attributed to the differences in the samples; a separate analysis that investigates differences in results in light of the composition of the underlying samples could prove to be useful for identifying other elements that are relevant to the culture-environmental performance relation. Regarding the negative effect of individualism on environmental performance in the Middle East and Africa sample reported by Halkos and Zisiadou (2018), one must underline that the present study includes only three countries from these regions, as the others were filtered out by the lack of available data across all six Hofstedian cultural dimensions or by the GDP per capita threshold, and therefore this difference in results is not conclusive. As for the dissimilarities between our findings and those of Park et al. (2007) - who employ a similar methodological approach but, as mentioned before, report significant relationships between environmental performance and the dimensions of power distance and masculinity while, unlike in this research paper, failing to identify such

a connection with respect to individualism – one must note that two potential sources of these differences can be identified: (1) important differences in the methodology of computing the environmental sustainability scores used by Park et al. (2007) and the environmental performance scores used in our analysis, with the former being constructed on 22 indicators, each of which combines between two and six variables, for a total of 67 underlying variables (World Economic Forum, 2001), while the latter employs 24 performance indicators across 10 categories covering environmental health and ecosystem vitality (Yale Center for Environmental Law & Policy, 2018); and (2) the data used to compute the environmental performance scores (more precisely the scores used by Park, Russel and Lee (2007) were published in 2001 and originate mainly from the 1996-2000 period, with some data going back as far as 1980, while the EPI scores that our analysis is based on derive from data that is mostly from the 2000-2017 period).

A deep comprehension of the culture-environmental performance relationship can be achieved only by analysing it from a multitude of perspectives, covering environmental performance from different time periods and computed using different methodologies (with the latter also being applicable to cultural dimension scores), thus highlighting the need for more extensive academic literature on this subject, a scientific endeavour that our research contributes to. Such an understanding of the culture-environmental performance relationship could prove to have increased utility for developing more effective and efficient environmental public policies, as the cultural adaptation of public policy could allow for a superior allocation of resources, especially in the context in which culture, by definition, endures (Mulholland, 1991) and thus modelling culture would prove to be

a much more difficult and long-lasting task than adapting to it. This should be interpreted in light of the fact that policy design is always dependent on the possibilities offered by a given cultural context (Anderson, 1971) and, that, as Daniell's comprehensive literature review shows, national culture significantly shapes public policy (Daniell, 2014). Moreover, culture is an important factor for both public policy development within countries and policy transfers between countries, thus highlighting the need for more culturally-aware public policies (Daniell, 2014). These findings are confirmed by Meuleman, who shows that governance doctrines need to be culturally adapted and that transfer as 'best practices' from one country to another is not efficient in its absence (Meuleman, 2010). Last but not least, we refer to Steensland's research that identifies multiple mechanisms through which culture can influence policy outcomes (Steensland, 2006). In this context, research on the relationship between national cultural dimensions and environmental performance is important because the success of environmental policies depends on the cultural context in which they are applied; thus an in-depth understanding of this relationship is crucial in order to efficiently adapt environmental policies to the relevant cultural characteristics of a given nation.

Concerning the limitations of the research, we acknowledge that the statistical results regarding the connection between the cultural dimension of individualism and environmental performance only constitute the first step towards an analysis that could indicate a potential causal relation, a piece of evidence that needs to be confirmed by (1) further theoretical studies that employ different methodologies, thus being prone to detecting other effects (statistical or not), and (2) empirical research. We believe that such further studies have the capacity to

add more clarity to the discussion on causation, providing additional details that would shed more light on the correlation-causation transition.

Of particular importance is the endogeneity of the variables issue, the existence of omitted variables, simultaneity and measurement errors being sources of potential inconsistency of the model.

In the case of the omitted variables bias, we highlight the persistent and rigid character of culture, which can be defined as “a set of shared and enduring meanings, values, and beliefs that characterise national, ethnic, or other groups and orient their behaviour” (Mulholland, 1991), or “the collective programming of the mind that distinguishes the members of one group or category of people from others” (Hofstede, 2011). Although this paper does not tap into issues pertaining to cultural formation and the sources of culture, we believe that the abovementioned characteristics of culture make the existence of certain variables that affect both environmental performance and one of the cultural dimension variables (or, alternatively, experiencing correlation between the cultural dimension in question and the error term) less likely, even though this eventuality cannot be completely discarded. A similar argument is brought forth with regards to potential simultaneity, as the structure of culture and environmental performance makes it unlikely that, at least in the short and medium term, the manifestation of national cultural dimensions is determined by environmental performance, although one must acknowledge that, in the long run, the consequences of environmental performance may create conditions that could culturally alter national character.

In the case of the measurement errors, we acknowledge that the conclusions of this paper are highly dependent on the accuracy of its underlying data stemming from

Hofstede’s cultural model (and implicitly the accuracy of the dimensional measurements on a national level) and the environmental performance evaluations provided by the 2018 Environmental Performance Index, and that errors in the measurement of the variables used can potentially cause endogeneity. Consequently, we believe that further research on the relationship between environmental performance and culture should be undertaken by using other cultural measurements and/or models in order to achieve a more accurate picture of this relationship. In this light, we restate that the objective of this paper is to perform the first analytical step in finding those areas of potential causality between the considered variables, and that we recognise that this potential may not be fulfilled due to a number of reasons, including endogeneity issues and that only the predictive function of the model is certain, while causality is, at this stage, only possible. However, we consider that the paper’s findings constitute a notable advancement in the investigation of the complex relationship between environmental performance and culture.

Also, one must note that the data selection process implied discarding the countries with a GDP per capita of lower than 15,000 USD, a threshold that we deemed necessary to filter out those countries whose economic situation hinders the achievement of a minimal level of environment infrastructure investment. We acknowledge the arbitrary nature of this threshold, which is based on the subjective appreciation of the author, but also argue that, in the absence of relevant independent studies aimed at measuring the GDP per capita level at which investment in environmental infrastructure is not heavily blocked by the lack of financial resources, any other threshold would prove to be arbitrary as well. On the other hand, we consid-

er that not eliminating such low-GDP per capita countries from the sample would bias the results of the analysis. That being said, one must concede that the chosen threshold is in itself a potential source of bias, and the results of the study should be validated by performing the analysis on other samples, as soon as more information that would allow for the establishment of a more appropriate threshold is available.

Lastly, it must be noted that a better understanding of the underlying mechanisms that govern the relationship between culture and environmental performance could be facilitated by future studies that extend the analysis to the various categories and subcategories of EPI, designing the investigation to also identify context-specific elements that determine why a given cultural dimension would affect a certain category of EPI and not others, if this would be the case. Moreover, another extension of the study would be to include subjective measurements of environmental performance (as opposed to the objective EPI) and, taking into consideration a similar analysis to that proposed in Erkut (2016a), to determine whether the same relationships to national culture apply.

Conclusions

This study has employed econometric instruments (as described in the methodology section) in order to identify the effects that the six cultural dimensions of the Hofstede cultural model induce on environmental performance, as defined and measured by the 2018 Environmental Performance Index. The analysis, which was performed on a sample of 49 countries which was constructed on the basis of data availability for all six cultural dimensions and the fulfilment of a condition referring to a minimum GDP per capita value, has revealed that only the cultural dimension of

individualism induces effects (positive) on the environmental performance variable, while all other hypotheses referring to the connections between the other Hofstedian cultural dimensions and environmental performance were discarded.

As discussed, the value of the results comes from their contribution to achieving a deeper comprehension of the culture-environmental performance relationship, with potential positive consequences regarding the design and implementation of culturally adapted public policies that could generate superior environmental outcomes. More precisely, the connections identified between cultural dimensions and environmental performance represents a useful step for further, more focused investigations on how different existing or proposed public policies targeting environmental issues relate to the national cultural environment, with potential direct consequences for their effectiveness and efficiency.

We believe that the findings of the paper constitute a valuable addition to the body of academic literature on the relationship between national culture and environmental performance, thus contributing to a foundation of knowledge that is instrumental in further investigating the phenomenon and applying the results to improved public policy design and implementation. In this context, we identify at least three further lines of study: (1) the first centring on refining the understanding of the culture-environmental performance interaction by focusing on specific elements pertaining to environmental performance (as defined by the sub-components of EPI or by other models), (2) the second, which has a more applied function, focusing on how the culture-environmental performance relationship impacts environmental public policies and on how the national cultural character may be included in the policymaking process for the purpose of constructing culturally adapted public

policies that have the potential to resolve environmental-related issues more efficiently, and (3) the third aiming to extend the results by taking national competitiveness into consideration and studying a threefold relationship between culture, environmental performance and competitive advantage, with the latter being viewed from the triple classification perspective proposed by Erkut (2016b), namely factor-driven, efficiency-driven and innovation-driven.

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Appendix A. Country characteristics (GDP per capita, EPI 2018 score, Hofstede's cultural dimensional values)

Country	GDP per capita	EPI 2018 score	Power distance	Individualism	Masculinity	Uncertainty avoidance	Long-term orientation	Indulgence
Thailand	15,683	49.88	64	20	34	64	32	45
Iraq	16,087	43.20	95	30	70	85	25	17
Mexico	16,832	59.69	81	30	69	82	24	97
Bulgaria	17,794	67.85	70	30	40	85	69	16
Argentina	18,489	59.30	49	46	56	86	20	62
Iran	18,498	58.16	58	41	43	59	14	40
Uruguay	20,047	64.65	61	36	38	99	26	53
Croatia	21,547	65.45	73	33	40	80	58	33
Romania	21,608	64.78	90	30	42	90	52	20
Chile	22,707	57.49	63	23	28	86	31	68
Latvia	23,718	66.12	44	70	9	63	69	13
Turkey	23,757	52.96	66	37	45	85	46	49
Greece	24,278	73.60	60	35	57	100	45	50
Russia	24,811	63.79	93	39	36	95	81	20
Hungary	25,654	65.01	46	80	88	82	58	31
Malaysia	25,669	59.22	100	26	50	36	41	57
Poland	26,051	64.11	68	60	64	93	38	29
Portugal	27,105	71.91	63	27	31	99	28	33
Lithuania	27,904	69.33	42	60	19	65	82	16
Estonia	28,095	64.31	40	60	30	60	82	16
Slovakia	29,224	70.60	100	52	100	51	77	28
Slovenia	29,933	67.57	71	27	19	88	49	48
Trinidad and Tobago	30,465	67.36	47	16	58	55	13	80
Czech Republic	31,353	67.68	57	58	57	74	70	29
Spain	33,349	78.39	57	51	42	86	48	44
Italy	34,715	76.96	50	76	70	75	61	30
South Korea	34,986	62.30	60	18	39	85	100	29
New Zealand	35,271	75.96	22	79	58	49	33	75
Malta	35,743	80.90	56	59	47	96	47	66
France	38,059	83.95	68	71	43	86	63	48
Japan	38,252	74.69	54	46	95	92	88	42
United Kingdom	39,230	79.89	35	89	66	35	51	69
Finland	39,523	78.64	33	63	26	59	38	57
Belgium	42,059	77.38	64	75	54	94	82	57
Canada	43,088	72.18	39	80	52	48	36	68
Germany	44,260	78.37	36	67	66	65	83	40
Austria	44,358	78.97	11	55	79	70	60	63
Australia	44,414	74.12	36	90	61	51	21	70
Iceland	45,276	78.57	30	60	10	50	28	67
Denmark	45,966	81.60	18	74	16	23	35	70
Sweden	46,662	80.51	31	71	5	29	53	78
Netherlands	47,303	75.46	38	80	14	53	67	68
Saudi Arabia	50,458	57.47	95	25	60	80	36	52

United States of America	53,342	71.19	40	91	62	46	26	68
Switzerland	57,430	87.42	34	68	70	58	74	66
Ireland	62,992	78.77	28	70	68	35	24	65
Norway	64,179	77.49	31	69	8	50	35	55
Singapore	81,443	64.23	74	20	48	8	72	46
Luxembourg	94,765	79.12	40	60	50	70	64	56

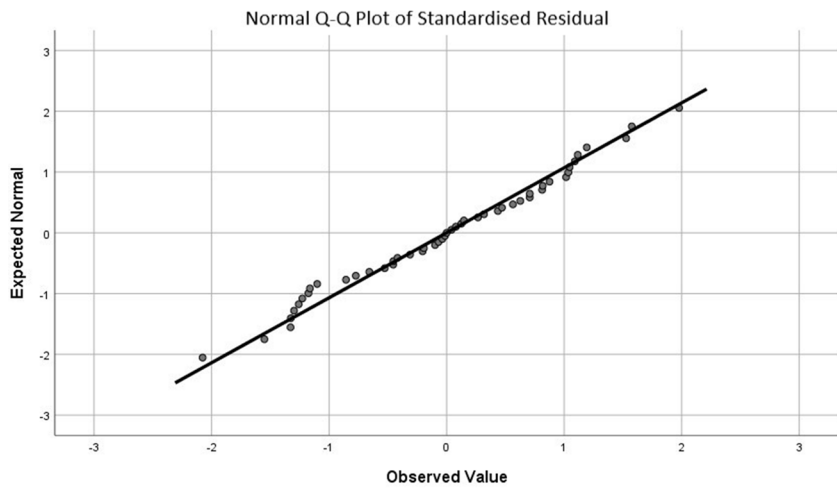
Note: EPI 2018 scores and cultural dimensional values can, as per their construction, range from 0 to 100.
Source: Own elaboration based on Hofstede, 2001, Hofstede et al., 2010 and Yale Center for Environmental Law & Policy, 2018.

Appendix B. Pearson correlations between independent variables and variance inflation factors

Pearson correlations between independent variables							VIF
	PD	INDIV	M	UA	LTO	IND	
PD	1.000	-0.653	0.180	0.416	0.068	-0.407	2.242
INDIV	-0.653	1.000	0.063	-0.359	0.081	0.227	1.955
M	0.180	0.063	1.000	0.134	0.067	0.017	1.144
UA	0.416	-0.359	0.134	1.000	0.112	-0.368	1.336
LTO	0.068	0.081	0.067	0.112	1.000	-0.501	1.425
IND	-0.407	0.227	0.017	-0.368	-0.501	1.000	1.783

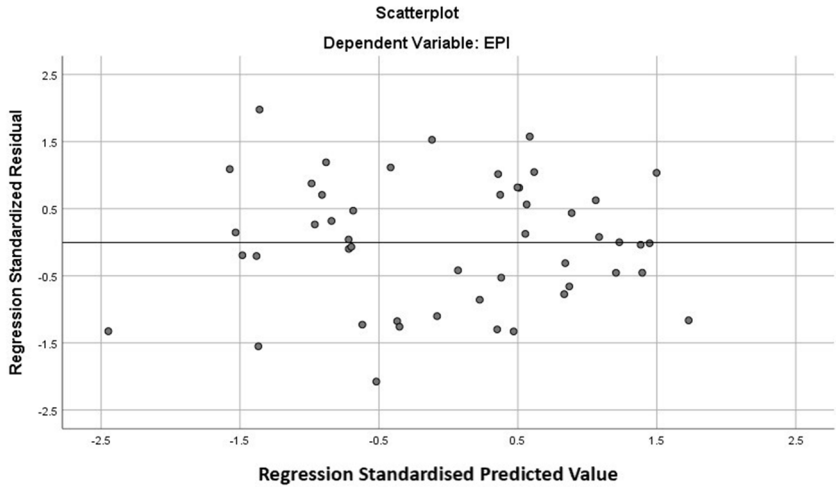
Source: Hofstede, 2001 and Hofstede et al., 2010 and own calculations.

Appendix C. Normal distribution of the residual analysis: normal Q-Q plot of standardised residual



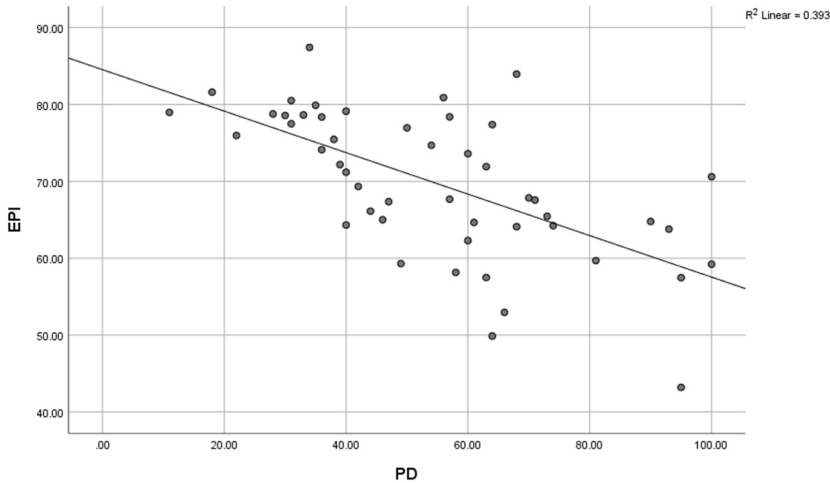
Source: Own elaboration.

Appendix D. Scatterplot of the residuals against the dependent variable



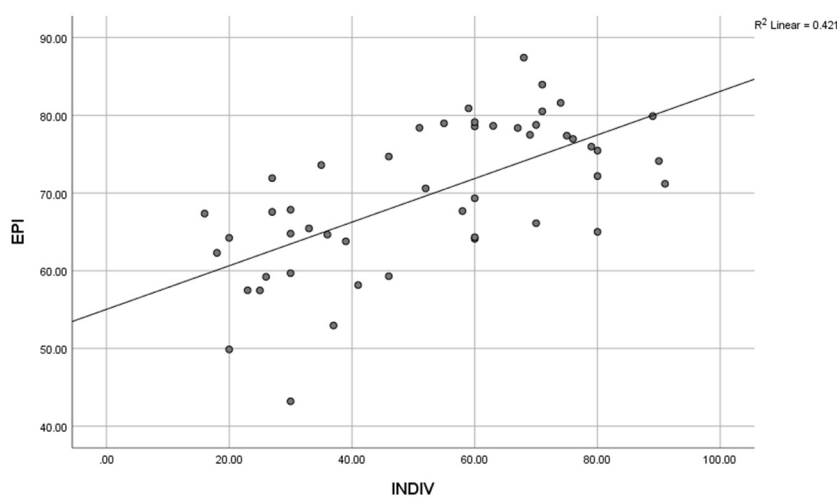
Source: Own elaboration.

Appendix E. The relationship between power distance and EPI 2018 score



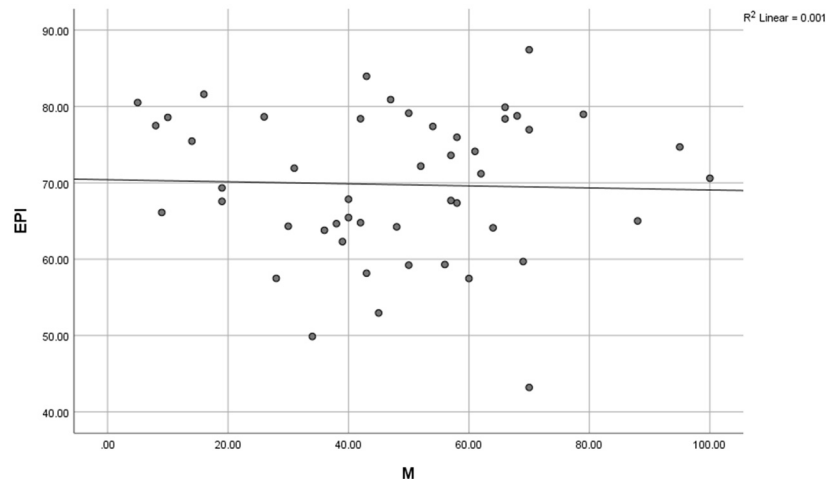
Source: Own elaboration based on Hofstede, 2001, Hofstede et al., 2010 and Yale Center for Environmental Law & Policy, 2018.

The relationship between individualism and EPI 2018 score



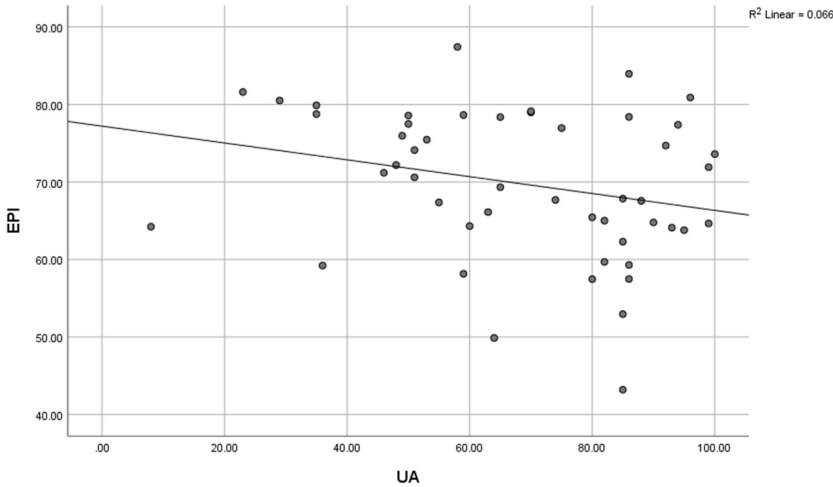
Source: Own elaboration based on Hofstede, 2001, Hofstede et al., 2010 and Yale Center for Environmental Law & Policy, 2018.

The relationship between masculinity and EPI 2018 score



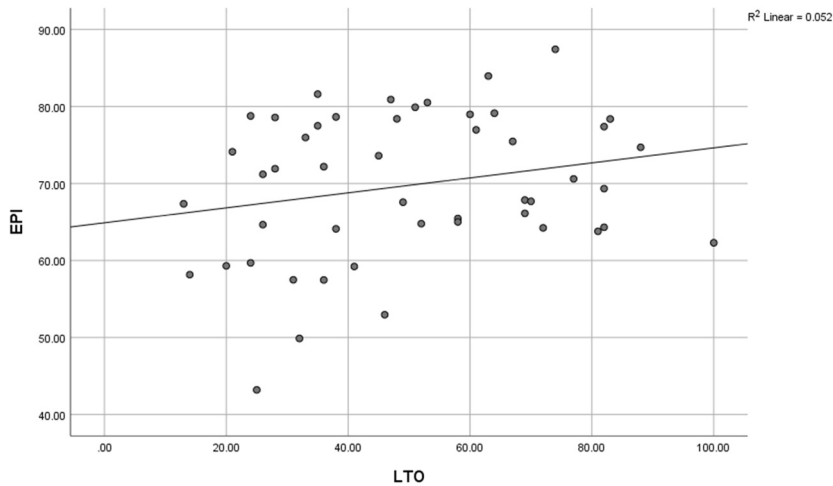
Source: Own elaboration based on Hofstede, 2001, Hofstede et al., 2010 and Yale Center for Environmental Law & Policy, 2018.

The relationship between uncertainty avoidance and EPI 2018 score



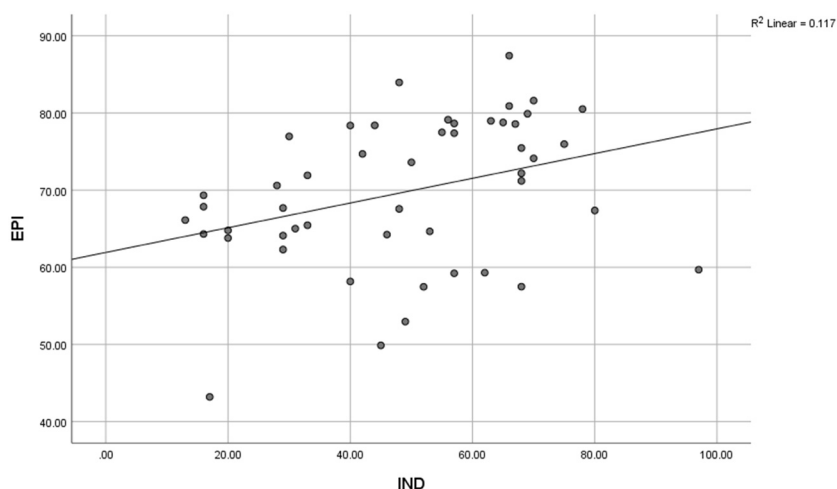
Source: Own elaboration based on Hofstede, 2001, Hofstede et al., 2010 and Yale Center for Environmental Law & Policy, 2018).

The relationship between long-term orientation and EPI 2018 score



Sources: Own elaboration based on Hofstede, 2001, Hofstede et al., 2010 and Yale Center for Environmental Law & Policy, 2018)

The relationship between indulgence and EPI 2018 score



Source: Own elaboration based on Hofstede, 2001, Hofstede et al., 2010 and Yale Center for Environmental Law & Policy, 2018.