The Association of Income Inequality with Environmental Attitudes.

An investigation of the independent association and the income moderation of income inequality on environmental concerns and responsibilities.

Master thesis Sociology, social inequalities
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Preface

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- Max Lelie, Rotterdam

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Abstract

This study analyses how income inequality moderates the relation the income-gradient has on environmental attitudes, specifically worries about climate change and personal responsibility to reduce its effects. Previous studies noted that environmentalism tends to increase with the income gradient. A higher level of income inequality will likely make this relation more pronounced, since the society will be more pronouncedly stratified according to income. I study this moderating effect by predicting environmental attitudes through a random slopes and intercepts model, based on income scale, the national Gini-coefficient and several control variables. Results were non-significant in the case of environmental worries. In the case of Personal Responsibility, I found a negative independent association at a p-value of .029, and a positive moderation of the income gradient at a p-value of .048.

Keywords: Environmental attitudes, environmental concerns, income inequality, income distribution, Gini-coefficient.

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Introduction

"An existential threat to civilization." This is what a team of climate scientists called the current climate situation (Lenton et al., 2019). The International Panel on Climate Change (IPCC) estimates that global temperatures have increased by approximately 1°C compared to pre-industrial levels, with a current estimated increase of 0.2°C per decade. This leaves only 2.5 decades before the critical point of 1.5°C is reached; the global tipping point where warming will have catastrophic consequences (IPCC, 2018). While the exact consequences are still debated, we can expect significant detrimental effects on global agricultural and fishing outputs, and flooding of coastal areas. In addition to this, increased frequency and intensity of natural disasters (storms, wildfires, droughts) will also present large human and economic costs. In addition to climate change, the many countries also experience growth in economic inequalities. After a period of significant decline of economic inequality after the second world war, economic inequality started to rise back up since the 1980s after a period of significant financial liberalisation (Bumann & Lensink, 2012). The financial crisis of 2007 did not improve upon this trend, with initial studies reporting that income inequality further concentrated at the top 1% of many developed countries (Raitano, 2016). Key factors are stagnant worker wages, loss of employment and structural changes to the labour market which increasingly favour high earners. These market forces have negatively impacted equal distribution in most of Europe, while fiscal transfers in particularly the Nordic and continental European countries have cushioned this significantly.

Amidst these dire warnings, all scientific disciplines have cause to study climate change. A global threat asks for interdisciplinary research, which is what this study aims to contribute to. From earlier socioeconomic research a positive relation between individual relative economic attainment and environmental concerns has been discovered. In this paper, I study how this relationship is moderated by economic inequality, as well as the independent association of income inequality on environmental attitudes. Put another way, I ask how income inequality and environmental attitudes are associated, as well as how the equity of distribution of income changes the way income affects environmental concerns. This ties together two dire societal issues, namely economic inequality and how society looks at the threat of climate change. As these are both issues that society as a whole needs to tackle in some degree, it is important to see how these concepts are interrelated within countries. I build upon previous models that have tested how income predicts climate change worries, expanding these to incorporate economic inequality. The reason to study this relation is two-fold. Firstly, I expect that in societies with a higher degree of economic inequality, the income gradient relation will be more pronounced. In other words, environmental concerns are more strongly stratified according to income. Related to this, I expect that the independent association is negative, i.e. that higher levels of income inequality are associated with

less pro-environmental attitudes within countries. These relations have not been studied so far in the case of environmental attitudes. Secondly, I hope to show that income inequality is a useful factor to take into account when studying income relations in its socioeconomic context, something that has been overlooked by previous studies. It is currently not commonplace to take income inequality into account in cross-country studies that use income as a predictor. Not a lot has been written about the justification of using income inequality to moderate the individual-level income gradient effects. This study aims to contribute to this gap. I argue this omission can lead to biased estimates, where the income-gradient is overestimated in countries with a high degree of income inequality.

This study takes a multilevel approach, combining individual (micro) level and contextual (macro) level factors, which is conceptually similar to other studies that have been done in the past. For example, Franzen and Vogl (2013) studied the impact of economic growth on environmental concerns. In their cross-national longitudinal study, they found that macro-economic growth seems to sustain environmental concern. Shen and Saijo (2008) found that environmental concerns are also positively tied to personal income. Boeve-de Pauw and van Petegem (2010) further confirmed this relation, finding it consistent across age-groups. Marquart-Pyatt (2012) and Kemmelmeier, Krol and Kim (2002) find similar results along the income-gradient in multilevel studies. This study aims to improve on these findings by taking into account that the effect of income is possibly tied to the level of income equality in a country. In addition to incorporating economic inequality as a factor, I also use a different dataset, namely the European Social Survey Wave 8 (ESS8). Using this dataset helps to control for some country-specific traits, something I will discuss in more detail in the data-section.

With this study I aim to contribute to the academic body of work by connecting environmental attitudes to economic circumstances. As mentioned, this has been done on the micro level for income, but also on the macro level for Gross Domestic Product (GDP) (Apergis & Garćıa, 2019; Mayerl & Best 2018). I expand upon this framework by introducing income inequality as a moderator. With this study, I add the dimension of income distribution and how this ties together with environmental attitudes. I opted to include income inequality on the centre stage, both as a moderator, as well as having an independent association. This provides an important context to the income gradient that many other studies have targeted. This also opens up new avenues of scientific study that expand upon the classical economic expansion theories which argue that improving economic circumstances improve environmental concerns.

On a societal level, this study can open the door for further societal discussions on how economic benefits are distributed among the population when these are tied to environmental concerns. This study could also have a practical benefit in developing policies. With a growing number of policies targeting

climate change, this study can help predict where the policies might count on acceptance based on economic information. Alternatively, regions with higher income inequality could be targeted as beneficiaries from environmental (educational) policies. Bridging between the societal and academic, this paper can also help explain why some affluent nations with varying levels of economic equality have different levels of environmental concern.

The rest of this thesis is structured as follows. In the first section, I will provide an in-depth discussion of the body of literature relevant to this topic. This is used in the second section, where I discuss the methodology, hypotheses and introduce the statistical model I will be using. I create a predictive model with random slopes and intercepts for the income level clustered across countries. In the third section I will discuss my dataset, sample and measures. In the fourth section I will present the results from the quantitative testing. Lastly, in the final section I will discuss these results, present my conclusions, limitations and recommendations.

1. Theoretical Framework

In this section, I discuss the literature pertaining to the determinants of environmental attitudes. First, I will discuss how household income relates to environmental attitudes. Since I expect that income inequality will moderate this relation, this is a logical point to start. Second, I will move to income inequality in sections 1.2 and 1.3. However not a great deal of literature exists about how economic inequalities relate to environmental attitudes as of yet. In section 1.4 I posit my formal hypotheses. Lastly, in sections 1.5 to 1.8 I will discuss some other identified determinants of environmental attitudes, such as education, political orientation, national wealth and national climate. Since these also affect the attitudes in question, this study's model should take these into account as controlling variables.

1.1 Income and environmental attitudes

Studies already noted the strong positive effect of progressing through the income-gradient on environmental attitudes and/or concerns (Kemmelmeier, Krol & Kim, 2002; Shen & Saijo, 2008; Boeve-de Pauw & van Petegem, 2010; Marquart-Pyatt, 2012). There are several factors that could influence why the most well off have stronger environmental concerns compared to the least well off. First, environmental concern is costly when it is tied to behavioural changes. Cleaner, environmentally friendly products usually carry a price premium. Thus, people who are on a tight budget have the broad choice between i) losing a significant proportion of income to "greener" products, ii) face the cognitive dissonance when combining higher levels of concern with low levels of behavioural concordance, or iii) mentally avoid the importance of environmental protection. In their meta-analysis Tully and Winer (2014) found that price premiums were most popular when they targeted the environment: an unconditional price premium of 111% was found when the environment was the advertised beneficiary of the premium (versus unconditional premiums of 22% for people and 9% for animals). While attitudes and behaviour are not the same, they tend to move in similar directions (Fazio & Zanna, 1978), and certainly are able to influence each other. This is one possible mechanism for why income has such a pronounced effect on environmental worries. When the required behavioural change is unaffordable, it can be easier to mentally evade the problem. Green products frequently carry a significant additional price premium over what is required to negate environmental impacts.

Herrera (1992) hypothesised another mechanism. High-income individuals grow up in cleaner environments, which fosters beliefs that favour environmental protection. Socioeconomic status is frequently carried over across generations, so these individuals tend to have both higher incomes and a greater level of environmental concern than individuals who grew up in low-income environments. Here

the income gradient is not explained through monetary values, but rather how income shapes different environments which can lead to different attitudes.

Economic attainment appears then to have two separate mechanisms that influence environmental attitudes. There is the *ability-to-pay*, which, in the presence of a price premium is *a priori* tied to economical attainment. Mahenc (2007) not only found that indeed green products are priced higher than conventional products, this is also partly due to necessity to signal a product's "green" status. On the other hand, there also appears to be a higher *willingness-to-pay*, where economical attainment appears tied to a sociocultural disposition to pro-environmental attitudes. This seems to indicate that income works on different levels on environmental attitudes.

1.2 Income inequality as an independent association.

Not a great deal has been written about how economic inequality relates to environmental attitudes. However, there are some indications that an independent association exists. Apergis & Garćıa (2019) found that energy efficiency from governmental policies in Europe tend to increase with governmental quality, a measure that included income equality. A longitudinal study in the United States found that CO2 emissions were positively linked with top income concentrations at the richest 10% (Jorgenson, 2017), however, it failed to find a significant link for the Gini-coefficient. This study did not identify a mechanism through which income inequality increased emissions but speculate that this stems from Veblen effects (essentially, the costs of pollution are not adequately allocated to the polluters). This same link between income inequality and CO2 emissions was noted by Chancel & Piketty (2015, finding that it holds true for both within-country inequality, as well as between-country inequality. Mikkelson et al (2007) further found that the loss of biodiversity was also tied to increasing levels of economic inequality. Again, no mechanism was found for this relation, however they do note the scarcity of available literature. Boyce (1994) also found a positive link between environmental degradation and inequalities in power and wealth, on the assumption that this inequality translates to how effectively polluters can overcome the costs of pollution with profits. These studies all seek to link economic inequalities with the physical state of the climate or the environment. To bring this back to attitudes, I will assume two things. Firstly, that this environmental degradation stems from a lack of environmental protection policies or a lack of enforcement thereof. Secondly, I will posit that this lack of policies is either rewarded, or not effectively punished by the national electorate, indicating a lack of concern.

These studies all indicate that there might be a link between a rising income inequality and a decrease in pro-environmental attitudes. In addition to this, there is one possible mechanism for how this inequality could affect environmental degradation, namely how the true costs of pollution are not

adequately allocated to the polluters, which are also benefitting the most from this pollution in economic terms. This however does not explain how the inequality is directly associated with the attitude. One possible route why this can still affect attitudes is noted by the article by Downey and Strife (2010). They argue that with greater economic rewards the top polluters use economic and political influence to shape public "knowledge, attitudes, values, beliefs and behaviour". Through this mechanism, I would expect that income inequality has a negative independent association with environmental attitudes, while also negatively moderating the income gradient. i.e. income inequality reduces how much the income gradient increases positive environmental attitudes.

Economic inequality could also alter risk perceptions in society. In experiments distributive inequality promoted greater risk-taking in subjects (Lopes, 1984). For many people who have not seen the effects of climate change first-hand, the concept could appear abstract, relating to heat maps of the world and icebergs breaking off into the sea. These are all signs of the inherent risk that faces our climate. A paper by Payne et al (2017) describes how economic inequalities can increase the perception of material needs through upward social comparisons. If economic inequality affects the risk perception, and increases our perceived material needs, it could in turn decrease the importance that the society collectively places on the environment. Engel & Pötschke (1998) also argue that indeed risk perception can affect environmental concerns and attitudes.

The most persuasive link to include income inequality comes from an article by Heerink et al (2001), which argues that economic inequality should be included when studying the effects of macro level wealth on environmental protection. They found that income inequality runs counter to, and sometimes outweighs the positive economic effects of macro-economic affluence on environmental protection, i.e. income inequality is positively related to environmental damage. Assuming that this damage is passively or actively condoned by the population, this would indicate a decreased level of environmental concern.

1.3 Income inequality as a moderator of the income-gradient.

While there are almost no studies that incorporate income inequality as a moderator of income effects for environmental attitudes, it has been tentatively used as a income-gradient moderator for different attitudes, such as life satisfaction and subjective wellbeing. For example, Cheung & Lucas (2016) found that income inequality increased the effects of relative income on life satisfaction. i.e. increases in income where found to have a stronger association with life satisfaction in countries with a higher level of income inequality. The proposed mechanism is one of social comparison, where higher inequality was associated with increased upward and downward comparisons of lifestyle and affluence. This could be applied to environmental attitudes, if one assumes that environmentalism and life satisfaction share similar market

transactions. For environmental attitudes, it is possible that countries with higher income inequality invite stronger social comparisons along the income-gradient. In terms of the previous terminology, the inequality increases the willingness-to-pay along this gradient.

A similar moderation is found in the field of health status, which has a similar positive correlation along the income-gradient. Präg et al (2014) studied this moderation, but found that the social comparison mechanism was applicable in this case, which shows that similar mechanisms don't always carry over to different fields of study. However, the similar gradient moderated by income inequality is present in the case of health status (Elo, 2009). It is possible that while the social comparison is not the correct mechanism other market forces are responsible. Schoen et al (2000) showed how low-income households financial access to healthcare was more limited in countries with higher income inequality. This would a priori seem to indicate that this access is more stratified according to income in countries with higher income inequality. This lack of ability-to-pay in turn could lead to a lower health status.

In the case of generosity and voluntary financial donations the results are ambiguous. Côté et al (2015) found in an experimental setting that high-income individuals less generous in an high inequality experimental setting, while in low inequality settings this was reversed. Interestingly, this result is disputed by Schuckle et al (2019), which found no significant effect for income inequality in the case of generosity (under the same definition as used by Côté et al). This is surprising, given that voluntary generosity across different levels of income inequality could have theoretically both worked through the willingness-to-pay mechanism, as well as the ability-to-pay. This shows that income inequality doesn't always have similar effects across income gradients in different settings.

Overall however, the majority of studies that have looked at the moderation in other fields find a positive moderation. Thus I expect that in the case of environmental attitudes and concerns income inequality has a similarly positive moderating effect. I would speculatively argue that income inequality moderates the income-gradient through both the ability-to-pay as the willingness-to-pay.

Markets where the distribution of income is more unequal face different demand functions than those markets where a lower income inequality is present. Combined with the earlier discussed price-premiums on green products, there seems to be at least a financial barrier to *engaging* with environmental concerns. This could translate back into attitudes in several ways. It is possible that the act of engaging itself strengthens environmental concerns. Alternatively, it is also possible that the financial costs associated with this engagement is a disincentive to hold strong environmental concerns. i.e. the cognitive dissonance from holding the environmental concern but unable to perform the corresponding behaviour leads individuals to lessen the environmental concern.

The willingness-to-pay could also be more strongly associated with the income-gradient in with higher income inequality through several routes. It is possible that it follows a similar social comparison mechanism as discussed by previous studies. There could be stronger comparisons between levels of environmental concerns along the income-gradient in countries with high inequality. I can also adopt the reasoning from the study by Herrera to incorporate income inequality. It is plausible that countries with a higher level of income inequality will have higher degrees of segregation based on socio-economic status. Applying this to his theory that the upbringing of high SES individuals had cleaner natural environments, we can expect that high inequality exacerbates this disparity between socio-economic statuses.

1.4 Hypotheses

Based on the discussed literature, I formulate hypotheses for both the independent association and the moderation effect. For both relations, the null will be one of no relation. In the case of the independent association, my alternate hypothesis is that there is a decreasing independent association between income inequality and environmental attitudes. In a similar fashion, my alternate hypothesis for the moderation effect is that income inequality has an increasing moderating effect on the income-gradient on environmental attitudes.

Ha: Income inequality has a negative independent association with the environmental attitude.

Hb: Income inequality has an increasing moderating effect on the income-gradient with the environmental attitude.

(n.b. I separate the environmental attitude into two separate attitudes, namely environmental concerns and personal responsibility. I will discuss this in more detail later.)

1.5 Controlling variables

Here I will briefly discuss some other variables that tie into environmental attitudes, because these will be used as controlling variables. Some of these variables will be interrelated to other independent variables, such as education and political orientation. However, even when they seem to solely be related to the outcome variable, it is important to identify and hold the variables constant in the statistical model to improve the overall accuracy.

Education and personal income are strongly tied together. This makes it hard to disentangle the income gradient from education. Previous studies find a strong link between education and environmentalism. (Barr, 2007; Boeve-de Pauw & van Petegem, 2010; De Rose & Testa, 2015; Dunlap & Liere, 1980). There are several mechanisms that could affect this some of which are summarized in an article by Blaikie

(1993). Education improves the aforementioned risk perceptions, leading highly educated people to place more importance in the environment. Education also improves general environmental knowledge, giving people a better grasp of its importance as well as the dangers it faces. In addition to this, education will also have a strong impact on household income. For the purposes of this study however, it is an important controlling variable to include in the statistical model.

It is also worth to briefly touch upon political orientation and environmental attitudes as well. It should come as no surprise that in most cases, parties that align themselves as "green" on the political alignment gradient tend to have the strongest environmental concerns. Traditionally, green parties have found sufficient mutual grounds with leftist parties, where environmental protection and worker protection could often go hand in hand (Dalton, 2009). Environmental concerns are often also receptible for centrist parties, but often not their prime concern. Lastly, the conservative parties have a mixed track record when it comes to the environment. This usually ranges from a free-market position which mostly leaves it to demand forces to protect the environment, while in other cases the interests of big industries are placed above environmental concerns. Lastly, an article by Gemenis et al (2012) notes that rightist parties often share sentiments ranging from unconcern to outright anti-environmental positions. That said, the political orientation can also be interrelated with the household income in some countries. Leftist parties classically align themselves with workers, while more conservative parties tend to side with capital owners, who tend to out-earn workers.

Knowing this, it is worthwhile to take the political orientation into account as a controlling variable both at the national level, as well as the individual level. At the national level it gives an indication of the importance the political culture places on certain ideals and values, spanning both economic policies and environmental policies. At the individual level, it also approximates the individual ideals and values for the social sphere, albeit not completely.

Similar to the household and individual income levels, national wealth and affluence have been just as strongly tied to environmentalism and environmental degradation in literature. Depending on the selection of countries, both positive and negative relations have been found, which has given rise to the environmental Kuznets curve (EKC). These concave curves plot the theorised greenhouse gas emissions based on the level of economic development. First, as an underdeveloped nation becomes a developing nation, emissions rise due to the rapid increase of industrial development. However, as the economy matures, this increase levels out and eventually becomes negative as more and more people settle into a middle-class lifestyle, and environmental protection schemes are put into place. This idea is however strongly contested. Firstly, as is the case for many of the developed countries which saw rapid decreases in emissions, this was not as much due to the industry cleaning up but extensive offshoring which simply

moved hazardous industries overseas. This international game of hot potato is why the EKC has been criticized in recent decades (Carvalho & Almeida, 2011; De Bruyn et al, 1998; Heerink et al, 2001; Moomaw & Unruh, 1997). While the EKC is not the panacea for global environmental problems, it does hold true within countries. For example, Ahmed et al (2016) find consistent environmental improvement in European countries with economic growth. For this reason, the national wealth is a useful control variable.

Lastly, I intent to control for several other factors that are not directly rooted in literature. These include standard individual level variables: age, partnership status and having children. I also include a country level variable for the climate zone of the country. It is feasible that countries in certain climates have already experienced climate change more noticeably than other countries. It is possible that colder countries have noticed melting glaciers and are thus more worried about climate change. Similarly, hotter countries might have experienced increased summer temperatures, leading to droughts. Again, there is no direct literature available to support a direct effect on environmental attitudes. However, given that the data does not allow to control directly at the country level (due to multicollinearity with income inequality), the climate seems like a good addition to the previously discussed variables. A cross-tabulation seems to indicate that climate worries linearly correspond to how hot a climate is, so the variable has been treated numerically, from coldest to hottest.

2. Data, measures and methodology

2.1 ESS8 Survey

As previously mentioned, this study uses the survey data from the European Social Survey (Wave 8) from 2016. The ESS8 had a special module on climate change, which asked several questions pertinent to attitudes and concerns regarding climate change. These questions are supplemented with where the respondents fall in the income distribution, what level of education they have received, baseline demographics and a myriad of other attitudinal questions. This full survey contains responses from 41,830 individuals from 23 participating European countries, and Israel. In order to make the countries as similar as possible however, observations from Israel and the Russian federation were dropped. This was also to preserve the political control dimension, as the remaining countries all were represented in the EP.

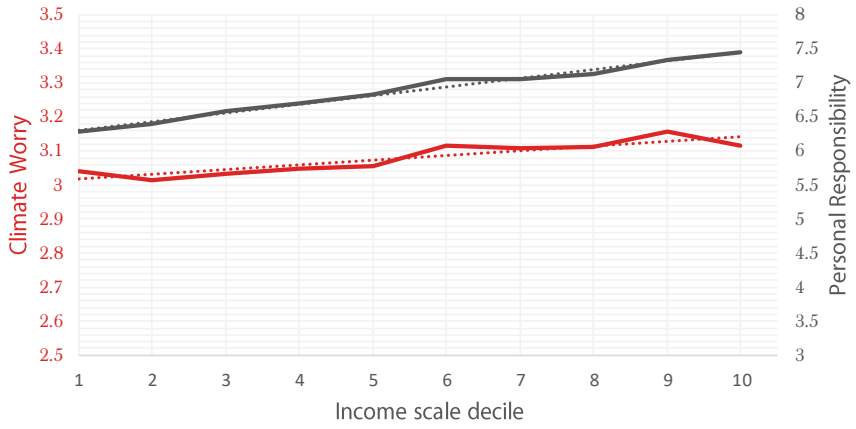
The initial dataset contained responses from 44,387 individuals. However after dropping two countries, as well as deleting any observation that did not provide a numerical answer on the relevant survey questions the sample consists of 28,452 observations. In addition to this, respondents older than 92 were also deleted, as their environmental attitudes dropped to zero. Appendix A has an overview of the variables, individual covariates and national parameters that I have used in this study.

2.2 Dependent variables

First, I will specify the dependent variables that are to be measured and interpreted. This makes it clear what the study is about, and equally important, what it does not measure. It also greatly improves the intuition behind the sample and other measures. There are some different ways to look at how individuals are orientated to the environment that are easy to confuse with each other. *Environmental Knowledge* (EK) are measures of how much an individual knows about environmental challenges. Frequently, these are measured as the answers to questions about the importance of the environment, how it can be protected and what is causing environmental degradation. It is often seen and cited as a necessary precursor for pro-environmental behaviours, concerns and attitudes. Unfortunately, as Geiger et al (2019) note, there lacks a scientific consensus on how it should be measured consistently across studies. Environmental Attitudes (EA) is defined by Schultz et al (2004) as ""the collection of beliefs, affect, and behavioural intentions a person holds regarding environmentally related activities or issues". Environmental Behaviour (EB) can be said as the physical (and observable) manifestation of said attitudes. Lastly, there are Environmental Concerns (EC). Sometimes, it is used as a partial proxy for environmental knowledge. Schultz et al (2004) defines it as "the affect (i.e., worry) associated with beliefs about environmental problems.". In this study, I look solely at two different environmental attitudes

about climate change, namely the respondent's worry about climate change, and the extent they feel personally responsible to reduce climate change. In English, these respective questions were phrased as "*How worried are you about climate change?*" and "*To what extent do you feel Personal Responsibility to reduce climate change?*". The reasoning to separate the attitude into two dimension is two-fold. Firstly, these two concepts are natural compliments in giving an idea of the environmental attitude. For instance, a high level of concern, but a low level of personal responsibility could indicate that the population is very worried about climate change, but places the responsibility to reduce it to some other actor. Secondly, I speculate that while previous studies focussed most on environmental concerns in the past, increased media coverage has eroded this stratification along the income gradient to some degree. I expected that the sense of personal responsibility has come to replace concern in this stratification.

These two outcome variables, which I shorten to "Climate Worry", and "Personal Responsibility", offer an interesting combined insight into individual attitudes to climate change. To easily equate these two measures, both are standardized. Climate worries relates to the mental load that the threat of climate change poses. On one hand, a low score probably indicates that the individual is not personally concerned about climate change, an interesting fact given that 96% of the final sample were reasonably or definitely sure that the climate is changing, with a further 87.4% sure that it will have a bad impact across the world. It is possible however that a low score indicates resignation, or conversely, optimism. This makes Climate Worry hard to interpret in a macro setting, but easier in a micro light: a measure of how much stress the threat of climate change causes. Overall, 23.1% of the sample was reported to be "not very worried" or less, while 29.4% reported to be "very worried" or worse. The Personal Responsibility gives some idea of how the public views their individual role in reducing climate change. This is an interesting metric in several ways. It is a measure of how supportive the public would be of policies that reduce climate change, potentially carrying some form of personal sacrifice. Additionally, it relates to the intent on changing individual behaviour, which is significant for market-based solutions. Of the final sample, 18.6% ranked a 3 or less on a 0 to 10 scale, 34.2% between 4 and 6, and 45.3% ranked themselves a 7 or higher.



graph 1: Average climate worries and personal responsibility across income scale deciles

2.3 Income scale and income inequality

The two main independent variables in this study are the income scale decile, and the income inequality Gini-coefficient. Starting with the income scale decile, this is helpfully reported in the ESS8 sample, which was calculated based on the respondent's household income, across the sample. Because the raw ta of household income was not reported, it means that the numbers could not be corrected for the national purchasing power. However, because of the uniformity of the scale, we can assume that the purchasing power is equalized to a moderate degree (under the assumption that the deciles will roughly conform to similar living standards across European countries in the sample). The sample is normally distributed across income scales, and cross tabulation with Climate Worry and Personal Responsibility shows a roughly linear trend, as visible in graph 1. One key assumption I make however is that these scales measure responses that are uniform and equidistant, roughly continuous. This assumption is not entirely realistic but was made for the sake of simplicity. Thankfully, the linear trend shown in the graph supports this assumption.

The Gini-coefficient measures the level of income inequality in a country on a 0 to 1 scale, with 1 meaning that there is perfect inequality, and 0 perfect equality. The Gini-index also fulfils the necessary principles of a successful index as laid out by the Human Development Report, which are: symmetry, population invariance, scale invariance, and the Piguo-Dalton transfer principle (Human Development Report, 2019). The last mentioned is especially useful and basic quality in an inequality index, as it requires that a financial transfer from a poorer person to a richer person makes the index increase, regardless of where they are in the income distribution. Because the Gini-coefficient fulfils these basic properties, it should be sufficient to give a numerical measure of income inequality for each country. In order to have the coefficient as relevant as possible, I have opted to take its lagged average value from the preceding five years before the survey, from 2011 to 2015. This coefficient was made available for

these years by Eurostat. I have further converted the coefficient to a logarithmic scale for easier interpretation.

2.4 Control variables

In addition to this, I adjust for several individual and country-level variables in this study. Foremost is the education level. In the dataset, the highest completed education was reported, which I have simplified to the ranking from the International Standard Classification of Education, 1997 version. This ranks the completed education from 0 to 6, with no education being the lowest and a doctorate the highest. Next to education, I also control for the self-reported political leaning on a simplified left to right scale. Finally, on an individual level I also control for age (linear and quadratic), having a (registered) partner, and having (now or previously) children living in the household.

Controlling variables on a national level were however much more challenging to select. Normally, one would control on a country level, but since every country had a unique Gini-coefficient, this led to perfect collinearity. Finally, I selected 3 dimensions on which to control on a country-level, namely economic, political and climate. Although there are no ideal ways to quantify a countries economic performance, I have for the sake of simplicity opted to use a standard gross domestic product per capita (GDP (PPP) per capita), adjusted for purchasing power. This is meant to capture a country's overall affluence and economic development. These statistics could easily be found in the database from the International Monetary Fund (IMF), but one alteration had to be made in the case of Ireland. As it happens, Irelands GDP is significantly inflated due to the structure of multinationals, using it for the favourable taxation system. This led to a 25% increase in GDP in 2015, largely from a corporate restructuring by Apple Inc. The Irish central statistics office estimated that the GDP is inflated by 130% (2016), so Irish GDP was corrected for this.

In the political dimension, I have opted to measure the ratio of parliamentary seats per party. I then aligned these parties on a categorical scale from leftist, green, centrist, conservative and rightist. Of course, this presented a comparison challenge. A centrist party in one country might be considered leftist in another, making accurate comparison hard. To overcome this, I have aligned the parties based on their allegiance to the European parliament parties. While this is likely not capturing the more subtle points of national policies, it should give a valid indication of the "prevailing political winds" in a country. For practical considerations, I have applied a cut-off point of 10% of parliamentary seats per party, with two types of exceptions. First, if the party has less than 10% of seats but did form a coalition in the executive branch of government, I have counted it as well. The second exception was Belgium, where I also counted the Open-VLD party, in order to have a minimum of 60% of all seats accounted for.

In order to determine the national climate, I have used the Köppen-Geiger classification method (Beck et al, 2018). This did involve some estimation of which climate zone was the most prevailing in a country. Overall, I opted to simply take the largest climate zone represented as the national climate. This presented no major surprises, and in most cases this was also the climate zone that covered the most populated regions of the country.

Multicollinearity between the control variables was not much of an issue, with Variance Inflation Factors between 1 and 4 for most variables, except between age and age squared, but this is expected.

2.5 Linearity

It is also important to briefly note if the dependent-independent relations behave linearly, as I will be employing a linear model. Based on the initial inspection of the data several things became apparent, which guided the statistical model outlined in this section. Most importantly, as discussed in section in section 2.3, the income scale gradient behaved linearly. Most of the variables I have chosen to include behave linearly in relation with the dependent variables. I say most, because the respondents age was a notable exception. Especially in relation to Personal Responsibility, it appeared as a function with some concavity, with the dependent variable first increasing with age, and later significantly dropping. While age is not the primary focus of this study, I have included an additional quadratic term for age to keep the model as accurate as possible.

The other variables behaved as linear as could be expected under initial inspections. Unexpectedly, the GDP variable did show some erratic patterns, especially in countries towards the lower end of the spectrum. Because this relation plots a singular macro-micro relationship, without further controls however, I have decided it was not too disturbing in terms of expectations. In Appendix B I have included the relevant graphs.

Further sorting the countries based on having an above or below average Gini-coefficient also gives some preliminary indication of the expected results. Specifically, graph B1 in Appendix B shows for Climate Worry the association with income inequality is ambiguous, however in the case of Personal Responsibility there at least seems to be a negative independent association. While these are very rough aggregates, this graph helps getting a grasp of the initial data. On the whole, the linearity of the dependent-independent variables is sufficient to justify using a linear model for all variables, with a quadratic addition for age.

2.6 Analysis, model and method

To study these hypotheses, I take a cross-country multi-level approach. By taking this approach, I can study how income inequality as measured by the Gino-coefficient moderates the gradient of relative household income, as well as how it directly influences environmental attitudes. This approach allows for a sufficiently large set of individual observations, moderated by the contextual parameters that differ from country to country. In order to analyse the relationship between the environmental attitudes and concerns and economic inequality, I will use a *linear multi-level model regression with random slopes and intercepts*.

The random slopes model estimates the slope for individual income scale decile across each cluster (country). This is done deliberately to allow the slope for the income gradient to float across countries. This gives both a better approximation of the income gradients on the environmental attitudes, as well as increasing the accuracy of the cross-level interaction later on. So, for all the different clusters the intercepts are allowed to change, in turn allowing for more accurate estimates of the beta-coefficients.

$$(I) \quad Y_{ic} = \alpha_1 + \alpha_c + (\beta_1 + \beta_c) \cdot IncomeScale_i + \beta_2 \cdot Gini(log) + \beta_3 \cdot \ Gini\,Interaction + \vec{\gamma}_i \cdot \begin{bmatrix} Education_i \\ Partner_i \\ Kids_i \\ Age_i \end{bmatrix} + \vec{\gamma}_c \cdot \begin{bmatrix} Parliament_c \\ Climate_c \\ GDP_c \end{bmatrix} + \varepsilon_i$$

$Y_{ic} = individual\ environmental\ attitude$
$\alpha_1 = fixed\ intercept$
$\alpha_c = random\ intercept$
$\beta_1 = fixed\ slope\ income\ gradient$
$\beta_c = random\ slope\ income\ gradient$
$\beta_2 = Gini\ independent\ association$
$\beta_3 = Gini\ moderation\ effect$
$\vec{\gamma}_i = individual\ control\ vector$
$\vec{\gamma}_c = cluster\ control\ vector$

Model I shows the final form of this regression. The Y corresponds to the relevant environmental attitude. The two coefficients that this regression finds for ß2 and ß3 denote the independent association and the moderation of the income gradient, respectively.

This model's output is enough to reject/not reject the null hypothesis, however in order to further illustrate these results I perform an additional post-estimation analysis. First, I use the coefficients for the income scale gradient, the independent association of the Gini-coefficient, and the moderation effect on the income scale gradient to predict the standardized environmental attitude. I plot this for several different levels of income inequality to show how this affects predicted environmental attitudes.

3. Results

3.1 Goodness of fit: model iterations, correlations

Before I can discuss the results of the statistical model, it is best to briefly discuss the incremental goodness of fit of the model itself. For each of the dependent variables, Climate Worry and Personal Responsibility, I have iterated the models four times. In the first specification, I include only a random intercept at the country level. This yielded a log-likelihood of -39462 and -38636 respectively for the two outcomes. The next iteration adds a random slope for the income scale decile, improving the log-likelihoods to -39427 and -38397. The third iteration adds all the control variables, whilst keeping the Gini-related variables removed. This further increased the log-likelihoods to -39086 and -37999, indicating that the sum of control variables is indeed a useful addition to the model. The final iteration adds the logarithm of the Gini-coefficient and the Gini interaction term with the income scale, which slightly improves the likelihoods to -39085 and -37994. The respective Chi2 probabilities show that for the first two increments the p-value is smaller than 0.000 for both dependents. However, when the Gini-variables are added, the p-value for Climate Worry is at 0.185, indicating that this addition does not substantially improve the model fit. The combined p-value for Personal Responsibility had a p-value of 0.025, which I judge to be sufficient to justify including the Gini-variables.

I have also calculated the intraclass correlations for these same four model iterations, which for a random intercept model only are rather low for Climate Worry and Personal Responsibility, at 6.3% and 11.2%. This indicates that there is a moderate degree of variance in the outcomes of choice that is accounted for by the country clustering. Furthermore, incrementally adding the variables similar to how the log-likelihoods were established, show that the ICC first slightly increases when the income scale decile is added to 6.6% and 11.2%. This might reflect that little of the country-level variation is accounted for by the composition of each country in terms of the individual-level variables I included in this step (income scale). Further expanding the model with the control variables and, lastly, the Gini-variables lowers the ICC to 3.1%, 5.2% and 2.6%, 4.4% respectively. This indicates that including these variables further reduces the observed variation at the country level.

In the appendix C I have included a table which displays these log-likelihoods, intraclass correlations and full correlation table in a concise fashion.

3.2 Regression results

Here I turn to the regression analysis for the standardized Climate Worry and Personal Responsibility. Starting with Climate Worry, the regression yielded estimates for the income scale gradient, logarithm of the Gini-coefficient and the Gini-income interaction term. The income scale decile has a coefficient of 0.1% of a standard deviation, with $p = .824$. The Gini logarithm has a coefficient of -2.7% of a SD, and an associated p-value of .059. Lastly, the interaction term has a coefficient of 0.3% of a SD and $p = .600$. Overall, these results are not statistically significant, nor are they practically substantial. It is interesting to compare this to the control variable for education level, which has a coefficient of 6.2% of a SD and a p-value below .000.

Next, for Personal Responsibility the regression analysis yielded a coefficient of 1.5% for the income scale gradient, with a p-value of .002. The logarithm of the Gini-coefficient shows a negative sign of -3.8% with $p = .029$. Lastly, the interaction term presents a coefficient of 1.3% of an SD with a p-value of .048. Overall, the results in the case of personal responsibility are statistically significant, as well as fairly substantial given the range of the covariates. The next section will make the magnitudes of the coefficients clearer.

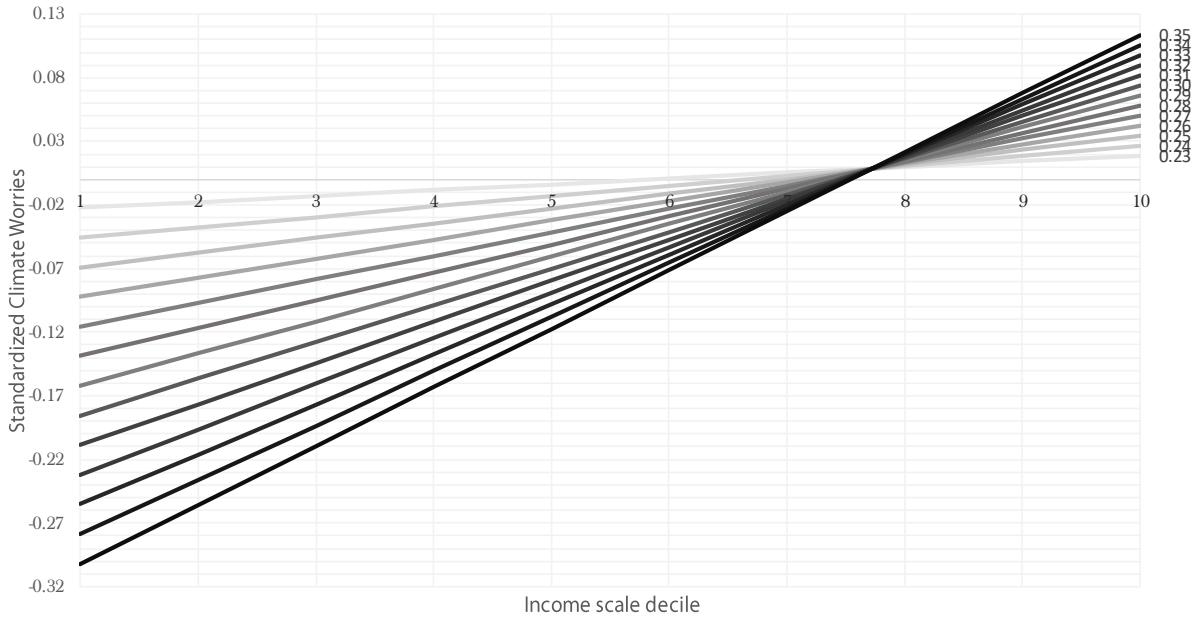
	Climate Worry			Personal Responsibility		
Independent	**_b**	**SE**	**Z-statistic**	**_b**	**SE**	**Z-statistic**
Individual Traits						
Income Scale Decile	0.001	0.005	0.22	0.015 ***	0.005	3.030
Education Level	0.062 ***	0.005	12.93	0.081 ***	0.005	17.610
Partner	-0.001	0.014	-0.07	0.005	0.013	0.400
Age	0.006 ***	0.002	3.06	0.018 ***	0.002	9.530
Age^2	-0.001 ***	0.000	-4.24	-0.001 ***	0.000	-11.400
Kids	-0.051 ***	0.015	-3.36	-0.014	0.015	-0.980
LeftRightScale	-0.048 ***	0.003	-17.96	-0.023 ***	0.003	-9.070
National Traits						
Climate	0.182 ***	0.036	5.05	0.104 **	0.045	2.330
GDP (PPP) p. Capita	-0.013 **	0.006	-2.06	0.019 **	0.008	2.540
Gini (log)	-0.027 *	0.398	-1.91	-0.038 **	0.489	-2.130
Gini Interaction	0.003	0.007	0.53	0.013 **	0.007	1.970
Parliamentary ratios						
Leftist	0.697	0.759	0.92	-1.180	0.938	-1.260
Green	1.447 *	0.750	1.93	-0.966	0.925	-1.040
Centrist	0.490	0.314	1.56	-0.636 *	0.386	-1.650
Conservative	0.621 *	0.254	2.45	-0.397	0.312	-1.270
Rightist	1.284 *	0.664	1.93	-0.699	0.819	-0.850
_cons	-1.421 ***	0.456	-3.12	-2.449 ***	0.108	0.110

table 1: Regression results, standardized
**** p < 0.01 ** p < 0.05 * p < 0.1*

3.3 Spectra of income gradients

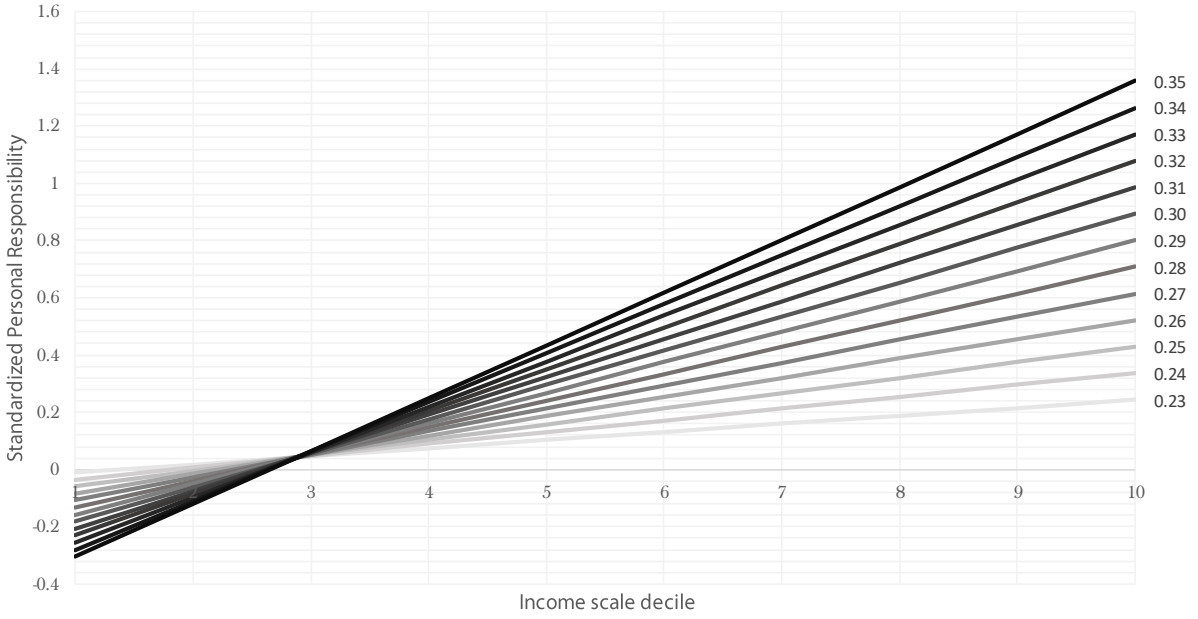
As I discussed in the methodology section, I use these coefficients in a post-estimation analysis to show the magnitudes of the coefficients across the covariates of the income-gradient and various levels of income inequality. This generates a spectrum of income-gradients for different levels of income inequality, with which we can see the magnitudes of the coefficients relate to one another.

In graph 2 I have plotted the predicted (standardized) Climate Worry levels for every income scale decile, ranging over several levels of income inequality (ranging from 23% to 35%, with darker greys indicating higher levels of income inequality. See table B3 in the Appendix for the specific Gini-coefficients for each country). The independent association of income inequality can be seen from how the intercept for increased levels of income inequality is lower than the preceding level. This independent association is rather small, with the entire range of income inequality levels only representing a change of 0.25 of a SD. The moderation can be observed by how the slope of the relation is steeper for higher levels of income inequality. The linearity of the estimation causes the ranking of climate worries to completely reverse between the 7th and 8th deciles. Comparing the prediction for the lowest level of income inequality with the highest, the lowest level income gradient starts at around -0.02 and stops around 0.02, an increase of 0.04 SDs of Climate Worry. For the highest level of income inequality, the intercept is around -0.3, and the prediction ends at 0.11, an increase of 0.41 SDs. Given that one SD for Climate Worry is around 0.9 of a response scale, this would come down to a change of 0.37 in response scale deciles at the highest and 0.036 at the lowest. The entire spectrum of intercepts represents a total change of 0.225 of a response scale decile.



Graph 2: Standardized Climate Worry across income scales

In graph 3 I present the case of Personal Responsibility, where a similar pattern emerges. The same negative independent association causes increasingly negative intercepts with increased levels of income inequality. While the range of intercepts covers a similar range as with Climate Worries, the slopes for Personal Responsibilities is steeper. The total range of intercepts represents a change of 0.29 of a SD. This causes the order to reverse between the 2nd and 3rd income scale deciles. The increased moderation of the income gradient by income inequality, compared to Climate Worries, is also responsible for the greatly increased disparity in attitudes that is seen at the top levels of the income scale. Here the income gradient is significantly more pronounced in cases with high income inequality compared to the cases with low income inequality. In this graph, the intercept of the income gradient with the lowest level lies around 0.00, and it ends at around 0.24 SDs.



Graph 3: Standardized Personal Responsibility across income scales

For the highest level of income inequality, the prediction starts around -0.28 and ends at 1.38, a total increase of 1.66 SDs. A standard deviation for Personal Responsibility represents a difference of 2.6 on the 0-10 response scale (which I have presumed to be uniform). This would indicate that the whole length of the income gradient is associated with a change at the lowest level of income inequality of only 0.62 of a response scale decile. This is contrasted against the highest level of income inequality, where the entire income gradient is associated with a change of 4.33 response scale deciles. The entire spectrum of intercepts represents 0.76 of a response scale decile.

4. Conclusions

4.1 Interpretation of the results

To start, I will provide a quick repetition of the formal hypotheses I have formulated in section 1.

H_a: income inequality has a negative independent association with the environmental attitude.

H_b: Income inequality has an increasing moderating effect on the income-gradient with the environmental attitude.

The research goals of this paper as mentioned in the introduction were to study both the independent association of income inequality, as well as how it moderates the income-gradient in relation to two environmental attitudes. As a secondary goal, I hope to contribute to incorporating income inequality in a broader range of socioeconomic research.

The results of this study did not prove significant in the case of the environmental attitude pertaining to climate change worries, while it does suggest that income inequality has a negative independent association with this attitude, and that income inequality enhances the income-gradient. The environmental attitude relating to the sense of personal responsibility to reduce climate change yielded results that were decidedly more significant. Here the independent association with this attitude was similarly negative, and the moderation of the income-gradient was positive. This was mostly in line with what could be expected from the literature. The income gradient showed a positive association, which was in line with the literature as discussed in section 1.1. Most of the literature also gave cause to expect that the independent association would be negative, as it turned out to be in for this independent variable. Lastly, the positive moderation effect was also in line with the literature, albeit that admittedly very little of this literature actually applied to environmental attitudes. It is surprising however that there is a clear distinction between Climate Worries and Personal Responsibility, since the former did not show any significant results. Since the literature does not immediately favour one independent variable over the other, and most of the theories should have been more or less equally valid for either, it was unexpected that the results were so distinctly different in significance. One possible explanation for that I can speculate to is that Climate Worries is simply not as stratified to the income gradient as it used to be in previous years. It is now more commonly discussed in mainstream media, it is a common topic in political debates and a mainstay component in corporate social responsibility. As such, it is possible that income, and related factors such as income inequality are no longer as relevant predictors. Personal Responsibility however has remained stratified according to income. In the next paragraph I will discuss what the results mean directly for my hypotheses.

For the climate worries, the logarithm of the Gini-coefficient has a negative coefficient of -0.027 SDs on climate worries, with an associated p-value of .059. This just falls outside of the range of significance at 5%, meaning that the null of no relation could not be rejected. the coefficient suggested that the interaction of the income-gradient by income inequality is positive, albeit by little more than 0.003 standard deviations. However, due to the non-significance of both the income-gradient and the interaction, the null could similarly not be rejected. For personal responsibilities, the independent association has a negative coefficient of -0.038 with a p-value of .029. While this is statistically significant, the magnitude is not substantial. Overall, every percent increase of the Gini-coefficient was associated with only 0.05 of a response scale decile. However, the significance does support H_a in the case of Personal Responsibilities. In addition, the interaction coefficient is positive, and moderates the income-gradient by 0.013 SDs. While this does not immediately seem like a large moderation, this effect is multiplicative for every income scale decile and percentage increase in income inequality. The coefficient was also significant at a p-value of .048, which supports H_b.

The practical application of these findings remain heavily dependent on the context. Looking at the most extreme case of a difference of 12 percentage points in the Gini-coefficient, the isolated independent association shows a disparity in Climate Worry of 0.278 standard deviations. Assuming uniformity and linearity of the climate worry scale, this corresponds to slightly over 0.25 of the attitude on a 1-5 scale. This independent association is more pronounced in the case of personal responsibility, where it has a disparity of 0.281 standard deviations, corresponding to 0.735 on the original 1-10 response scale. Comparing the differences across the entire income-gradient between the lowest and highest Gini-coefficients show the most extreme moderations. In the case of Climate Worry, the income-gradient increased 0.04 standard deviations for the lowest level of income inequality, and 0.41 standard deviations in the highest level, a total difference of 0.37 standard deviations. For Personal Responsibility, the income-gradient increased by 0.24 standard deviations at the lowest level of income inequality, and 1.66 standard deviations at the highest. Here, the difference is decidedly more pronounced, with a disparity of 1.42 standard deviations.

This paper only studied the association without looking at any possible causation, however I can speculate about further implications, should such a causal link exist. Given the subject matter, I am inclined to expect that the causality would flow from the income inequality to the environmental attitude. This is reminiscent of Coleman's boat, with the macro-relation between income inequality and Personal responsibility is brought about through mediation and moderation in interrelated micro-mechanisms. The moderation I have discovered could be part of such a micro-mechanism. Again, purely speculatively, such a causal link would add a new dimension to the societal discussions about income

distribution, seeing as it also affects our attitudes to sustainability. Sustainable urban development, industries and services are still developing markets, that are looking to gain a broader consumer base in the western world. If we assume that the equity in Personal Responsibility can be improved through decreasing income inequality through governmental policies, it would seem natural that this would broadly improve sustainable behaviour. This should give an additional reason for reducing income inequality. Further research would be needed to support this, but such policies present rare opportunities to improve several different areas in one move: income inequality itself, the development of future markets, and reducing the environmental footprint of the society.

This is also true for the secondary research goal, which was to make a case that income inequality can be an important factor when studying income gradients. Although my study only provides a single instance that this is true, there are several possible mechanisms that could explain this, which I have grouped in two broad categories of the ability-to-pay, and the willingness-to-pay. Both of these types of mechanisms could speculatively work in different areas of study as well, for example when studying the income gradient in healthcare utilisation, or educational attainment, family formation, and others. Ignoring income inequality could lead to the overstatement of the income gradient, especially when the sample consists of countries that have a higher level on income inequality. Another question comes to mind when I look at graph 3 in the results section. Looking at the lowest level of income inequality, I feel that the slope of the income gradient is severely flattened. This makes me wonder if it is possible for the income gradient to disappear, or even reverse, given sufficiently low levels of income inequality. My current sample had no cases where income inequality were low enough to test this, but it would be interesting to see the limits this spectrum income gradients. Regardless, I feel that there is sufficient cause to further study how income inequality moderates income gradients in other contexts as well. Doing so provides important insights to now only the quantitative associations, but also through what kind of mechanisms income could have an effect on outcomes.

4.2 Limitations and recommendations

Admittedly, this study had significant limitations. First and foremost, I worked with static average Gini-coefficients which presented a snap-shot picture of the state of income inequality. While this was sufficient, it was by no means ideal. This study only accounted for attitudes measured in the year 2016, with a lagged 5-year average of the Gini-coefficient. Because this current study was time-sensitive, it is not certain that these associations hold up over time.

Secondly, this also meant that I had to manually control for country specific variables which could feasibly affect these attitudes, while minding the limited degrees of freedom that this allowed. While the

significance of this study should be unaffected by this, it is likely that the association magnitudes are sometimes overstated due to inadequate controls at the national level.

Relatedly, not being able to control adequately at the national level also presented limitations in terms of the countries that could be included in the dataset. Using only countries in the European free trade zone meant that the countries had a fair degree of similarity in their legal framework, while also allowing for political comparisons. This however meant that Israel and Russia could not be included. Again, because this study was limited in how many countries were utilized, it is not certain how well these associations hold up in other countries or groupings thereof.

A final important limitation was the scarcity of available literature that could give a clear indications of which mechanisms play a role in the independent associations and the moderation effects. This limited my ability in some degree to put the discovered quantitative relations into a context. I tried to overcome this by borrowing heavily from studies that have looked into income inequality and other topics, such as life satisfaction and health status. Overall however, there was no immediate obvious overlap between these outcomes and environmental attitudes which I could discern, so I had to be careful in how much I borrowed from these studies.

This immediately ties into the recommendations for future studies, this being whether the observed associations also hold up across time and with more geographical variance. Secondly, it is also worthwhile to discover which other factors on both the individual and national level influence environmental attitudes, given the large portion of unexplained variance. Lastly, further studies could use this association as cause to look for circumstances that allow for uncovering directionality, causality and/or the underlying mechanisms for these associations.

References

Ahmed, A., Uddin, G. S., & Sohag, K. (2016). Biomass energy, technological progress and the environmental Kuznets curve: Evidence from selected European countries. *Biomass and Bioenergy*, *90*, 202-208.

Apergis, N., & Garćıa, C. (2019). Environmentalism in the EU-28 context: the impact of governance quality on environmental energy efficiency. Environmental Science and Pollution Research, 26(36), 37012-37025.

Barr, S. (2007). Factors influencing environmental attitudes and behaviors: A UK case study of household waste management. *Environment and behavior*, *39*(4), 435-473.

Beck, H. E., Zimmermann, N. E., Mcvicar, T. R., Vergopolan, N., Berg, A., & Wood, E. F. (2018). Present and future Köppen-Geiger climate classification maps at 1-km resolution. Scientific Data, 5(1). https://doi.org/10.1038/sdata.2018.214

Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st century. (2019). *Human Development Report 2019 Human Development Report*, 136–138. doi: 10.18356/d92f4005-en

Blaikie, N. (1993). Education and environmentalism: ecological world views and environmentally responsible behaviour. *Australian Journal of Environmental Education*, *9*, 1-20.

Boeve-de Pauw, J., & Van Petegem, P. (2010). A cross-national perspective on youth environmental attitudes. The Environmentalist, 30(2), 133-144.

Boyce, J. K. (1994). Inequality as a cause of environmental degradation. *Ecological Economics*, *11*(3), 169-178.

Bumann, S., & Lensink, R. (2012). *Financial Liberalization Does Not Benefit Them All*. Working Paper, University of Groningen.

Carvalho, T. S., & Almeida, E. (2011). The global environmental Kuznets curve and the kyoto protocol. *CEP*, *36036*, 330.

Chancel, L., & Piketty, T. (2015). Carbon and inequality: From Kyoto to Paris Trends in the global inequality of carbon emissions (1998-2013) & prospects for an equitable adaptation fund World Inequality Lab.

Cheung, F., & Lucas, R. E. (2016). Income inequality is associated with stronger social comparison effects: The effect of relative income on life satisfaction. Journal of personality and social psychology, 110(2), 332.

Downey, L., & Strife, S. (2010). Inequality, democracy, and the environment. Organization & Environment, 23(2), 155-188.

De Bruyn, S. M., van den Bergh, J. C., & Opschoor, J. B. (1998). Economic growth and emissions: reconsidering the empirical basis of environmental Kuznets curves. *Ecological Economics*, *25*(2), 161-175.

Elo, I. T. (2009). Social class differentials in health and mortality: Patterns and explanations in comparative perspective. Annual review of sociology, 35, 553-572.

Engel, U., & Pötschke, M. (1998). Willingness to pay for the environment: social structure, value orientations and environmental behaviour in a multilevel perspective. *Innovation: The European Journal of Social Science Research*, *11*(3), 315-332.

Fazio, R. H., & Zanna, M. P. (1978). Attitudinal qualities relating to the strength of the attitude-behavior relationship. *Journal of Experimental Social Psychology*, *14*(4), 398-408.

Geiger, S. M., Geiger, M., & Wilhelm, O. (2019). Environment-Specific vs. General Knowledge and Their Role in Pro-environmental Behavior. *Frontiers in psychology*, *10*, 718.

Gemenis, K., Katsanidou, A., & Vasilopoulou, S. (2012, April). The politics of anti-environmentalism: positional issue framing by the European radical right. In *MPSA Annual conference* (pp. 12-15).

Heerink, N., Mulatu, A., & Bulte, E. (2001). Income inequality and the environment: aggregation bias in environmental Kuznets curves. *Ecological Economics*, *38*(3), 359-367.

Intergovernmental Panel on Climate Change, IPCC. (2018). Special report: Global warming of 1.5 ºC.

Jorgenson, A., Schor, J., & Huang, X. (2017). Income inequality and carbon emissions in the United States: a state-level analysis, 1997–2012. *Ecological Economics*, *134*, 40-48.

Lenton, T. M., Rockström, J., Gaffney, O., Rahmstorf, S., Richardson, K., Steffen, W., & Schellnhuber, H. J. (2019). Climate tipping points — too risky to bet against. Nature, 575(7784), 592–595. doi: 10.1038/d41586-019-03595-0

Liere, K. D. V., & Dunlap, R. E. (1980). The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *Public opinion quarterly*, *44*(2), 181-197.

Mahenc, P. (2007). Are green products over-priced? *Environmental and Resource Economics*, *38*(4), 461–473. doi: 10.1007/s10640-007-9084-9

Marquart-Pyatt, S. T. (2012). Contextual influences on environmental concerns cross-nationally: A multilevel investigation. Social science research, 41(5), 1085-1099.

Mayerl, J., & Best, H. (2018). Two Worlds of Environmentalism?: Empirical Analyses on the Complex Relationship between Postmaterialism, National Wealth, and Environmental Concern. *Nature and Culture*, *13*(2), 208-231.

McLoyd, V. C. (1990). The impact of economic hardship on Black families and children: Psychological distress, parenting, and socioemotional development. Child development, 61(2), 311-346.

Mikkelson, G. M., Gonzalez, A., & Peterson, G. D. (2007). Economic inequality predicts biodiversity loss. *PloS one*, *2*(5), e444.

Moomaw, W. R., & Unruh, G. C. (1997). Are environmental Kuznets curves misleading us? The case of CO_2 emissions. *Environment and development economics*, 451-463.

Payne, B. K., Brown-Iannuzzi, J. L., & Hannay, J. W. (2017). Economic inequality increases risk taking. *Proceedings of the National Academy of Sciences*, *114*(18), 4643-4648.

Piketty, T. (2018). Brahmin Left vs Merchant Right: Rising Inequality and the Changing Structure of Political Conflict. *WID. world Working Paper*, *7*.

Präg, P., Mills, M., & Wittek, R. (2014). Income and income inequality as social determinants of health: do social comparisons play a role?. European sociological review, 30(2), 218-229.

Raitano, M. (2016). Income Inequality in Europe Since the Crisis. *Intereconomics*, *51*(2), 67–72. https://doi.org/10.1007/s10272-016-0579-x

Reardon, S. F., & Bischoff, K. (2011). Income inequality and income segregation. *American Journal of Sociology*, *116*(4), 1092-1153.

Schmukle, S. C., Korndörfer, M., & Egloff, B. (2019). No evidence that economic inequality moderates the effect of income on generosity. Proceedings of the National Academy of Sciences, 116(20), 9790-9795.

Schoen, C., Davis, K., DesRoches, C., Donelan, K., & Blendon, R. (2000). Health insurance markets and income inequality: findings from an international health policy survey. Health policy, 51(2), 67-85.

Schultz, P. W., Shriver, C., Tabanico, J. J., & Khazian, A. M. (2004). Implicit connections with nature. *Journal of environmental psychology*, *24*(1), 31-42.

Shen, J., & Saijo, T. (2008). Reexamining the relations between socio-demographic characteristics and individual environmental concern: Evidence from Shanghai data. Journal of Environmental Psychology, 28(1), 42–50. doi: 10.1016/j.jenvp.2007.10.003

Thorbecke, E., & Charumilind, C. (2002). Economic inequality and its socioeconomic impact. *World Development*, *30*(9), 147-1495.

Tully, S. M., & Winer, R. S. (2014). The Role of the Beneficiary in Willingness to Pay for Socially Responsible Products: A Meta-Analysis. *SSRN Electronic Journal*. doi: 10.2139/ssrn.2420537

Appendix

Independent variables	Explanation	Scale / range	Method	Source
Individual Traits				
Income Scale Decile	Income decile, from lowest to highest, per country.	1 - 10	Calculated	ESS8
Education Level	Simplified education level, based on ISCED 1997.	0 - 6	Self-reported	ESS8
Partner	Any form of registrated partnership.	yes / no	Self-reported	ESS8
Age	Age at the time of the interview	15 - 98	Calculated	ESS8
Age^2	Age squared	225 - 8464	Calculated	ESS8
Kids	Ever had children living in the house	yes / no	Self-reported	ESS8
Political leaning	Simplified political leaning, from left to right.	0 -10	Self-reported	ESS8
National Traits				
Climate	Ranging from cold to mediterrenean, Köppen-Geiger Classification.	1 - 4	Calculated	Article
GDP (PPP) p. Capita	Gross National Product, purchasing power parity, per capita.	18951 - 65840	Calculated	IMF
Gini (log)	Lagged income inequality Gini-index, converted to logarithmic scale.	-1.43 - -0.970	Calculated	Eurostat
Gini Interaction	Interaction term between the Gini Coefficient and the income scale decile.	NA	Calculated	NA
Parliamentary ratios				
Leftist	These are the ratios of parliamentary seats per party in 2015. The party	NA	Calculated	Local
Green	allignment on the political spectrum is based on their respective allignment			news
Centrist	in the European Parliament.			sources
Conservative				
Rightist				
Dependent variables				
Climate Worry	Scale response on "How worried are you about climate change?"	1 - 5	Self-reported	ESS8
Personal Responsibility	Scale response on "To what extent do you feel personal responsibility to reduce climate change?"	1 - 10	Self-reported	ESS8

table A1: Summary of variables.

APPENDIX A: Overview of variables and covariates.

	Average	Standard deviation	Kurtosis	Skewness
Dependent variables				
Climate Worry	3.080	0.906	2.964	-0.064
Personal Responsibility	5.877	2.616	2.722	-0.572
Individual Variables				
Income Scale Decile	5.412	2.714	1.895	0.028
Education Level	3.424	1.348	2.135	-0.172
Partner	0.616	0.486	1.228	-0.477
Age	50 years	17.8 years	2.104	0.011
Kids	0.704	0.457	1.797	-0.893
Political leaning	5.072	2.179	3.080	-0.079

Table A2: Individual variable distributions

APPENDIX A: Overview of variables and covariates.

Country		Observations	Avg Climate Worry (1-5)	Avg Personal Responsibility (1-10)	Climate type	Gini coefficient (Income)	GDP (PPP) per capita 5-year average	Ratio of parliamentary seats					
								Green	Leftist	Centrist	Conservative	Rightist	Seats
Austria	AT	1357	3.0	6.1	Cold Temperate	**0.272**	46,009	0.0%	12.4%	26.8%	24.0%	20.5%	83.7%
Belgium	BE	1600	3.2	6.4	Warm Temperate	**0.262**	42,486	0.0%	20.3%	34.4%	11.6%	0.0%	66.2%
Switzerland	CH	1170	3.1	6.8	Warm Temperate	0.296	57,165	0.0%	0.0%	35.2%	0.0%	29.4%	64.6%
Czech Republic	CZ	1508	2.7	4.3	Cold Temperate	**0.25**	29,842	14.9%	0.0%	39.1%	18.8%	0.0%	72.8%
Germany	DE	2447	3.4	6.5	Warm Temperate	0.31	45,087	10.2%	10.0%	30.5%	48.6%	0.0%	99.3%
Estonia	EE	1647	2.7	5.1	Cold	0.348	26,057	0.0%	0.0%	67.7%	13.7%	0.0%	81.4%
Spain	ES	1270	3.5	6.1	Mediterrenean	0.346	32,964	19.7%	0.0%	37.1%	35.1%	0.0%	92.0%
Finland	FI	1753	3.1	6.7	Cold	**0.252**	40,618	0.0%	0.0%	41.5%	37.5%	0.0%	79.0%
France	FR	1727	3.2	6.4	Warm Temperate	0.292	40,026	0.0%	0.0%	48.5%	33.6%	0.0%	82.2%
United Kingdom	GB	1471	3.0	6.3	Warm Temperate	0.324	41,351	0.0%	0.0%	35.7%	50.8%	0.0%	86.5%
Hungary	HU	827	3.1	5.1	Cold Temperate	**0.282**	24,465	0.0%	0.0%	14.6%	67.3%	11.6%	93.5%
Ireland	IE	1659	2.8	5.9	Warm Temperate	**0.272**	51,326	0.0%	0.0%	34.3%	45.8%	0.0%	80.1%
Iceland	IS	764	3.1	6.5	Cold	**0.247**	42,869	0.0%	11.1%	44.4%	30.2%	0.0%	85.7%
Italy	IT	1063	3.3	6.0	Mediterrenean	0.324	35,347	0.0%	0.0%	64.4%	15.6%	0.0%	80.0%
Lithuania	LT	1121	2.9	5.4	Cold	0.379	27,849	0.0%	0.0%	47.9%	23.6%	7.6%	79.1%
Netherlands	NL	1383	3.0	6.7	Warm Temperate	**0.267**	47,592	10.0%	0.0%	52.7%	0.0%	10.0%	72.7%
Norway	NO	1406	3.0	6.5	Cold	**0.239**	65,840	0.0%	0.0%	32.5%	28.4%	17.2%	78.1%
Poland	PL	1002	2.8	6.0	Cold Temperate	0.306	24,388	0.0%	0.0%	0.0%	81.1%	0.0%	81.1%
Portugal	PT	1021	3.5	5.3	Mediterrenean	0.34	26,878	0.0%	0.0%	37.4%	29.1%	0.0%	66.5%
Sweden	SE	1367	2.8	6.7	Cold	**0.267**	45,522	0.0%	0.0%	32.4%	24.1%	14.0%	70.5%
Slovenia	SI	917	3.2	5.6	Mediterrenean	**0.245**	29,299	0.0%	0.0%	57.1%	23.3%	0.0%	80.4%
Totals / Averages		28480	3.1	6.1		0.291	39189						

table A3: Overview of National covariates

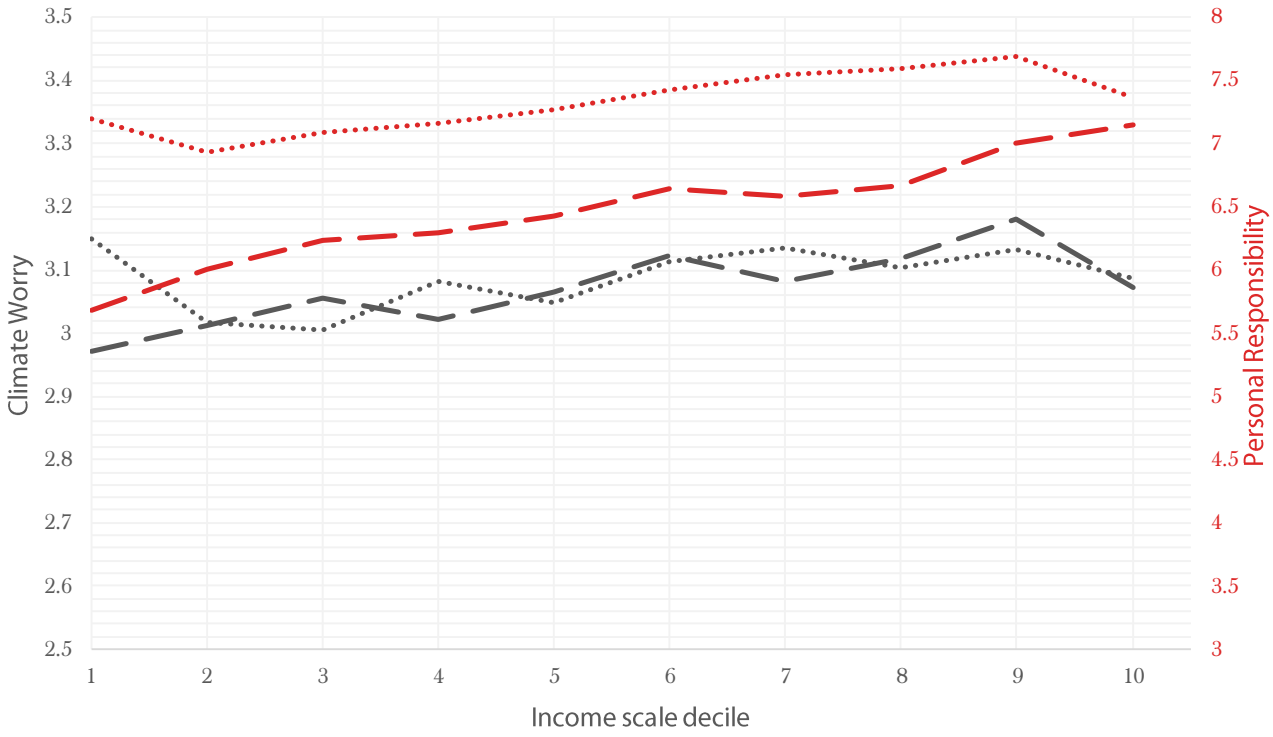
APPENDIX A: Overview of variables and covariates.

	GDP (PPP) per capita, Int. $					
Country	**2011**	**2012**	**2013**	**2014**	**2015**	**Average, 5 years**
AT	44,541	45,466	45,934	46,778	47,327	46,009
BE	41,077	41,647	42,168	43,338	44,200	42,486
CH	54,769	55,728	57,098	58,808	59,423	57,165
CZ	28,560	28,802	29,096	30,433	32,317	29,842
DE	43,193	43,933	44,882	46,223	47,202	45,087
EE	23,919	25,494	26,508	26,508	27,856	26,057
ES	32,467	32,076	32,158	33,285	34,835	32,964
FI	40,377	40,340	40,490	40,771	41,114	40,618
FR	38,657	39,251	39,912	40,801	41,507	40,026
GB	37,007	37,994	39,154	40,762	51,838	41,351
HU	22,923	23,086	24,006	25,553	26,757	24,465
IE	45,359	46,058	47,422	52,133	65,656	39481
IS	40,022	41,005	42,953	44,220	46,146	42,869
IT	35,544	35,051	34,804	35,310	36,025	35,347
LT	22,751	24,382	35,903	27,537	28,670	27,849
NL	46,309	46,491	47,015	48,363	49,780	47,592
NO	62,656	64,699	65,673	67,377	68,795	65,840
PL	22,575	23,359	24,068	25,334	26,602	24,388
PT	26,588	26,093	26,359	27,218	28,130	26,878
SE	43,719	44,057	44,906	46,410	48,518	45,522
SI	28,774	28,448	28,534	29,879	30,858	29,299

table A4: GPD (PPP) per capita per country, including running average

source: IMF, W. (2018). Databases www. imf. org.

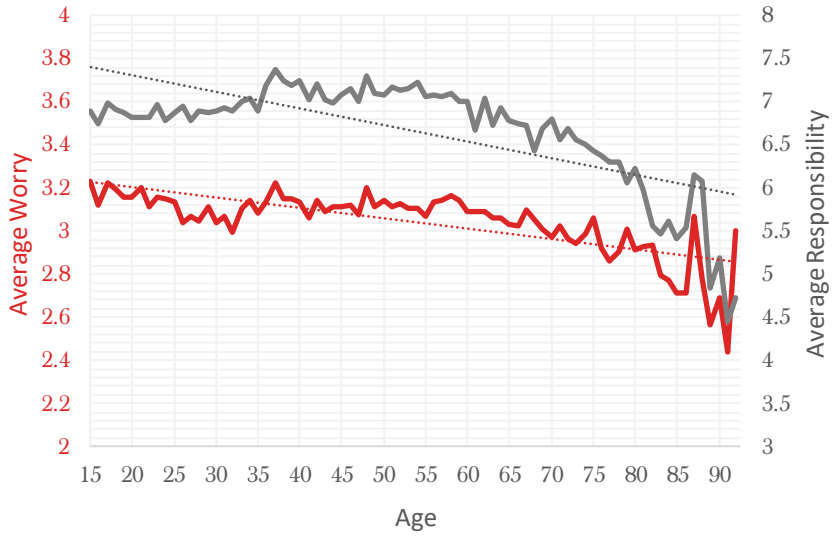
APPENDIX B: Overview of dependent-independent relations.



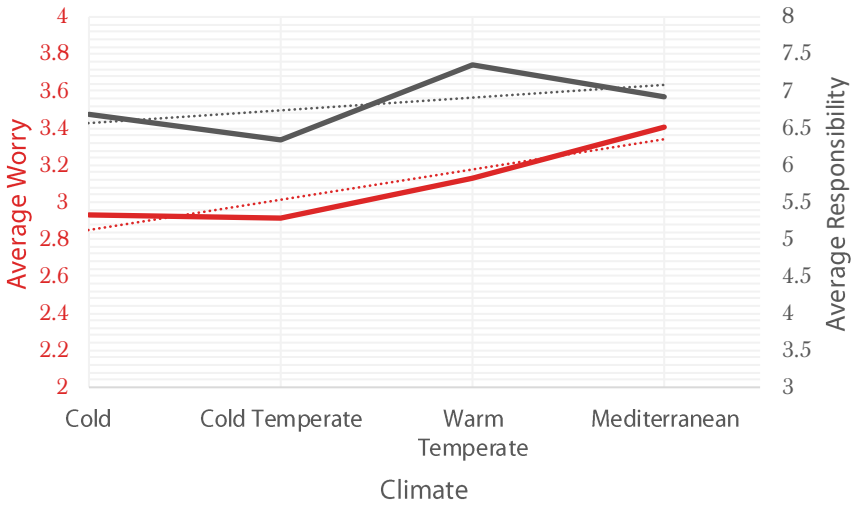
Legend: dotted lines represent countries with a below average Gini-coefficient. Dashed lines represent countries with an above average Gini-coefficient.

graph B1: differences in average environmental attitudes based, sorted by high/low income inequality.

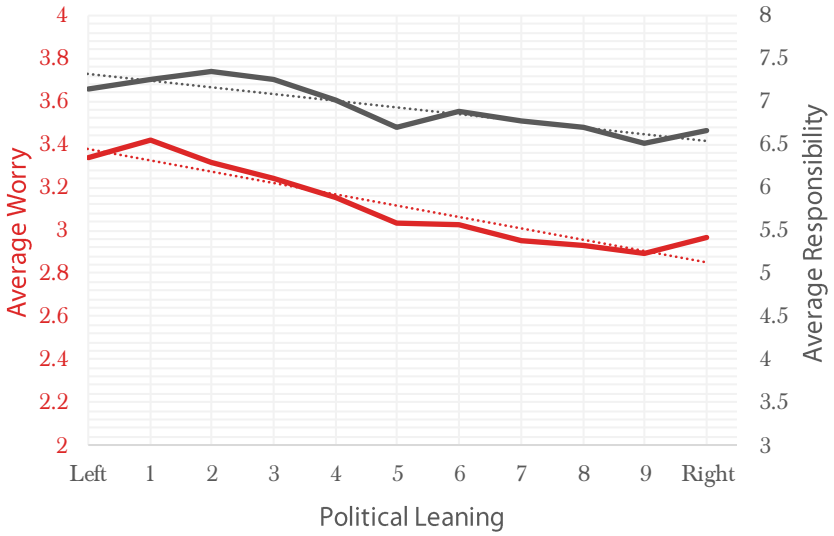
APPENDIX B: Overview of variables.



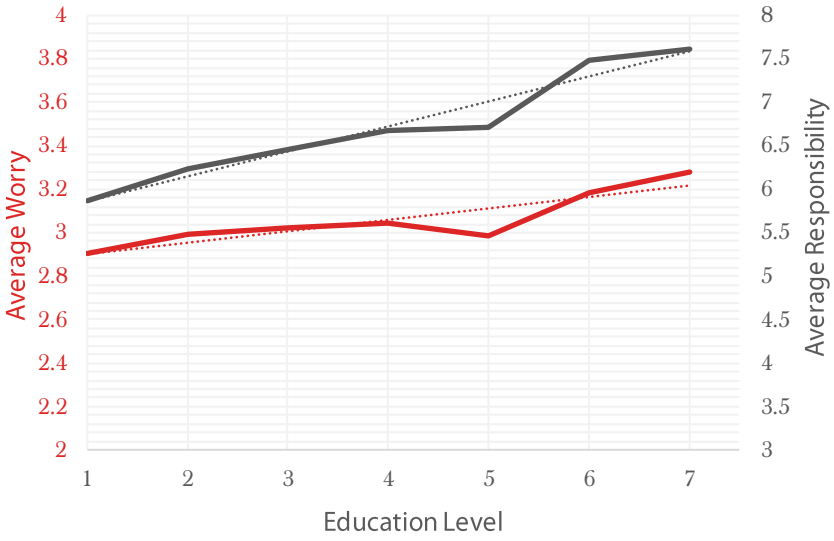
graph B2: age-dependent relations



graph B3: climate-dependent relations

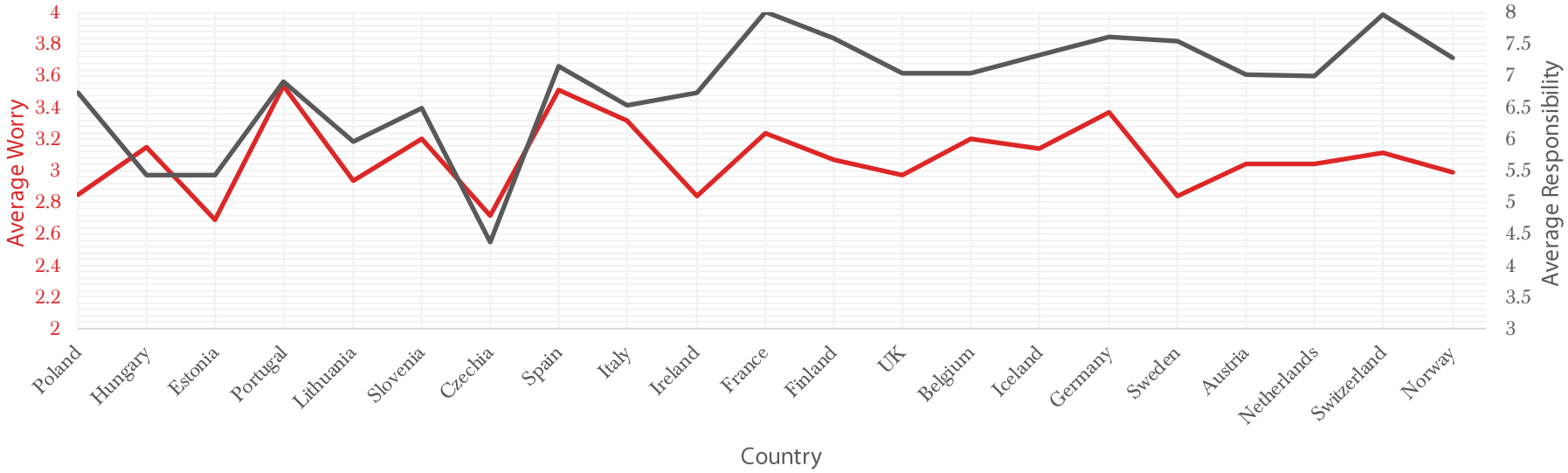


graph B4: political leaning-dependent relations



graph B5: education-dependent relations

APPENDIX B: Overview of variables.



graph B6: GDP-dependent relations

	Average Attitudes			
Responsibility	6.92	6.86	6.68	7.00
worry	3.13	3.06	3.07	3.09
	~ Kids	With Kids	~ Partner	With Partner

table B1: average attitudes family status

APPENDIX C: Model likelihood tests

Likelihood-ratio tests

Iteration model 1

	Climate Worry	Personal Responsibility
	Country clusters	
Intraclass correlation	0.063	0.112
Log likelihood	-39462	-38636

Iteration model 2

	Climate Worry	Personal Responsibility
	Country clusters	
	Income Scale Decile	
Intraclass correlation	0.066	0.112
Log likelihood	-39433	-38417
Prob > Chi^2	0.000	0.000

Iteration model 3

	Climate Worry	Personal Responsibility
	Country clusters	
	Income Scale Decile	
	Education Level	
	Partner	
	Age	
	Age^2	
	Kids	
	Political leaning	
	Climate	
	GDP (PPP) p. Capita	
	Parliamentary Ratios	
Intraclass correlation	0.031	0.052
Log likelihood	-39083	-37996
Prob > Chi^2	0.000	0.000

Iteration model 4

	Climate Worry	Personal Responsibility
	Income Scale Decile	
	Education Level	
	Partner	
	Age	
	Age^2	
	Kids	
	Political leaning	
	Climate	
	GDP (PPP) p. Capita	
	Parliamentary Ratios	
	Gini (log)	
	Gini Interaction	
Log likelihood	-39082	-37993
Intraclass correlation	0.026	0.044
Prob > Chi^2	0.1845	0.025

table C1: model iterations