ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Master Thesis: Data Science and Marketing Analytics

Walk the talk in sustainable consumption

Characteristics of young consumers who adopt sustainable behaviours

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Abstract

Climate change is a serious problem that threatens the quality of life of our future generations. As consumer behaviour is largely related to the human impact on climate change, this study aims to discover what type of consumers from young generations choose to adopt sustainable alternatives. For this study, we build on an existing web-based survey with responses from 10.900 youngsters originating from 44 countries, supplemented with country-related data. Using a cumulative logit model with a country fixed effect we investigate the relationship between individual- and country-level characteristics and sustainable consumption. Our findings show that lower levels of risk aversion, the experience and expectation of extreme weather events, cognitive ability and the extent to which youngsters receive information from their parents on the topic all enhance the probability to adopt sustainable behaviours. On the country-level, we find that youngsters from wealthier countries are more likely to adopt sustainable behaviours whereas higher life expectancy, as well as government expenditure on education, have a negative effect. No clear evidence is therefore obtained with which we can state that either people from developing or developed countries adopt more sustainable practices. The fixed effect parameter indicates that culture is also likely to influence the level of sustainable consumption. This research shows that sustainable consumption can be stimulated by providing information that is easy to understand, visualized and lowers the perceived risk. Parents could be targeted to spread this information as they appear to be an effective medium.

Keywords: *Sustainable consumption, pro-environmentalism, consumer behaviour, attitude-behaviour gap, cumulative link model*

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1. Introduction

Climate change is a serious problem that receives broad attention from various academic fields nowadays. Since the Industrial Revolution, almost two hundred years ago, the world has seen significant increases in the average temperature (Cuomo, 2011). Most of this increase is observed in the last decades which causes a great concern according to various researchers (Gorke, 2003; Barnosky, 2009; Secretariat of the Convention on Biological Diversity, 2010). The change in global climate could have big catastrophic consequences for humanity and all other living species on earth, of which a large share is threatened by extinction due to global warming (IPCC, 2007; Secretariat of the Convention on Biological Diversity, 2010; Bradley et al., 2010). Action against the alteration of the climate is therefore important.

The biggest driver behind climate change is humanity itself (Rockström et al., 2009). That is, climate change is mainly caused by CO2 emissions which find their biggest roots in transport and food production (Guan et al., 2008). Besides, deforestation increases the human impact on climate change since trees can absorb the emitted CO2 and thereby purify the air (Bala et al., 2007). Consequently, human behaviour needs to be changed in order to fight climate change. Due to the scale of the problem, it is necessary to take wide-ranging actions if one wants to make an impact. Yet, high-level actions by companies and political institutions are unlikely to occur if there is no significant demand for those actions from below (Cuomo, 2011). Stimulating consumer demand and interest in sustainable operations is therefore of great importance.

1.1 The challenge of creating awareness

Increasing awareness for the problem of climate change and move society towards more sustainable consumption yet appears to be a great challenge. Since the effects of climate change are still hardly noticeable for most people, the future consequences for the self are likely to be too intangible (Reczek, Trudel, and White, 2018). Consumers, therefore, might not feel the urgency to alter their current behaviour. On the other hand, knowledgeable consumers that report that they are willing to reduce their ecological footprint most often fail to act after these claims (Frederiks, Stenner, and Hobman, 2015). This observed mismatch between the claims stated by consumers and their actual behaviour in the market is called the attitude-behaviour gap (Boulstridge and Carrigan, 2000). The attitude-behaviour gap poses a challenge for companies who are willing to take actions towards more sustainable operations. In the past, several academics have stated that companies that involve in sustainable business practices will become more resilient and earn higher profits in both the short and long term (Caminity, 1992; Trapp, 1998; Porter and Kramer, 2011; Ortiz-de-Mandojana and Bansal, 2016). However, since observed present consumer behaviour does not support this claim (Pereira Heath and Chatzidakis, 2012; Thøgersen, 2014) companies

are less likely to change their way of doing business. By these means, human impact on climate change largely stays the same, resulting in the deterioration of our planet to continue.

1.2 The focus on younger generations

A reasonable thought that arises states that our younger generations will experience most of the negative consequences from climate change as the global temperature is expected to increase up to 5.5 degrees Celsius over the next century (IPCC, 2013). Additionally, change of behaviour is also relevant for our youngsters as climate change will impact the quality of life of their children. For these reasons, the tangibility of the problem is expected to be larger for this group and it is reasonable to think that creating awareness will be easiest for them. A next factor that causes one to think that the younger generations are an important target group for stimulation of sustainable behaviour, is the fact that changing the consumption behaviour of this group results in the highest long-term impact. Not only will this consumer group be the one amongst us that still lives longest on earth, but it is also likely that they are the ones to transfer behavioural habits to the next generations resulting in the change to be durable. For these reasons, changing the consumption behaviour of this particular group is of high importance if one aims to put a stop to climate change. Consequently, this study focusses on answering the following research question: *Which factors contribute to a higher likelihood of sustainable consumption behaviour in terms of meat consumption and water utilization by current younger generations?*

By answering this research question, we will provide academic ground for governments and companies aiming to motivate consumers to behave more sustainable. These answers can help those institutions to find tools and incentives that can successfully turn the buying behaviour of the present and next generations. By these means, this research supports the reduction of the ecological footprint of humanity and enables the realisation of a high-level impact in the battle against climate change.

1.3 Academic relevance

A lot of academic literature has been written on the existing attitude-behaviour gap that is observed around the adoption of sustainable consumption behaviour. White, Habib and Hardisty (2019) provide an overview of many psychological theories that have been written about potential causes of this gap and solutions to overcome it. Yet, a lack of empirical research regarding the drivers behind sustainable consumption behaviour has been observed. Furthermore, the empirical studies that do exist most often only focus on one specific form of sustainable consumption, as well as one factor that influences this. As an example, Price and Leviston (2014) study the influence of risk aversion on the level of sustainable land management by farmers.

Apart from individual-level factors like risk aversion, several empirical studies have been focussing on the differences in levels of sustainable consumption between developed and developing countries. High controversy is observed here in statements whether either wealthy or poorer nations adopt higher levels of pro-environmental behaviour. This hints for the need for further investigation.

This study enriches the empirical literature on the attitude-behaviour gap by being the first one to investigate the factors that influence the level of sustainable consumption of the younger generations in several countries across the globe. Hereby, our focus is unique in the fact that we put our attention on several relationships both at the individual- and the country-level. We go beyond the existing literature on country-level relationships as we also control for the effects of the socio-demographic and cultural environment. Moreover, we broaden the definition of sustainable consumption by combining two well-known alternatives: the reduction of meat and water consumption. Both behaviours have already been studied individually by Clonan et al. (2016) and Corbella and Pujol (2009) respectively but in another context. By combining the two into one definition we offer better ground to make generalizations of the concept of sustainable behaviour.

Our insights open up new angles for future research as we offer new insights about potential drivers behind pro-environmental behaviour of young consumers from multiple backgrounds. New work could use our findings to investigate to what extent these findings could be generalized.

1.4 Research specifications

To answer the research question, there has been made use of an existing online survey that is held among young generations. The survey asked questions related to awareness of the climate change problem and their level of involvement in preventive actions. The sustainable behaviours that were measured by the survey, and thereafter used for the analysis of this research, included the reduction of meat and water consumption. For this reason, sustainable consumption is defined in this paper as adopting at least one of those two practices. The data was enriched by country-specific variables to incorporate the measurement of country-specific relationships. Several ordinal logistic regression models were estimated in order to find potential individual drivers and incentives for sustainable consumption behaviour and country-specific relationships. In the final model, a multilevel component was added to control for country-specific cultural effects that could not be measured directly by the variables in our data.

In the next section, we will introduce our conceptual framework together with a review of the relevant academic literature. Based on this literature, we derived seven different propositions that were used to support our conceptual framework. In the subsequent sections, we will dive deeper into the data that was used and elaborate on the applied methodology. After this section, elaborations will be provided on data transformation techniques followed by a section with the main analysis and results. The paper will conclude with a discussion on the implication of our outcomes and some statements for future research.

2. Conceptual framework and literature

2.1 Conceptual framework

2.1.1 Derivation of concepts

As we used data from an existing survey that was not custom made for this research, we were limited in terms of individual-level concepts that we could study. The survey questions all focussed on revealing the thoughts of participants on the problem of climate change and the actions they had taken against it. At the same time, questions were designed to reveal some personal characteristics of the participants which allow us to study which type of respondents ended up to adopt sustainable behaviours. The topics that we finally selected for this research will be discussed below. Those were the ones that could be linked directly to existing academic literature.

While we were limited in our measurement of individual-level concepts, we could still link the individual observations to more general data on the country-level. Thereby, incorporating the level of the economic prosperity of the country that the participants originate from and their socio-demographic environment. By these means, we could extend our study by looking at the general relationship between sustainable consumption and country-related factors, as this is a topic which has been discussed in academic literature several times.

2.1.2 Framework

The conceptual framework in Figure 1 shows the expected relationships between our data and sustainable consumption. The model measures individual-level effects ranging from risk aversion to personal economic state (as marked by **P1- P6**), as well as country-level effects which are measured by the country-related factors (marked by **P7**). Five relationships are measured using several variables that are marked in the grey boxes on the left side of Figure 1.

2.2 Literature review

The attitude-behaviour gap as observed in situations that involve decisions on the adoption of sustainable alternatives is an aspect that is thoroughly discussed in academic literature. The phenomenon implies that, even though a large share of consumers report concerns about the environment and indicate readiness to act upon this, many often fail to comply with these claims when it comes to their actual consumption behaviour (Vermeir and Verbeke, 2006; Frederiks, Stenner and Hobman, 2015). One clear example is the growing pattern of over-consumption that

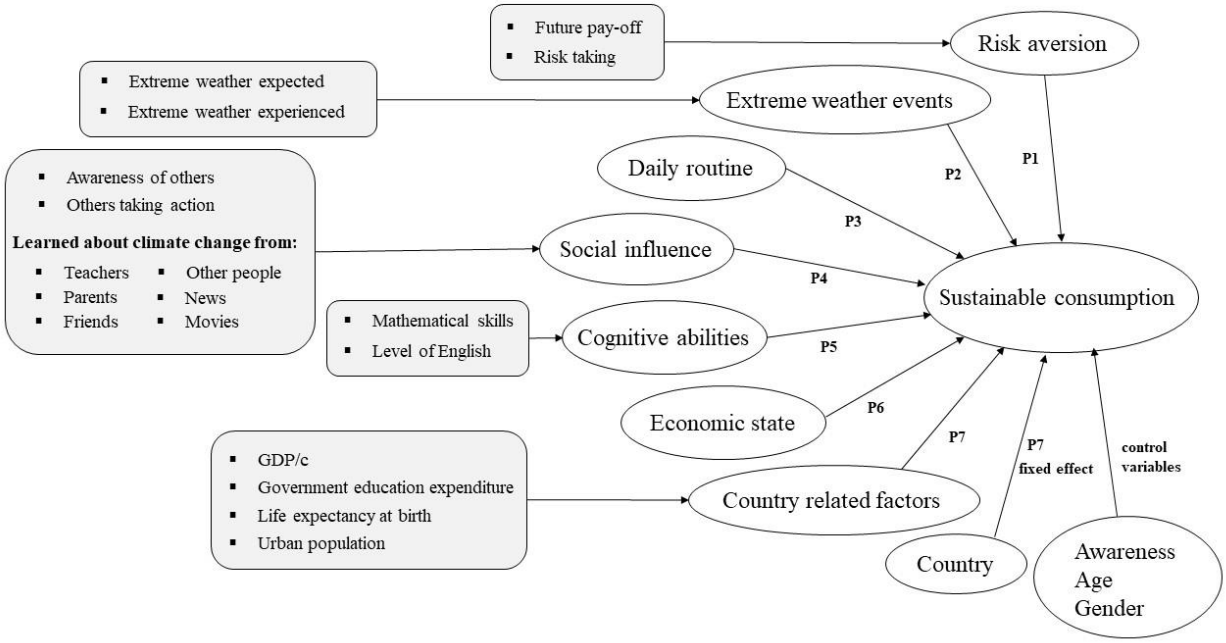

Figure 1: *Conceptual framework*

is still observed today while a large share of the population indicates to be aware of this phenomenon (Krystallis et al., 2012).

2.2.1 Human behavioural bias

The existence of the attitude-behaviour gap is hard to unify with the classic economical thoughts on consumption. Economic theory assumes that consumer choices are purely rational (Simon, 1955; Becker, 1962) which means that individuals make a decision based on their optimised utility in terms of benefits and costs (Scott, 2000). However, consumer behaviour related to pro-environmental actions is often irrational. This is especially true when considering the long-term outcomes (Ariely, 2008). The explanation for this is provided by the fields of psychology and behavioural economics. That is, consumers' consumption decisions are influenced by cognitive biases (DiClemente and Hantula, 2003). These cognitive biases are often the result of 'heuristics' or mental short-cuts that are unconsciously taken by the human brain to avoid the need of dealing with too much complex information around sustainable consumption decisions (Gigerenzer, Hertwig and Pachur, 2011). Correspondingly, Shields, Šolar and Martin (2002) find that stimulations of sustainable behaviour provided by public institutions are only effective when the information around sustainability is spread in a form that people can understand and relate to.

Uncertainty or ambiguity is an important characteristic of sustainable consumption decision making (Reczek, Trudel and White, 2018). Heuristics are also exploited in these types of situations (Kahneman et al., 1982). The outcome of sustainable consumption today will often only translate in pay-offs in the future which causes them to be ambiguous (Weber, 2010). Additionally, the future pay-offs are likely to be experienced by the entire society and to a lesser extent by the individual itself. Therefore, the consumer has to sacrifice some positive utility of today while he or she is not certain how much of the future pay-off will be received back (White, Habib and Hardisty, 2019). The fact that the exact future pay-offs are uncertain implies that pro-environmental behaviour involves a high risk (Holt and Laury, 2002). Since most humans tend to be risk-averse, consumers are likely to avoid such behaviours (Kahneman, Knetsch and Thaler, 1991). Related to this, Price and Leviston (2014) find that the adoption of pro-environmental practices by farmers is negatively impacted by the individual level of risk aversion. These findings raise the thought that risk aversion will also impact the decision of young consumers to involve in sustainable behaviour. This leads to our first proposition statement:

P1. *The adoption of sustainable consumption behaviour by young consumer groups depends on their level of risk aversion*

2.2.2 Problem tangibility

One heuristic that is often exploited by the human brain in uncertain and high-risk situations is 'availability' (Tversky and Kahneman, 1974). According to Tversky and Kahneman (1974), the availability bias causes people to use relatable outcomes or situations that are top of mind as a handle for future decisions. Yet, the problem with sustainable practices is that both the outcomes of climate change and the preventive actions are intangible (Carrete et al., 2012). Therefore, it is likely that consumers show suboptimal behaviour regarding pro-environmental actions based on this heuristic. Efforts to enhance the tangibility could help in solving this problem (White, Habib and Hardisty, 2019). For example, one can stimulate consumers to think more about the future and increase the awareness of the possible impact they can have on the quality of their own future life and that of their children (Wade-Benzoni, Tenbrunsel and Bazerman, 1997; Zaval, Markowitz and Weber, 2015). Communication on local climate change effects instead of generalizing it to a world problem can also help to make the problem more tangible (Scannell and Gifford, 2013). Framing the message in such a way that the future losses for the self are emphasized is likely to result in even bigger improvements (Hardisty and Weber, 2009). This, in combination with a detailed description of the different steps that can be taken to prevent climate change, is likely to stimulate the actual desired behaviour (White, MacDonnell and Dahl, 2011).

A study with a link to tangibility is provided by Lebel (2013). He finds that awareness of climate change and the level in which people take actions against it depends on to what extend extreme weather conditions have been experienced in the past in the local area. Individuals tend to adopt more sustainable practices when direct consequences of climate change, like the experienced level of temperature change (Zaval et al., 2014) or extreme weather events, are 'available' in their mind (Berrang-Ford et al., 2011). Findings that support this show higher levels of awareness in developing countries compared to Western countries (Schneider, 1988; Livernash, 1992; Brechin and Kempton, 1994) as those countries seem to experience more of the early day effects of environmental deterioration (Durning, 1989). As a result, people from these countries are more likely to have experiences available in their minds (Lebel, 2013). Based on this, our following proposition states:

P2. *The familiarization with extreme weather events contributes to the level of sustainable consumption by young people.*

2.2.3 Habit formation

Other factors have also been suggested to trigger pro-environmental actions. One of them is habit formation. Many types of sustainable behaviours (like reduced meat and water consumption) are most often habitual (Verplanken and Roy, 2016). When old (unsustainable) habits can be changed into new and more sustainable ones, the sustainable behaviour is likely to become permanent (Brown, Werner and Kim, 2003; Verplanken et al., 2008). Corresponding to this, the third proposition of this research states:

P3. *Incorporation of sustainable consumption patterns in the daily routine of young consumers will lead to higher levels of sustainable consumption.*

However, changing former habits forms a major challenge since these behaviours are performed automatically (Verplanken and Roy, 2016). Yet, individuals appear to be more flexible to change their habits as soon as a contextual discontinuity around the old habit occurs (Bamberg, 2006). Multiple studies showed that major life events like moving to another place (Bamberg, 2006; Thøgersen, 2012; Verplanken et al., 2008) or switching jobs (Walker, Thomas and Verplanken, 2015) form moments in which people are flexible to switch their habits. Events like these can then be used to determine the right moments to impose incentives for sustainable behaviour (Verplanken and Roy, 2016).

2.2.4 Social influence

Another potential driver behind sustainable consumption behaviour is the mind-set and behaviour of the social environment. Social influence is stated to be a high contributor to awareness and the level of adoption of sustainable consumption patterns (Abrahamse and Steg, 2013). The sustainable buying

behaviour of consumers and their involvement in certain actions like energy conservation is highly affected by what close others think, believe and do (Cialdini and Goldstein, 2004; Moretti, 2011; Howland, Hunger and Mann, 2012). Three forces are mainly at work. The first of them is the prevailing social norm (Cialdini et al., 2006) which can be split out in two different types: the descriptive norm, which describes what other people do, and the injunctive norm, which expresses what others approve of (Cialdini, Kallgren, & Reno, 1991). Especially the descriptive norm can highly influence peoples' intentions to involve in sustainable behaviour (Han and Stoel, 2017). When the larger share of society does not engage in sustainable actions it is very unlikely that an individual consumer does so himself (Schultz et al., 2007). The second force, social desirability, implies that people are strongly driven by social status (Griskevicius, Tybur and Van den Bergh, 2010). Consumer decisions are partly driven by the desire to make a good impression on others (Green and Peloza, 2014). Therefore, the adoption of pro-environmental behaviour is unlikely if other people do not attach value to sustainability or even see it as undesirable (Brough et al., 2016; Olson et al., 2016). The last force is social identity, which is related to the feeling of group membership (Stets and Burke, 2000). The presence of social identity means that people are more likely to engage in sustainable actions if other in-group members are doing so (Goldstein, Cialdini and Griskevicius, 2008). For all these reasons above, it is believed that the level of sustainable consumption of youngsters is affected by the social environment. Our fourth proposition therefore states:
P4. *Social influence impacts the adoption of sustainable consumption behaviours by young consumers.*

Yet, social influence can also be used as a driver to encourage sustainable behaviour when information is spread about the sustainable actions of other people in society (White, Habib and Hardisty, 2019). By making publicly known what other people are doing, the forces of the social norm, social desirability and social identity can incentivise people to behave in the desired manner (Goldstein, Cialdini and Griskevicius, 2008).

2.2.5 Cognitive abilities

As discussed before, Shields et al. (2002) find that pro-environmental behaviour is more likely to occur when people understand the information that has been spread about climate change. Corresponding to this, several researchers have argued that pro-environmental behaviour is positively related to the amount of education that an individual received (Torgler and García-Valiñas, 2007; De Silva and Pownall, 2014). Empirical evidence for this was found by Meyer (2015), who showed that an extra year of obtained education enhances the probability of a consumer to adopt sustainable behaviours. As most of the participants in our survey are not likely to have finished their educational careers, it is not possible to apply this measurement to our population. Yet, it is assumed that the total number of years of education is strongly

related to the cognitive ability of an individual. For this reason, we validate whether a similar relationship exists for the newest generation of consumers by analyzing the effect of cognitive skills. This leads to the statement of the fifth proposition:

P5. *There exist a positive relationship between cognitive ability and the level of sustainable consumption by young consumers*

2.2.6 Economic state

A few studies regarding sustainable consumption have highlighted the influence of a household's perceived financial state. The theory on this was introduced by Steg and Vlek (2009) who designed a conceptual theoretical framework on the drivers behind sustainable consumption. Here, it was stated that a household's economic state might be positively related to the adoption of pro-environmental behaviours. Supportive empirical findings for this theory are provided by Ertz et al. (2016) and Clark, Kotchen and Moore (2003). The latter find that participants of green-electricity programs generally report above-average incomes. Based on these studies we might expect that higher financial ability will also play a positive role in the level of sustainable consumption of youngsters. This leads to the statement of the sixth proposition:

P6. *The economic state of young individuals positively influences their level of sustainable consumption*

2.2.7 Country-related differences

As suggested by the differences in experienced changes in weather conditions, levels of sustainable consumption possibly differ between countries and regions (Brechin and Bhandari, 2011; Zaval et al., 2014; Lee et al., 2015). Schneider (1988), Livernash (1992), and Brechin and Kempton (1994) already showed that differences in weather conditions resulted in a higher awareness about the problem of climate change in developing countries. However, earlier studies have spread the thought that only people from developed countries are adopting pro-environmental behaviours (Sill, 1975; Broad and Cavanagh, 1993). Some research even states that sustainable behaviour is limited to only the wealthiest social groups within developed countries (Tucker, 1982). This thought is supported by the theory of post-materialism which is the driver behind the development of environmental concern according to researchers (Paehlke, 1989; Inglehart, 1992). Regardless the rise of globalization (O'Brien and Leichenko, 2000), a more recent study of Lee et al. (2015) still shows large variations in the adoption of sustainable practices across the globe with higher levels in Western countries. These observed differences between developed and developing countries might be influenced by cultural differences (Jamelske, Barrett and Boulter, 2013; Lee et al., 2015), socio-demographic factors (Schultz, Zelezny and Dalrymple, 2000; Whitmarsch, 2011) and economic prosperity (Scruggs and Benegal, 2012). Hence, the last proposition of this research states:

P7. *The adoption of sustainable practices by young consumers depends on country-specific factors.*

2.3 Fixed effects and control variables

2.3.1 Fixed effects

Since countries can differ in their culture, socio-demographics and state of economic development, it is expected that individuals from different countries will vary in their likelihood of adopting sustainable consumption behaviours. As our data does not allow to control for cultural effects directly another component should be added. The effect of culture is assumed to be constant for each respondent and is therefore stated to be "fixed" (England et al., 1988). For this reason, a fixed effect parameter for country is introduced which allows the initial probability that an individual adopted sustainable consumption practices, to vary according to their country of origin.

2.3.2 Control variables

Since an individual needs to be aware of the climate change problem before he or she can consciously take actions against it, it is expected that an individuals' general level of awareness is related to the level of sustainable consumption. At the same time, some of our independent factors like extreme weather events, and social influence are also likely to relate to awareness. Therefore, part of the effect that awareness has on sustainable consumption behaviour is likely to be nested in our independent factors. Even so, it is expected that age and gender influence the response patterns of the survey participants. To make sure those variables do not impact the main effects of our variables of interest, it was decided to include age, gender, and awareness as control variables in our models.

3. Data description

3.1 Survey data

The data that was used for the analyses of this research is derived from the Global State of Youth Preferendum survey that was held in November and December 2019. The survey was initiated by a collaborative effort of KidsRights and Facebook. KidsRights is a worldwide acknowledged non-profit organization that devotes its' efforts to the preservation of children rights and child well-being across the globe (KidsRights, 2020). The survey has been published via a campaign on the Facebook platform and targeted people in the age of 13 to 24 from all countries of which the Facebook default language was English.

The survey consisted of 27 questions that were developed by members of various European academic institutions. The goal of the survey was to reveal the thoughts of youngsters around the world about several topics around climate change. Participants were asked about whether they thought climate change is a serious problem. Answers were given on a 7-point Likert scale where 1= Not at all and 7= Very much. Participants were also asked about whether they participated in one or more of the following five different actions in the past twelve months:

- Avoided eating meat or reduced their meat consumption
- Re-used plastic shopping bags and/or recycled plastic bottles
- Reduced water consumption
- Protested against climate change
- Volunteered for an organization that tackles climate change

Other questions focused on the characteristics of the participants. Several questions asked about personal information like gender, country of origin, and current education. Others asked about their willingness to take risks or to help others on a 10-point scale where 1= Not at all willing and 10= Very willing. Those were supplemented by questions about whether they generally showed certain personal behaviours (on a 7-point scale where 1= Definitely disagree and 7= Definitely agree) and routines (on a 2-point scale where 1= Disagree and 7= Agree). Lastly, questions were asked about the participants' economical state (on a 7-point scale where 1= Strongly disagree and 7= Strongly agree) and their thoughts about the involvement of other young people in their country with the climate change problem (on a 7-point scale where 1= No one and 7= Everyone).

Answers were registered as soon as the participants created an account that allowed access to the survey.

The dataset resulting from the survey consists of 10.900 respondents. Out of these respondents, 259 were in the age over 24. Since their exact age was unknown it was decided to remove those observations and limit our definition of young consumers to people in the age of 13 to 24. The remaining observations originated from 44 different countries divided over all continents. The division of observations over all countries can be derived from Figure 2. Almost fifty per cent of all respondents come from the United States, followed by Austria and Angola that represent both around ten per cent of the observations. Furthermore, a majority of the countries are only represented by a minor share of respondents. All countries on the right of Lebanon contain less than fifty observations. Because this amount of observations is too small to detect any country related effects it was decided to omit these countries from the analysis. This left the dataset with 10.497 observations. As a last notice, the resulting dataset was evenly balanced in terms of gender. This gender variable was subsequently transformed into a factor to be able to incorporate it as a control variable later on. The variable for age was transformed into numeric to reduce the amount of independent variable categories in our future models.

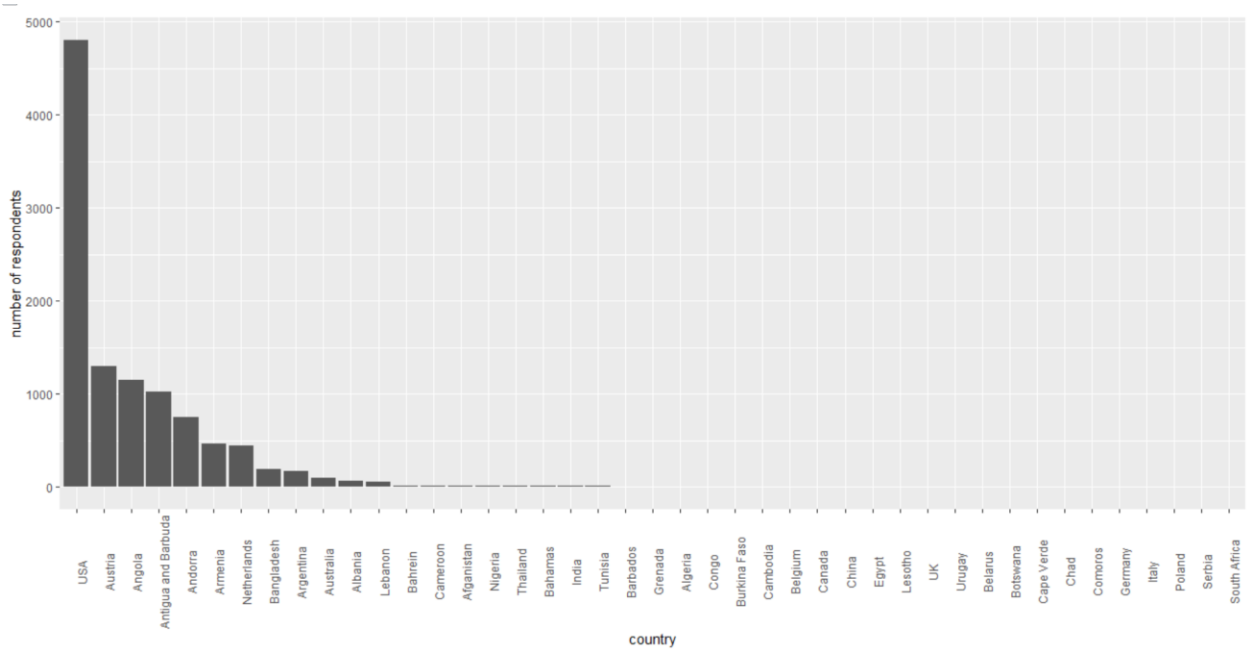

Figure 2: *Total number of respondents per country*

Not all of the 27 questions in the survey were of interest for this research. Since the interest lies in consumers that reduce meat consumption and water usage, the three variables representing the other sustainable behaviour options were removed from the dataset. Furthermore, variables that represented respondents subjective ideas on climate change solutions were taken out from the analyses.

3.1.1 Construction of the dependent variable

Two dummy variables were used to indicate whether a respondent reduced his or her meat consumption and water usage (=1) or not (=0). To create a dependent variable for the analysis, these two variables were merged into a single ordinal variable that takes the following values:

0 = adopted none of the sustainable behaviours

1 = adopted one of the two sustainable behaviours

2 = adopted both sustainable behaviours

The two original dummy variables were subsequently removed.

3.1.2 Risk aversion

P1 suggests that the level of risk aversion affects the choice to involve in sustainable consumption. Two variables were derived from the survey to measure this relationship. *Future pay-off* expresses a respondent's willingness to give up utility today to receive an uncertain pay-off in the future. Secondly, *risk taking* expresses the level of an individual's reported willingness to take risks.

3.2 Country specific variables

The dataset was enriched by country-specific variables that were retrieved from the World Bank, an international organization that works together with governments all over the world to gather data and practices efforts to reduce poverty in developing countries (The World Bank Group, 2020). From the World Bank, the World Development Indicators (WDI) report was obtained which includes 1428 variables for 217 different countries regarding the topics of poverty and equality, socio-demographics, the environment, and economics. From this dataset, four different variables were selected for all 12 countries that remained after the above-performed transformations. Variables included a country's GDP per capita, government expenditure on education as a percentage of GDP, life expectancy at birth, and the share of the population living in urban areas. It was chosen to select government expenditure on education as an approximation for the quality of education in a country since this data was available for all 12 countries. For each variable, the most recent data was selected which stems from the year 2018.

3.3 Descriptive statistics

3.3.1 Country variable descriptive statistics

Table 1 presents descriptive statistics of a selection of the macro-economic and socio-demographic variables. The large standard deviation for the GDP per capita indicates that there are vast differences in country prosperity. Also the standard deviations and minimum and maximum values of the other variables

show large differences between countries. This indicates that both developed and developing countries are represented in our dataset.

Table 1: *Descriptive statistics of macro-economic and socio-demographic variables*

Statistic	Mean	St. Dev.	Min	Max
GDP per capita (in $)	43,321	23,686	1698	62,795
Government expenditure on education (% of GDP)	4.36	1.12	1.97	5.5
Life expectancy at birth	76.54	6.01	60.78	82.75
Urban population (% of total population)	71.06	19.09	24.60	91.87

3.3.2 Survey variable descriptive statistics

To obtain descriptive statistics for the survey variables, the character variable that indicates which country the participant originates from was transformed into a factor variable to be able to provide descriptives per category. All other variables that were on a Likert scale were transformed into numeric so the ordered nature of the categories could be captured by later analysis. A first impression of the possible relationships in our data could be obtained by looking at Figure 3. Here, the correlations between the ordinal variable and the numeric variables are presented. No strong relationships are yet revealed since the largest absolute value is lower than 0.17.

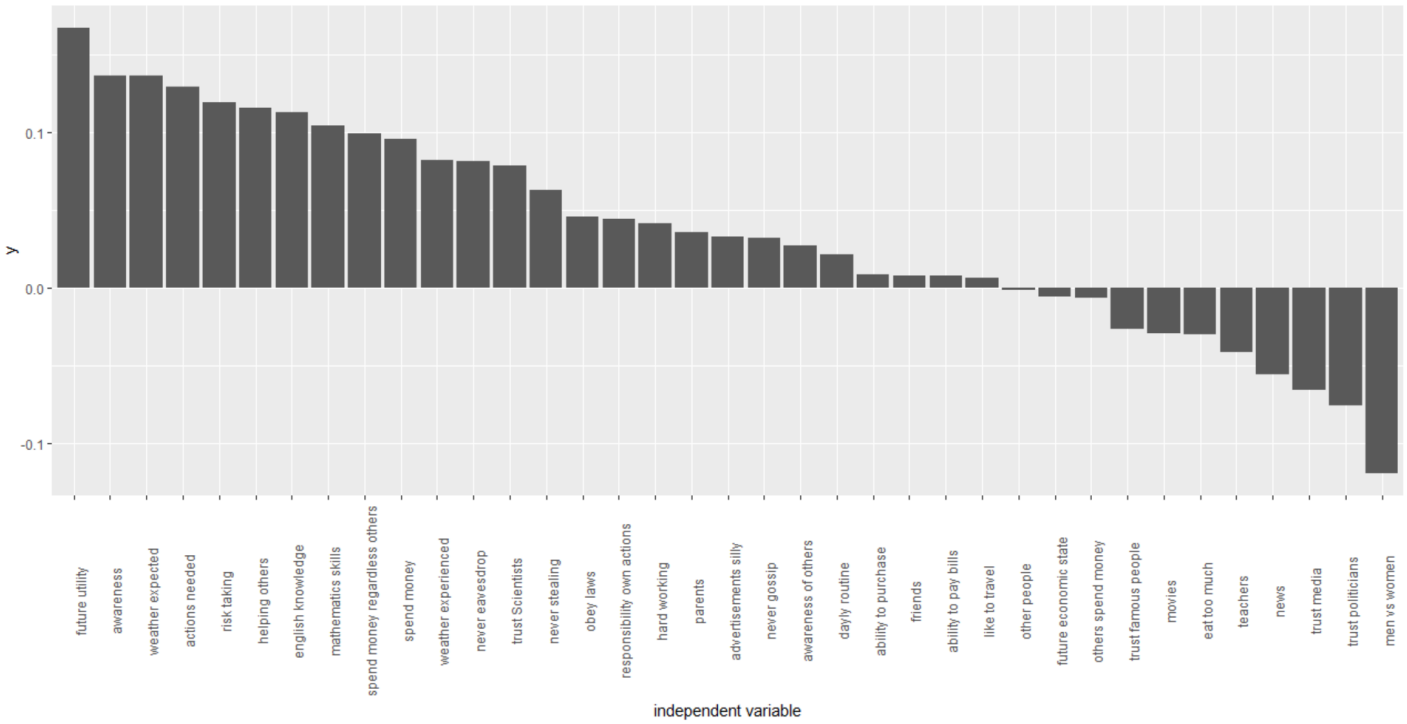

Figure 3*: Correlation between the numeric independent variables and the dependent variable*

3.3.3 Testing means

To proceed with the investigation into the existing relationships in our data, one-way ANOVA tests have been executed to test the existence of different mean levels of sustainable consumption for different groups in our independent variables of interest. Here, we started to look at whether the means differ per country. Figure 4 indeed shows different patterns. The outcome of the ANOVA test on different means that can be derived from Table 2 verifies that at least one of these means is significantly different from the other countries ($p<0.05$). This indicates that respondents from at least one country show different patterns in the level of sustainable consumption compared to the rest.

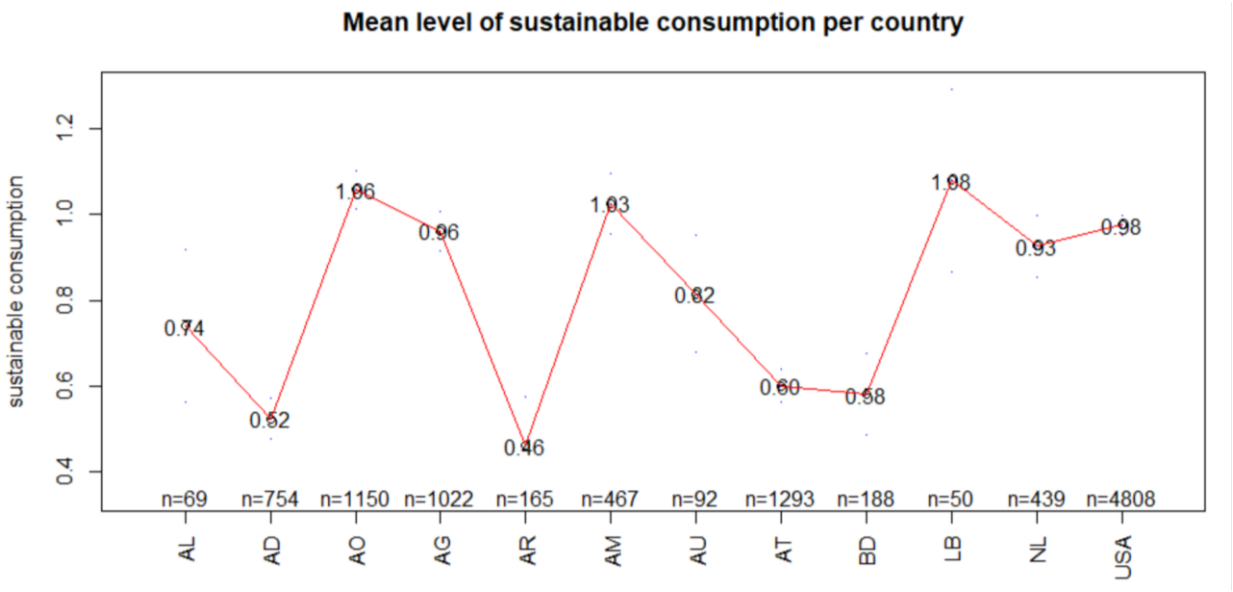

Figure 4: *Differences in mean level of sustainable consumption between countries*

Table 2: *Results of a one-way ANOVA test on different mean levels of sustainable consumption among countries*

	Sum of Squares	df	mean squares	F	Sig.
Country	443	11	40.25	72.82	0.000***
Residuals	5795	10485	0.55		
Total	6138	10496			

The existence of different group means in the level of sustainable consumption has also been studied for all other independent variables of interest. Twelve out of fifteen variables show that at least one group has a different mean level of sustainable consumption ($p<0.05$). The results of these ANOVA tests can be found in Table 3 in Appendix A. Based on these outcomes, the expectation arises that later analyses will show significant relationships between these twelve variables and the level of sustainable consumption.

4. Methods

The objective of this study is to discover which variables hold a significant relationship with *sustainable consumption.* As explained in chapter two, we expect relationships to exist on both the individual- and country-level. Above all, we expect that the answer patterns vary based on the country young individuals come from due to the country-specific culture. This thought directly harms the assumption of our observations to be fully independent. A method is therefore needed that controls for this interdependency.

We will start this section with an exploration of the different methods of analysis that could be used for this research. Subsequently, we will proceed with a theoretical and mathematical explanation of the method that was finally selected. The last part of this section deals with the explanation of *principal component analysis* (PCA) with *varimax* rotation, that is used to strengthen the analyses by adding summary variables of the survey data to the model.

4.1 Available methods

First, one way to determine the relationships between our variables and *sustainable consumption* could be to merge the information whether a respondent reduced meat and/or water consumption into one dummy variable, that indicates if the individual involved in sustainable consumption behaviour (=1) or not (=0), and estimate the effects in a simple, generalized linear model. Yet, a drawback of this model is that it is not able to control for the partial-interdependency. On top of that, using this method would result in a loss of information on the intensity of sustainable behaviour since a respondent could adopt different levels. That is, reducing both meat and water consumption is better than adopting only one of the two. This implies that our research deals with an ordered categorical response variable with $k = 3$ categories. As a consequence, a method of analysis is required that can deal with this ordered nature.

To overcome this problem, our dependent variable could be split into two separate dummy variables for both the reduction of meat and water consumption and run a generalized linear model for each of them. By this, we would measure the relationships between our factors and the reduction of meat and water consumption separately. However, for this research we would rather want to focus on more general relationships between various factors and sustainable consumption. This would not be obtained by looking at the specific effects of those factors on reduced meat and water consumption independently. Furthermore, we want to take into account that the adoption of both behaviours is of higher value than the adoption of only one of the two.

In some cases, the use of a survey can cause forms of sample biases. A method that could be useful in these cases is the bivariate probit model. Sometimes bias can be caused in the data due to some prior selection process. An example of this is given by Boyes, Hoffman and Low (1989) who use the bivariate probit model for the estimation of credit loan repayment probabilities. Sample bias was present here because credit officers already refused to grant loans to a certain group of applicants and thereby left out a part of the population in advance that would be less likely to repay the loan. The bivariate probit model can correct for this kind of bias by running a model a priori to the normal generalized linear model that controls for the characteristics of the group that was left out. Our data could be prone to a bias of a similar kind as our survey was only available in English. Yet, since we still have data from a large variety of countries this bias was not believed to be big. Our wish to maintain the ordered nature of our response variable outweighs the risk of this potential bias and therefore it was decided not to use the bivariate probit model.

Furthermore, possible situations exist in which the underlying distribution of the different response categories is correlated. This problem would be likely to occur when the sustainable consumption behaviour of respondents is measured multiple times over a certain period. In these cases, multivariate probit models could be useful which allow for more flexible modelling of this correlated structure (Chib and Greenberg, 1998). Since we expect different response patterns for various countries our underlying structure is indeed likely to adopt some correlation. Yet, multivariate models still assume all different cases to be independent. This method would, therefore, fail to deliver accurate predictions as our observations are likely to be interdependent.

Since we anticipate different answer patterns between countries, the data distribution among countries is likely to differ. A method that could be applied when a dataset faces different distributions between subgroups is a mixture model. Mixture models can identify latent subgroups in a dataset that are normally distributed by itself but differ in distribution from other groups. This causes the overall population not to correspond to a normal distribution (Demidenko, 2013). When using mixture models, the group (mixture component) membership of the observations is often not directly observed. For this reason, the model tries to identify these separate mixture components itself (Day, 1969). Applying a mixture model to our sustainable behaviour dataset would enable us to find different subgroups that wouldn't be limited to the country border. Thereby, we would be able to identify possible effects of social group memberships that go beyond just country-related culture. Think of certain (pro-environmental) social movements or religions that find members across multiple countries worldwide. Nevertheless, it was chosen for this study to focus solely on the possible effects that could be caused by country-specific culture. Since certainty is not guaranteed

that a mixed model would identify subgroups that exactly correspond to the different countries it was chosen not to adopt this method.

An alternative method that could be employed to control for subgroups (and resulting interdependencies) in our data is a multilevel regression model. Multilevel models are generally used when observations are nested in groups (the level 2) (Snijders and Bosker, 2011), in our case the different countries. These type of models allows for the calculation of varying regression coefficients for each of the separate classes of the level 2 and thereby controlling for the effect that culture can have on the relationship between a predictor and a covariate.

However, a problem that is observed frequently is the lack of a sufficient sample size for the multilevel model to result in accurate estimations (Maas and Hox, 2005). This lack in observations most often occurs for level 2. Maas and Hox (2005) show that inaccuracy in the estimation is very likely to occur for groups with 50 observations or less. Besides, not only the number of observations within groups tend to be important, but also the total number of groups itself when one aims to obtain accurate variance estimates (Van der Leeden et al., 1997; Browne and Draper, 2000). The minimum number of groups is therefore stated to be 24 to 30 (Browne and Draper, 2000). Our initial dataset contains 44 different countries which would be sufficient according to the latter prerequisite. However, only 12 countries contain 50 observations or more and three of those only just surpass this threshold. For these reasons, our data appears not to be fully suitable for the use of a multilevel model that calculates separate coefficients for each country. In making the trade-off between the certainty of reliable outcomes and the level of details provided by our analysis, it was decided not to use such a model as our main method of analysis.

Furthermore, it should be noted that original multilevel regression models are not able to deal with the ordered nature of our response variable. The alternative that is offered, the multilevel cumulative logit model, will finally be used as our method of analysis and will be discussed in detail later on in this section. The multilevel cumulative logit model is an extension of the class of cumulative link models. This method offers the ability to deal with ordered response categories and has the flexibility to account for the multilevel characteristics in our data. For these reasons, cumulative link models have been chosen as the method of analysis in this study. The next part of this section will be used to further explain the technical details of this method and its' multilevel extensions.

4.2 The cumulative link model

As has been stated before, this research deals with an ordered response variable. There are two types of ordinal variables which are identified by Anderson (1984): continuous grouped variables, that for example cover different income classes (0-16000 euro, 16000-32000 euro, and so on), and "assessed" ordered variables that represent a scale of judgement (*totally disagree,…, totally agree)*. The cumulative link model (CLM) can correctly handle the ordered character of both types (Agresti and Natarajan, 2001). The model has been introduced first by McCullagh (1980) who referred to it as *the proportional odds* model. The model is related to classes of linear models and generalized linear models which gives it the benefit that outcomes are easily interpretable. Additionally, just like generalized linear models, the CLM uses the principle of *maximum likelihood* for finding model convergence.

4.2.1 Basic model

The different classes of observation in the ordinal response variable can be expressed by a random variable y_k where $k = 1, \dots, l$ indicate the different categories. y_k is stated to be a random variable as it is assumed that the categories are related to an underlying continually distributed variable, v. For any given observation i the model tries to predict the cumulative probability that y_k is smaller than or equal to the k'th class given a set of predictor variables $\boldsymbol{x}$. This can be mathematically expressed by

$$F(\gamma_k) = \theta_k - \boldsymbol{\beta^T x}, \tag{1}$$

where,

$$\gamma_k = P(y_k \leq k|\boldsymbol{x}) = \pi_1 + \cdots + \pi_k \text{ with } \sum_{k=1}^{l} \pi_k = 1$$

are the cumulative probabilities and F represents a link function that converts a (0,1) interval into $(-\infty, \infty)$. Since γ_l must be equal to one, the CLM only calculates $l - 1$ probabilities. Additionally, θ_k indicates the threshold parameters $(\theta_1, \dots, \theta_{l-1})$ that can be interpreted as the intercepts for the $l - 1$ categories, and $\boldsymbol{\beta^T}$ is a vector of parameters $(\beta_1, \dots, \beta_z)$ that represent the unidentified regression coefficients. Since the estimated probabilities are cumulative, θ_k is strictly ordered and satisfies

$$\theta_0 < \theta_1 < \cdots < \theta_{l-1}. \tag{2}$$

The thresholds indicate the cut points on the latent scale of v. Furthermore, because the basic model assumes that the thresholds are independent of i, any observed category difference between two observations is merely caused by different values of $\boldsymbol{x}$.

4.2.2 Link functions

Since CLM aims to calculate a cumulative probability, the value of γ_k is situated on a (0,1) interval. This implies that the occurrence of the event γ_k cannot be linearly related to $\boldsymbol{x}$, but rather takes the form of a sigmoid relationship. To correct for this, the link function in the cumulative link model transforms the relationship of the linear function $\theta_k - \boldsymbol{\beta^T x}$.

Three types of link functions are commonly used. These link functions are the same as those that are exploited in generalized linear models and are known as de logit, probit and log-log link function. It is also possible to insert other link functions that allow for more flexibility, just as observed in Ortega et al (2003). However, explanations of these functions are omitted in this section since the data in this research does not need that much complexity.

As stated above, the logit link is used to transform the linear combination of the covariates into probability measures on a scale between 0 and 1 while assuming a logistic distribution. Applying the logit to (1) we get,

$$ln\frac{\gamma_k}{(1-\gamma_k)} = \theta_k - \boldsymbol{\beta^T x}\,. \tag{3}$$

In case x is a dummy variable containing two categories the odds ratio (OR) of $\gamma_k(x_1)$ relative to the same conditions, except for $x = x_2$, can be expressed by

$$OR = \frac{\gamma_k(x_1)/(1-\gamma_k(x_1))}{\gamma_k(x_2)/(1-\gamma_k(x_2))} = \frac{\exp(\theta_k - {x_1}^T\beta)}{\exp(\theta_k - {x_2}^T\beta)} = \exp((x_2^T\text{-}x_1^T)\beta). \tag{4}$$

Since $x_2 - x_1 = 1$ the odds ratio is $\exp(-\beta_2)$. Equivalently, the odds ratio of $\gamma_k(x_2)$ is $\exp(\beta_2)$.

Whereas the logit link function assumes a logistic distribution, the probit link uses a normal distribution for the latent distribution function. This results in the following model,

$$\Phi^{-1}(\gamma_k) = \theta_k - \boldsymbol{\beta^T x}, \tag{5}$$

where Φ^{-1} represents the inverse of the normal distribution function.

Lastly, the log-log distribution is derived from the proportional hazards model from Cox (1972) and is especially useful in cases where one wants to measure the probability of survival beyond category k given $\boldsymbol{x}$. The cumulative log-log model makes use of the Gumbel distribution and can be expressed by the following formula,

$$\log\{-\log(1-\gamma_k)\} = \theta_k - \boldsymbol{\beta^T x}, \tag{6}$$

where $1 - \gamma_k$ constitutes the probability of survival.

4.2.3 Multilevel extensions

The classic cumulative link model assumes that the threshold values are independent of $\boldsymbol{x}$ which leads to constant thresholds for all covariates. However, cases can be depicted where thresholds are affected by the values of one or more variables. Because these effects are not part of the ordinal features of the data, Christensen (2018) refers to these as *nominal effects*. Breen and Luijkx (2010) also use the term *location effects* since these effects cause the average location of the relationship to differ across different subgroups. Yet, when looking at general statistical literature, these effects fall within the class of *fixed effects*. The *partial proportional odds* model introduced by Peterson and Harrell Jr. (1990) relaxes the *proportional odds* assumption by implementing the *fixed effects* by a linear relationship between the thresholds and one or more covariates $\boldsymbol{w}$ into the CLM. Here, one important condition includes that covariates in $\boldsymbol{w}$ may not be present in $\boldsymbol{x}$ since the parameters would otherwise not be identifiable.

Furthermore, the cumulative link model assumes equal variance among all observations on the latent continuous distribution. However, as explained with the multilevel regression model, one can call for instances where different subpopulations in the data show different variance in their responses. An easy example can be given by thinking of respondents having different answer patterns because they come from different social and cultural environments. Data is then more likely to correspond to *non-proportional odds* (Peterson and Harrell Jr., 1990).

Adding a scale parameter that allows the scale of all other parameters in the model to vary according to certain covariates $\boldsymbol{z}$ also relaxes the *proportional odds* assumption. By incorporating *scale* and *fixed effect* parameters into model (1) we obtain,

$$F(\gamma_k) = \frac{\tilde{\theta}_k - \boldsymbol{\beta x}^T}{\exp(\boldsymbol{z\zeta})}, \tag{7}$$

where $\tilde{\theta}_k(\boldsymbol{w}^T) = \theta_k - \tilde{\boldsymbol{\beta}}\boldsymbol{w}^T$ corresponds to a linear relationship between the category thresholds and the covariates $\boldsymbol{w}$, which is the added *fixed effect*, and $\exp(\boldsymbol{z\zeta})$ represent the addition of *scale effects*.

Both aforementioned extensions allow to control for the effect of underlying subgroups in our data. Hence, we state that both correspond to a multilevel element. Adding the scale parameter results in a multilevel model that comes closest to the original multilevel regression model since it allows the covariate coefficients to differ for each level 2 group ($\boldsymbol{z}$). However, only one single multilevel parameter is calculated when adding the scale parameter to the cumulative link model. This means that, per country, all individual-level coefficients are corrected by the same value. This is a deficiency compared to the original multilevel regression model where the level 2 effect is allowed to vary per individual regression coefficient.

4.3 Principal component analysis

Principal component analysis (PCA) is an unsupervised method that aims to reduce the number of dimensions m in a dataset by summarizing the data into r uncorrelated *principal components*, also called factors (Wold, Esbensen and Geladi, 1987) while explaining as much of the variation in the data as possible. PCA approximates the original data matrix $\boldsymbol{X}$, with N rows and m columns, by a linear relationship with two other matrices: $\boldsymbol{T}$ and $\boldsymbol{P}$,

$$\boldsymbol{X} = \boldsymbol{T}\boldsymbol{P}' + \boldsymbol{E} \tag{9}$$

where the columns of $\boldsymbol{T}$ are a representation of the object patterns in $\boldsymbol{X}$ and the rows of $\boldsymbol{P}$ show the different variable patterns in the data in the form of *factor loadings*. The latter represent the correlations between the factors $\boldsymbol{f}_r$ and the original variables in the dataset under the condition that the original values are scaled. Lastly, $\boldsymbol{E}$ contains the error term that covers the residuals in the model.

The amount of variance that is explained by $\boldsymbol{f}_r$ is expressed by its' *eigenvalue* $\lambda_r^2 = var(\boldsymbol{f}_r)$ and indicates the importance of the factor. The nature of $\boldsymbol{f}_r$ is ordered such that $\lambda_1^2 > \lambda_2^2 > \cdots > \lambda_r^2$ and it holds that

$$\lambda_1^2 + \lambda_2^2 + \cdots + \lambda_r^2 = m. \tag{10}$$

One important part of the PCA analysis is to decide on the value of r. This value can be derived from a scree plot, which is a visual display of the relative importance of a factor. This relative importance is also known as the variance accounted for $(VAF) = \lambda_r^2/m$. The value for r that is chosen is the number for which a clear bend in the decrease of VAF is observed in the plot.

One characteristic of PCA is that the resulting factors can be mathematically rotated which changes the value of the loadings while not losing any of the variance that was captured. This is realized by adding a rotation matrix $\boldsymbol{R}$ to (9) via,

$$\boldsymbol{T}\boldsymbol{P}' = \boldsymbol{T}\boldsymbol{R}\boldsymbol{R}^{-1}\boldsymbol{P}' \tag{11}$$

A common rotation that is used for the analysis of survey data is called *varimax*, which is derived from Kaiser (1958). The rotations that are applied with *varimax* are *orthogonal* and the method aims to maximize, per factor, the value of the loadings for only a few variables while it minimizes the loadings of the other variables. The rotation matrix corresponding to this is constituted by,

$$\boldsymbol{R} = \sum_{j=1}^{r} \frac{m\sum_{i=1}^{m}(a_{ij}^2/h_i^2)^2 - \left(\sum_{i=1}^{m} a_{ij}^2/h_i^2\right)^2}{m^2}, \tag{12}$$

where a_{ij} is the original factor loading for variable i where $i = 1 \ldots m$ and h_i^2 represents the squared VAF.

Applying $\boldsymbol{R}$ to (9) via (11) results in a matrix of *factor loadings* where i has a high *factor loading* for only one or a few factors. By these means, the data gets summarized into a few latent concepts that were indirectly measured by the survey, which results in more interpretable factors.

One can use the PCA solution in subsequent analyses by incorporating the columns of $\boldsymbol{T}$ as new variables in a model. With this practice, the level of uncertainty in the model may be reduced. Because, incorporating the latent concept instead of the original variables is likely to eliminate a part of the noise that was measured by the individual elements (Chapman and Feit, 2015).

5. Data transformation

5.1 Variable summarization

As the data that was used for this research stems from a survey, the first step in the data analysis process involved exploring the existence of latent concepts as measured by the survey questions. Accordingly, a PCA with *varimax* rotation has been performed. For this execution, the data requires no missing values. Because the participants were not required to answer all questions this condition does not hold in the original dataset. Observations that included at least one missing value could not be used for the analysis. Consequently, only 3798 out of the 10641 initial observations could be included in the PCA and subsequently in all other methods of analysis that were performed in later stages.

Before the execution of PCA, all numeric variables were scaled by subtracting the mean of each variable from its' original value and subsequently divide this result by its' standard deviation. PCA often shows bad performance on categorical data which led to the decision to only summarize the scaled numerical variables.

A scree plot was used to decide upon the number of factors to be generated by the PCA. The first five factors were selected for the analysis since a clear bend was observed at the fifth dimension as is shown in Figure 5.

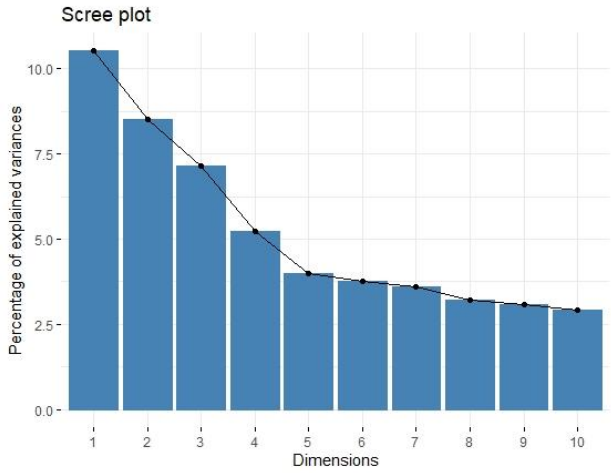

Figure 5: *Scree plot showing the relative variance explained by the first 10 dimensions*

Table 4 shows the resulting *factor loadings* for the first five components. Factor 1 contains high *loadings* (>0.4) for variables that indicate the influence of other parties. This factor is therefore defined as the 'social

influence factor' and can be used in our models to support the measurement of **P4**. The variance that is captured by factor 2 mostly explains the variances caused by variables that are concerned with the financial state of participants. This factor is called the 'economic state factor' and will be used to measure the effect of individual *economic state* in any subsequent model. Next, the highest loadings in factor 3 correspond to variables that focus on the extent to which the respondents do good in life. For this reason, we call this factor 'level of doing good'. Factor 4 clearly shows the highest loadings for the two problem recognition related variables. Accordingly, this factor is named 'awareness factor' and can be used as an alternative control variable. Lastly, factor 5 contains the highest loadings for the variables that are concerned with the extent to which respondents are willing to pay money to tackle the problem. Consequently, this factor is defined as 'willingness to spend money on climate change'. Since factor 3 and 5 do not capture large shares of any of the variables in the conceptual framework, they were not used in further analysis.

5.2 Oversampling

For the determination of model performance in later stages, the predictive accuracy of the model was tested on new data that was not used for model training. For this, the 3798 observations were divided over a training and test set according to an 80-20 per cent ratio. The distribution of the training set over the dependent response categories is presented in Figure 6. As becomes clear, the observations in the original training set were not equally divided over the categories. This initial distribution is likely to cause the problem of inaccurate prediction of cases when people do not involve in sustainable consumption. Consequently, the resulting model would have been less valuable since it is not likely to capture full reality. Oversampling was used to overcome this problem, resulting in a more equally balanced training dataset.

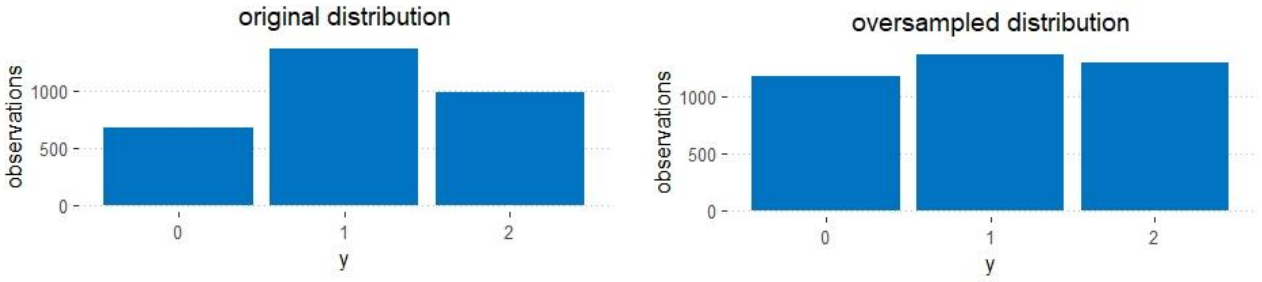

Figure 6: *Original and oversampled distribution of the training cases over the different response categories*

Table 4: *Factor loadings of all numeric survey variables for each of the first five components*

	Factor1	Factor2	Factor3	Factor4	Factor5
awareness	0	0	0	0.750	0
more actions needed	0	0	0	0.760	0
teachers	0.506	0	0.117	0	0
parents	0.489	0	0.181	0	0
friends	0.480	0	0	0	0
other people	0.309	0	0	0.151	0
news	0.321	0	0	0	0
movies	0.384	0	0.138	0	0
trust politicians	0.424	0	0	−0.146	0
trust media	0.477	0	0	0	0
trust Scientists	0.178	0	0	0.204	0
trust famous people	0.468	0	0	0	0
mathematics skills	0	0.131	0.109	0.127	0
English knowledge	0	0.126	0.151	0.261	0.104
willingness to spend money	0	0.174	0	0.236	0.852
spend money regardless others	0	0.123	0.112	0.212	0.869
awareness of others	0.461	0.104	0	0	0
others spend money	0.515	0	0	0	0.141
extreme weather experienced	0	0	0.105	0.117	0
extreme weather expected	−0.127	0	0	0.234	0
future pay-off	0	0	0.335	0.313	0.259
Risk taking	0	0	0.361	0.228	0.219
helping others	0	0	0.396	0.265	0.137
ability to purchase	0	0.806	0	0	0
ability to pay bills	0	0.906	0	0	0
expected future economic state	0.103	0.696	0	0	0
responsibility for own actions	0.134	0	0.529	0	0
never stealing	0	0	0.466	0	0
never gossip	0	0	0.591	0	0
obey laws	0	0	0.416	0	0
never eavesdrop	0	0	0.551	0	0
men vs women	0.302	0	0.112	−0.292	0
hard working	0	0	0.150	0	0
eat too much	0	0	−0.185	0	0
like to travel	0	0	0	0	0
advertisements are silly	0	0	0	0	0
dayly routine	0.115	0	0	0	0

6. Analysis and results

6.1 Analysis

The seven propositions that have been stated so far, will be studied together in one single ordinal logit model. Seven different variations of this model were created and their performances will be compared in this section by looking at the Akaike information criterion (AIC), log-likelihood value and predictive accuracy. The latter will be calculated by generating model predictions on the test set and comparing the outcomes with the original values. Consequently, model accuracy identifies the out-of-sample performance of the model whereas the first two performance measures test the in-sample performance. The oversampled training dataset was used for model estimation which implies that results hereafter are based on 3801 cases of which some are randomly selected copies of the minority class observations. A note should be made that this action causes the introduction of a small bias in our sample. Lastly, model estimation has been applied to the scaled variables to obtain comparable coefficients.

The first model that was generated only included the individual-level predictors to solely focus on the individual-level effects. The second model does the same for the country-level predictors, whereas the third model combines the two. The fourth model also adds direct control variables for individual-level awareness, age and gender. In the fifth model, the *awareness* control variable got replaced by the 'awareness factor' to see whether this improves model performance. While including the best-performing control variable, model six replaces the social influence variables by the 'social influence factor' to see if this better captures the essence of the relationship. The last model takes the optimal model obtained and replaces the country related variables by a country fixed effect parameter to indirectly control for cultural effects.

The coefficients that result from the models represent the log odds which means that we can interpret them in the way that, significant positive coefficients indicate a higher probability of an observation to correspond to the higher categories of sustainable consumption, for higher values of the predictor. The reverse applies to negative coefficients. The threshold coefficients express the cumulative intercept indicating the base log-odds of belonging to category k or lower.

6.2 Results

6.2.1 Model performance

The individual model performances and model coefficients are reported in Table 5 and Table 6 respectively. Table 5 shows that using both individual and country-level variables in model 3 compared to only

individual-level variables in model 1 improves the in-sample performance by reducing the AIC with more than 50 points and enhancing the log-likelihood with 30 points. Yet, out-of-sample performance cannot be stated to improve compared to the sole use of individual-level predictors. However, replacing the direct country-level variables with a country fixed effect parameter does increase out-of-sample performance. The highest accuracy of all was obtained with this model since a correct prediction was obtained for 42.7% of the out-of-sample cases. This performance is better than random guess as the latter is likely to generate an accuracy of 33.33%. Also, the in-sample performance is highest for this model which leads to the statement that model 7 is our optimal model. The model with the fixed effect parameter, therefore, outperforms the models with the direct control for macro-economic and socio-demographic factors which suggests that cultural factors also play an important role in the probability that a youngster will adopt sustainable consumption patterns.

The addition of the control variable turns out to be an improvement of the model since both in and out-of-sample performances of model 4 and 5 are higher compared to (1)-(3). Since (5) outperforms (4), especially on in-sample performance, it was decided to include the ´awareness factor´ as the control variable in model 7. Lastly, replacing the social influence variables by the ´social influence factor´ did not improve model performance. The improvement of the AIC value of 3 points that is observed, can be mostly explained by the fact that more variables are included in the factor than the total number of social influence variables. Consequently, the ´social influence factor´ is not used for the estimation of model 7.

Table 5: *In and out of sample performance of ordinal logit model on sustainable consumption*

model	AIC	Log Likelihood	accuracy
1	8,077.11	-4,020.58	0.405
2	8,258.73	-4,123.37	0.336
3	8,025.47	-3,990.73	0.406
4	7,993.25	-3,970.63	0.415
5	7,985.73	-3,965.77	0.416
6	7,982.31	-3,971.62	0.398
7	7,913,37	-3,912.48	0.427

6.2.2 Proposition statement results

P1 suggests that the level of risk aversion affects the choice to involve in sustainable consumption. Table 6 shows that the coefficients of both *future pay-off* and *risk taking* are positive and significant across all 6 models that include these variables. Individuals that report higher willingness to give up utility today to receive some uncertain pay-off in the future have a higher likelihood to end up in the higher categories of

sustainable consumption, $\beta_{future\ pay-off} = 0.246,\ P < 0.001$. This probability is also higher for individuals that reported a higher willingness to take risks, $\beta_{risk\ taking} = 0.071, P < 0.01$.

P2 states that familiarization with extreme weather events contributes to the level of sustainable consumption of our respondents. According to (7), both the extent to which participants experienced extreme weather events and expect them in the future have a positive effect on the level of involvement in sustainable consumption, $\beta_{extreme\ weather\ experienced} = 0.061,\ P < 0.05,\ \beta_{extreme\ weather\ expected} = 0.125, P < 0.001$. Our results thereby support this proposition.

P3 suggests that the incorporation of sustainable consumption behaviour in a young individual's daily routine would lead to higher levels of *sustainable consumption*. Model (3)-(6) show significant positive relationships ($P < 0.05, P < 0.01$). Yet, this effect is cancelled out by adding the fixed effect parameter. For this reason, convincing support has not been found for the thought that stimulating sustainable behaviour to become part of an individual's daily routine will lead to higher levels of sustainable consumption.

Next, **P4** claims that young consumers' involvement in sustainable consumption is affected by social influence. (7) only shows that the extent to which young consumers learn about climate change from their parents is positively related to the probability to end up in higher categories of *sustainable consumption*, $\beta_{parents} = 0.097,\ P < 0.001$. At the same time, the extent to which participants learnt about climate change by watching the news reduces the probability of involving in higher *sustainable consumption* levels, $\beta_{news} = -0.062, P < 0.05$. Support for **P4** was therefore only found partly.

P5 claims a positive relationship between cognitive ability and the level of sustainable consumption by young consumers. Accordingly, (7) indicates a significant positive relationship between *mathematical skills* and *sustainable consumption*, $\beta_{mathematical\ skills} = 0.152,\ P < 0.001$. This means that the better a respondent reported to be at math, the higher the probability of this respondent to end up in the higher categories of the dependent variable. This outcome supports **P6**. Conversely, the level of English of the respondents has no significant effect according to (7).

Next, **P6** suggests a positive relationship between the financial situation of a participant and the level of *sustainable consumption* of this individual. Contrary to this, (7) shows that the better the reported financial state of the respondent, the lower the probability of involving in *sustainable consumption*, $\beta_{economic\ state\ factor} = -0.081, P < 0.001$. Therefore, we actually find evidence against **P7**.

Lastly, **P7** suggests that country related factors influence the level of *sustainable consumption*. As (5) is our best performing model that includes the direct country-related factors, we look at this model to assess the effects of the macro-economic and socio-demographic variables. Three out of four variables show significant relationships with our dependent variable. People from countries with a higher GDP per capita have a higher likelihood to involve in *sustainable consumption*, $\beta_{GDP/c} = 0.656$, $P < 0.001$. This variable is highly significant across (2)-(6). Contrarily, *government expenditure on education* and *life expectancy* show significant negative relationships with *sustainable consumption* across (2)-(6).

An alternative that was used for the investigation of proposition 7 is to add a fixed effect that allows the thresholds to vary per country. This allows us to not only control for macro-economic and socio-demographic variables but also cultural effects. This component was introduced in (7). When looking at the threshold parameters in Table 6, vast differences in odds can be observed between countries. The thresholds for Argentina are missing in the model since it was included as the base country in the intercept. Without the individual factors, it can be observed that the odds to involve in sustainable consumption are vastly higher for people from countries like Australia, Austria and Bangladesh, $\beta_{1|2(Australia)} = 1.287$, $\beta_{1|2(Austria)} = 1.040$, $\beta_{1|2(Bangladesh)} = 1.094$. Furthermore, $\beta_{0|1(Andorra)} = 0.388$, which is the largest value for this threshold of all countries. This implies that youngsters from Andorra have higher odds to correspond to the 0 category. In other words, youngsters from Andorra have the lowest probability to involve in sustainable consumption when individual factors are not taken into account. All in all, both (2)-(6) and (7) confirm that country related factors have a relationship with the level of sustainable consumption.

6.3 Scale parameter

As stated above, the model with the fixed effect outperforms the models that directly control for the macro-economic, and socio-demographic factors. Therefore, the likelihood is present that the decision to adopt sustainable consumption patterns is affected by cultural factors. The fixed effect parameter already allowed to control for this effect indirectly but the exact nature of this effect remains obscure. Another way to think of cultural factors is to assume that the individual-level relationships work out differently among various cultures. For example, it would be reasonable to think that the effect of social influence is dissimilar for countries with different religions. One way to control for this is to replace the fixed effect by another multilevel component in the form of a scale parameter which allows the coefficients in our model to vary for each country. The results of this operation are displayed in Table 7 in Appendix B. Yet, as discussed before, these results are rather quite restrictive as only one country-related scale parameter is applied to all coefficients. Additionally, the total number of countries in our training set is too small to obtain accurate variance estimates. Also, the fact that only a relatively small number of observations is available for a

couple of countries complicates the act of finding separate scale effects for each covariate. Still, we show the results of adding this parameter to analyze the potential existence of inconstant coefficients.

The results in Table 7 indeed point to the verification of this assumption. That is, respondents from Lebanon appear to have a significantly different scale, $\zeta_{Lebanon} = -1.193\ P < 0.01$. This results in $\exp(-1.193) = 0.30$. The scale parameter for Argentina is missing from the model since this country is used as the baseline. this implies that Lebanese respondents tend to have a lower probability to involve in higher levels of *sustainable consumption* compared to respondents from Argentina under ceteris paribus conditions as the parameter corresponds to a lower scale of 70%. Still, we cannot be certain of the validity of this result as Lebanon contains only 50 observations.
For other countries, no indication exists that the scale of the coefficients is any different from those of individuals from Argentina.

6.4 Robustness

To check if our results are not vulnerable to small changes in our data we check the robustness employing two methods. With the first one, we will control for any alteration in our results when independent variables are changed and control variables are added. In Table 6, seven alternatives to our model are presented. It can be observed that with every modification, only slight changes occur in our coefficients. At the same time, the significance of our coefficients does not alter. These conclusions point to the fact that our findings are quite robust.

Second, the robustness of our results is verified by comparing Table 6 with various descriptive statistics that are reported in Appendix C. Figure 7 contains boxplots that show the distribution over our significant independent variables for each level of sustainable consumption for the entire population. For most coefficients, it can be observed that observations corresponding to category 2 are concentrated at higher levels of the independent variables. This provides us with an argument to claim that those coefficients are quite robust. Yet, the differences in distribution between categories of sustainable consumption are harder to observe for *extreme weather experienced*, *mathematical skills*, and the *economic state factor*. For this reason, we are less certain that robustness also applies to these coefficients.

***Table 6**: Ordinal logit model coefficients on sustainable consumption*

	Dependent variable:						
	sustainable consumption						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
future pay-off	0.275***		0.277***	0.242***	0.224***	0.222***	0.246***
	(0.036)		(0.036)	(0.037)	(0.037)	(0.037)	(0.037)
risk taking	0.096***		0.090***	0.096***	0.085**	0.080**	0.071**
	(0.034)		(0.034)	(0.035)	(0.035)	(0.035)	(0.035)
extreme weather experienced	0.083***		0.078**	0.065**	0.061*	0.064**	0.061*
	(0.031)		(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
extreme weather expected	0.212***		0.199***	0.177***	0.155***	0.150***	0.125***
	(0.032)		(0.032)	(0.033)	(0.033)	(0.033)	(0.034)
daily routine	0.048		0.061*	0.061*	0.067**	0.075**	0.051
	(0.031)		(0.031)	(0.032)	(0.032)	(0.032)	(0.032)
awareness of others	0.041		0.014	0.013	−0.004		−0.024
	(0.038)		(0.039)	(0.039)	(0.039)		(0.040)
others willingness to spend money	−0.057		−0.039	−0.038	−0.024		−0.003
	(0.038)		(0.039)	(0.039)	(0.039)		(0.039)
teachers	−0.058*		−0.056*	−0.041	−0.037		−0.056
	(0.033)		(0.034)	(0.034)	(0.034)		(0.034)
parents	0.099***		0.070**	0.081**	0.092***		0.097***
	(0.034)		(0.035)	(0.035)	(0.036)		(0.036)
friends	−0.021		−0.019	−0.028	−0.042		−0.043
	(0.034)		(0.035)	(0.035)	(0.035)		(0.036)
other people	−0.006		−0.003	−0.017	−0.028		−0.025
	(0.031)		(0.031)	(0.031)	(0.032)		(0.032)
news	−0.074**		−0.059*	−0.069**	−0.080***		−0.062**
	(0.030)		(0.031)	(0.031)	(0.031)		(0.031)
movies	−0.037		−0.036	−0.037	−0.036		−0.022
	(0.032)		(0.033)	(0.033)	(0.033)		(0.033)
social influence factor						−0.087***	
						(0.028)	
mathematics skills	0.158***		0.153***	0.158***	0.150***	0.160***	0.152***
	(0.031)		(0.031)	(0.032)	(0.032)	(0.032)	(0.032)
English knowledge	0.119***		0.106***	0.076**	0.054	0.049	0.044
	(0.035)		(0.035)	(0.036)	(0.036)	(0.036)	(0.037)
economic state factor	−0.092***		−0.096***	−0.078***	−0.078***	−0.077***	−0.081***
	(0.029)		(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
GDP/c		0.660***	0.588***	0.651***	0.656***	0.694***	
		(0.088)	(0.092)	(0.096)	(0.096)	(0.095)	
government expenditure on education		−0.476***	−0.425***	−0.499***	−0.505***	−0.512***	
		(0.074)	(0.076)	(0.080)	(0.080)	(0.079)	
life expectancy		−0.411***	−0.341***	−0.339***	−0.335***	−0.357***	
		(0.051)	(0.053)	(0.053)	(0.053)	(0.052)	
urban population		0.023	0.001	0.023	0.025	0.020	
		(0.045)	(0.046)	(0.046)	(0.046)	(0.046)	

awareness				0.214***			
				(0.042)			
awareness factor					0.191***	0.175***	0.140***
					(0.032)	(0.031)	(0.033)
age				0.005	0.008	0.008	0.031
				(0.035)	(0.035)	(0.034)	(0.035)
male				−0.209***	−0.193***	−0.179***	−0.216***
				(0.067)	(0.068)	(0.067)	(0.069)
thresholds:							
(intercept) 0—1	−0.809	−0.800	−0.795	−0.904	−0.903	−0.822	−0.484
	(0.037)	(0.036)	(0.037)	(0.049)	(0.049)	(0.048)	(0.402)
(intercept) 1—2	0.768	0.710	0.802	0.745	0.749	0.707	0.610
	(0.036)	(0.035)	(0.037)	(0.049)	(0.048)	(0.047)	(0.411)
0—1 Andorra							0.389
							(0.432)
1—2 Andorra							0.680
							(0.457)
0—1 Angola							−0.471
							(0.416)
1—2 Angola							−0.047
							(0.422)
0—1 Antigua and Barbuda							−0.686
							(0.423)
1—2 Antigua and Barbuda							0.082
							(0.427)
0—1 Armenia							−0.619
							(0.430)
1—2 Armenia							−0.100
							(0.434)
0—1 Australia							−0.440
							(0.588)
1—2 Australia							1.332
							(0.683)
0—1 Austria							0.387
							(0.416)
1—2 Austria							1.073
							(0.437)
0—1 Bangladesh							−0.060
							(0.531)
1—2 Bangladesh							1.053
							(0.637)
0—1 Lebanon							−2.397
							(1.108)
1—2 Lebanon							−0.009
							(0.622)
0—1 The Netherlands							−0.209
							(0.431)
1—2 The Netherlands							0.351
							(0.441)
0—1 USA							−0.725
							(0.405)
1—2 USA							−0.206
							(0.412)
Observations	3,801	3,801	3,801	3,801	3,801	3,801	3,801
Log Likelihood	-4,020.557	-4,123.367	-3,990.734	-3,970.627	-3,965.767	-3,971.618	-3,912.481

Note: *p<0.05; **p<0.01; ***p<0.001

7. Conclusions

This section will start with a general discussion of the results in which we will provide an interpretation of our findings and make a link to previous literature. This part will be followed by a discussion of the academic and societal relevance. Lastly, the limitations of this research will be discussed and ideas on future research will be provided.

7.1 General discussion

The performance of this research served the principal goal of answering the research question: *Which factors contribute to a higher likelihood of sustainable consumption behaviour in terms of meat consumption and water utilization by current younger generations?*

Several propositions have been stated that supported the investigation of the effects of seven different factors that were divided among the individual- and country-level. By applying an ordinal logit model with a scale parameter on a survey enriched by country-related variables, evidence was found for the validation of four out of seven propositions. On the individual level, it appears that lower levels of risk aversion, past experience and expectation of extreme weather events, mathematical skills and the extent to which youngsters received information from their parents about climate change all have a positive effect on their level of sustainable consumption. It also appears that youngsters from countries with a higher GDP have a higher probability to adopt sustainable consumption behaviours. Lastly, results were found that indicate a likelihood that culture influences the choice to adopt sustainable alternatives. An elaboration on these findings is provided in the sections below.

7.1.1 Validated propositions

On the individual level, evidence was found that youngsters who are less risk-averse have a higher likelihood of at least reducing either meat or water consumption. As Weber (2010) stated, sustainable consumption often involves an uncertain future pay-off. As most consumers tend to be risk-averse (Kahneman, Knetsch and Thaler, 1991) this outcome indicates a problem. To make sure that more risk-averse youngsters will also adopt pro-environmental behaviour it is important that the level of uncertainty, and thereby perceived risk, will be reduced. This can be done by communicating clear examples of benefits for youngsters to be better able to visualize future rewards.

Second, it was found that youngsters who have experienced extreme weather events in the past, as well as those who expect to face extreme weather events in the future, have a higher probability to adopt sustainable consumption. This implies that having a picture of a possible outcome available in one's mind helps in

stimulating sustainable consumption behaviour. The idea that future effects need to be tangible (White, Habib and Hardisty, 2019) is therefore verified. If governments or managers want to push society towards more sustainable consumption alternatives, a tangible picture needs to be created in the mind of consumers. Since the effect of expectation of future extreme weather events is bigger than those coming from past experiences, we conclude that this picture does not necessarily need to come from involvement in past events to be effective. An effective tangible picture can also be created by spreading knowledge on extreme weather events via media like the news, social media or education.

Third, our results support the thought that youngsters with higher cognitive ability are more likely to adopt sustainable consumption patterns. Individuals with higher cognitive skills might be better able to understand the future consequences that climate change might have and are better able to see the impact of their own actions. This supports the claim of Shields, Šolar and Martin (2002) who argue that incentives provided by the government to stimulate pro-environmental behaviour are only effective when individuals can understand them. Consequently, our finding shows that governments should design their message in such a way that also people with less cognitive ability can understand the problem and solutions.
Previous findings also show that the number of years of educational attendance is positively related to pro-environmental consumption (Meyer, 2015). However, we do not find support for the effect of education itself since no significant relationship was found between the extent to which youngsters learned about climate change from teachers and their level of involvement in sustainable consumption.

On the country level, evidence was found that a country's GDP is positively related to the level of involvement in sustainable consumption. This finding points towards the statement of Sill (1975), and Broad and Cavanagh (1993) that developed countries take more actions against climate change than developing countries.
However, contrasting findings were reported when it comes to government expenditure on education and life expectancy. That is, both show a negative relationship with sustainable consumption. Since either higher educational expenditure and life expectancy are associated with prosperous countries (Bose et al., 2007), these findings contrast with our earlier results that indicate a positive effect of a country's GDP. This means that no conclusive results are found that support either the claim that people from developed countries take more actions against climate change or the people from developing countries, as argued by Schneider (1988), Livernash (1992), and Brechin and Kempton (1994).

The second part of our investigation on the effect of country-level factors included the addition of multilevel extensions to our model. As the number of cases in our sample was too limited to obtain reliable scale effect

parameters, our main model contained a multilevel component in the form of a fixed effect that allowed the category thresholds to vary per country. Clear differences in thresholds were observed between countries. Under ceteris paribus conditions, probabilities to reduce meat and/or water consumption are higher for youngsters from Australia, Austria and Bangladesh compared to other countries. At the same time, youngsters from Andorra have the highest probability not to adopt one of the sustainable practices under the same conditions. As the model with the fixed effect component out-performs the model that directly controls for macro-economic and socio-demographic variables, we find support for an effect that is caused by culture.

All in all, the above-stated results indeed show that country-related factors matter for the adoption of pro-environmental practices. The role of governments is therefore definitely of importance when it comes to the stimulation of pro-environmentalism. Yet, the finding of potential cultural effects also highlights a challenge since cultural characteristics are hard to change (Huntington, 1993). Nevertheless, the change of cultural values is possible with the right governmental efforts (Inglehart and Baker, 2000)

To obtain extra support for the existence of cultural effects the fixed effect was replaced by the scale effect. The relationships between our independent variables and sustainable consumption are different for Lebanese youngsters compared to those from other countries. Since this model extension allowed to control for macro-economic and socio-demographic factors directly, we can argue that this difference is mainly caused by cultural characteristics. However, we cannot be certain about the reliability of these results as our data does not meet the multilevel model requirements that were identified by Browne and Draper (2000). Still, since general consumption patterns have already been shown to be influenced by culture (Shaw and Clarke, 1998), especially when it comes to food (Dubé et al., 2005), we call for a further investigation on the exact nature of these cultural effects.

7.1.2 Non-validated propositions

Unfortunately, we could not find support for all our propositions. First of all, it has been expected that the individual economic state of consumers positively impacts the level of sustainable consumption of young consumers. However, the opposite has been observed. This could possibly be clarified by the thought that individuals adopt more sustainable consumption patterns to actually save money. Looking from the perspective of reduced meat and water consumption we could remind ourselves that meat is a relatively expensive good, and households energy costs will decrease by using less water. At the same time, it could still be the case that the economic state of consumers has a positive relationship with other forms of sustainable consumption like the participation in green-electricity programmes (Clark, Kotchen and Moore,

2003). Possibly, because these programmes are generally more expensive than ordinary ones (Clark et al., 2003).

Second, for the reason that Moretti (2011) and Howland, Hunger and Mann (2012) found strong relationships between the social environment and the consumption pattern of youngsters, it was assumed that this would also apply to sustainable consumption. Yet, no evidence was found that the level of sustainable consumption of the respondents got impacted by the behaviour of peers. We only find that the information they get from parents has a significant impact. This means that parents are an important medium to promote higher levels of pro-environmental consumption. Contrasting to this, the results show that using the news for this purpose is likely to have the opposite effect. One possible hypothesis could be that the news triggers free-riding behaviour since it creates the feeling that climate change is a problem for the entire society and not so much for the self (Krishnan et al., 2004; White, Habib and Hardisty, 2019). Consequently, this medium should not be used to incentivize youngsters to adopt more pro-environmental practices.

Lastly, we could not find proof of the proposition that incorporating pro-environmental consumption patterns in a young individual's daily routine leads to higher levels of sustainable consumption as the relationship got cancelled out by the fixed effect. This indicates that the routine behaviours are likely to be related to someone's culture which causes the effect to be captured by cultural factors. Stimulating the incorporation of pro-environmental practices in the daily routines of youngsters is therefore only likely to be effective in certain cultures.

7.2 Academic relevance

Our study contributes to the academic research that has been executed about the drivers behind sustainable consumption behaviour. Our work enriches the empirical research on this topic which has been observed to be limited up until today. By analyzing different characteristics at the individual-level we provide new insights in what type of young consumers adopt sustainable consumption patterns and hereby give empirical support for the existing theories about potential ways to close the observed attitude-behaviour gap (Vermeir and Verbeke, 2006; Frederiks, Stenner and Hobman, 2015). Also, by focusing on the act of reducing both meat and water consumption we use a broader definition of sustainable consumption than most other empirical studies which offers better ground for generalization of the concept.

Furthermore, by looking at country-related factors we complement earlier research about differences in sustainable consumption patterns across countries. Even though we do not find closure on the discussion whether developed or developing countries show higher levels of sustainable consumption patterns, we

enrich this field of research with the incorporation of socio-demographic factors. Moreover, we open up a new area of research in this domain by introducing the potential role of culture in the sustainable consumption patterns of young consumers.

Lastly, the statement of seven different propositions provides new angles for research that wants to investigate the drivers behind pro-environmental behaviour for other types of consumer groups or that wants to focus on specific countries.

7.3 Managerial and political relevance

Today, climate change has been recognized as a serious problem in many countries worldwide. Most countries have set multiple climate goals and are looking for various measures that could be taken to reach them. Political institutions can use our findings to determine which types of nudges are likely to be effective in stimulating pro-environmental behaviours of the younger generations in society. Also, effective mediums can be assessed. We have noted that the group of young consumers is especially important since they will live longest on earth and will raise the next generations. This means that changing the lifestyle of this group into a more sustainable one is likely to have the biggest impact.

Because of the large scale influence that companies generally have on the behaviour of society (MacGuire, 1963; Whetten et al., 2002), they are pushed by governments to adopt a more pro-environmental way of doing business (Albareda et al., 2007). However, for companies to adopt sustainable business practices, significant demand for this is needed from below (Cuomo, 2011). For this reason, the attitude-behaviour gap of consumers causes a problem for society and for managers who face rules by the government that forces them to take action. This research can support managers in finding the right ways to promote their message of being a pro-environmental business and to find the right target groups among younger generations of consumers. Since this research directly investigates the drivers behind youngsters' reducing their meat consumption, our findings are especially useful for companies that bring meat substitutes to the market. They can use our study to determine the right marketing message for the right target group.

7.4 Limitations and further research

This study has been prone to several limitations. In this part, we will discuss the several constraints of our research and add some visions on how future research could overcome these. Extra alternatives for future research will be provided that could not be covered by our analysis.

7.4.1 Data limitations

The first constraints of this study are already imposed during the data collection process. The survey has been spread via Facebook which means that the possible participants were already limited to those who had access to this medium. Next, it is plausible to think that there is a certain sample bias among the participants since Facebook as a medium usually targets the audience that is most likely to be interested in the survey topic. On top of that, the audience could share the survey with people from their inner circle. Those people have a higher likelihood to share similar thoughts resulting in a population bias.

Another limitation arises from the fact that the survey was only available in English. For this reason, potential participants were only targeted across countries for which the Facebook default language was English. This caused us having to exclude many countries from our analysis. Another result of the survey being only available in English is that automatically a pre-selection was made of participants who were comfortable with this language. This means that there is a higher likelihood of higher educated people to take part in the survey. This results in another possible sample selection bias. For this reason, future research should make sure that the survey is available in multiple languages and use at least other media next to Facebook to reach the target audience.

The fact that participants did not have to answer all questions of the survey adds another limitation to this study. Many observations were omitted due to missing data which resulted in the loss of a lot of information. This loss of information was reinforced by the fact that observations from countries with less than 50 respondents got removed from the dataset. Consequently, the study was limited to the analysis of only twelve different nations of which numbers of observations were also unequally divided. To broaden our knowledge on the relationship between country-related factors and levels of sustainable consumption, future research should incorporate a vast variety of new nations and try to balance the number of respondents per nation.

Lastly, because our data comes from an online survey, the variables in our dataset are self-reported. This results in the fact that the data in our study are subjective and prone to bias. That is, certainty is not guaranteed that answers were given in full honesty by our respondents. For example, youngsters could find it confronting to report low levels of financial well-being or to report that they did not do any effort to save our planet from climate change. Hence, caution should be taken when generalizing the conclusions of our study.

7.4.2 Research method

A drawback of the cumulative link model is that it is hard to interpret the θ_k values directly as these indicate the intercept of the odds that an observation belongs to category k or smaller rather than to one category in specific. This problem could have been overcome by estimating separate general linear logit models for each class of k. Yet, it was believed that using the cumulative link model was more suitable for the analysis at hand since all relationships were combined in one model. Besides, merging the two different types of sustainable consumption led to the creation of an ordinal variable. The proportional odds model can capture this ordinal nature whereas application of separate general linear logit models is not.

Furthermore, by using the cumulative logit model with a fixed effect parameter we were only able to capture the country effects related to culture by varying the thresholds between countries. It would have been more insightful to add a multilevel component that would have provided us with separate coefficient estimates for each country. Nonetheless, as stated before, our survey data did not meet the requirements that were needed for this model. Efforts should be made in future research to extend this dataset by acquiring more observations for the countries that were left out. Also, one should aim to acquire more observations for the countries that currently contained <100 cases to be certain of reliable estimates.

7.4.3 Missed relationships

As our research depended on an existing survey, there exists a variety of possible factors that contribute to the adoption of sustainable consumption patterns that could not be measured. For example, Griskevicius, Tybur and Van den Bergh (2010) find that an important reason for consumers to choose a sustainable alternative in a public shopping environment is that it communicates higher social status. This finding points to self-interest, which is reported as being another possible driver (De Dominicis, Schultz and Bonaiuto, 2017). Additionally, political beliefs have proven to influence consumption behaviour which is also likely to apply to sustainable alternatives (Hart and Nisbet, 2012; Gromet, Kunreuther and Larrick, 2013). This provides a reason for new studies to investigate the effect of these factors that not have been discussed in the research at hand.

7.4.4 New areas of research

The study at hand has defined sustainable consumption as the reduction of meat and water consumption. Yet, many other types of sustainable consumption practices could be thought of like the implementation of solar panels (Spaargaren, 2003) or taking part in the sharing economy (Cohen and Munoz, 2016). Hence, new areas of research could investigate whether our results could also be generalized to these forms of pro-environmental behaviour.

Next, our analysis only covered consumers in the age range of 13 to 24. Future research could enrich our results by studying the factors that drive sustainable consumption behaviour for older generations. As the information on climate change that was provided by parents shows to have a significant impact on the adoption of pro-environmental behaviour of youngsters, targeting older generations seems of importance.

Lastly, the results of this research hint for the likely existence of cultural influences on sustainable consumption patterns. However, these effects could not be quantified directly. This study, therefore, opens up a new area of research that focusses on investigating the exact effects that culture can have on the adoption of sustainable consumption patterns. Future research could focus on creating measures for these cultural effects and subsequently modelling these relationships.

Besides, this study focused on the culture within country borders. Though, cultural groups can also exist that go beyond these borders. For example, one should think of religions or (pro-environmental) social-movements that can also influence sustainable consumption behaviour. Facing the ongoing globalization, the relationship between these groups and sustainable consumption can even be more interesting than just looking at countries. By replacing the cumulative link model by a mixture model, future research can be devoted to discovering these groups and their corresponding relationships to pro-environmental consumption behaviour.

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Appendix A

***Table 3**: Results of a one-way ANOVA test on different mean levels of sustainable consumption among countries*

	Sum of Squares	df	mean squares	F	Sig.
future pay-off	121	10	12.14	22.86	0.000***
Residuals	3728	7014	0.53		
Total	3849	7024			
risk taking	66	10	6.60	12.26	0.000***
Residuals	3755	6976	0.54		
Total	3821	6986			
extreme weather expected	3	72	24.10	45.01	0.000***
Residuals	6956	3724	0.54		
Total	6959	3796			
extreme weather experienced	6	33	5.55	10.24	0.000***
Residuals	7141	3869	0.54		
Total	7147	3902			
daily routine	4	3	0.85	1.56	0.000***
Residuals	6591	3588	0.54		
Total	6595	3591			
awareness of others	10	18	1.75	3.21	0.000***
Residuals	7314	3988	0.55		
Total	7324	4006			
others willingness to spend money	10	5	0.47	0.86	0.571
Residuals	7296	3973	0.55		
Total	7306	3978			
teachers	6	9	3.20	5.86	0.000***
Residuals	8238	4496	0.55		
Total	8244	4505			
parents	6	9	1.52	2.77	0.012*
Residuals	7684	4212	0.55		
Total	7690	4221			
friends	6	6	0.95	1.73	0.11
Residuals	7625	4189	0.55		
Total	7631	4195			
other people	6	11	1.81	3.32	0.003**
Residuals	7601	4157	0.55		
Total	7607	4168			
news	6	16	2.59	4.74	0.000***
Residuals	8343	4552	0.55		
Total	8349	4568			
movies	6	6	1.01	1.84	0.087
Residuals	7859	4318	0.55		
Total	7865	4324			
mathematical skills	10	72	7.20	13.33	0.000***
Residuals	8664	4681	0.54		
Total	8674	4753			
English knowledge	10	98	9.75	18.15	0.000***
Residuals	8405	4514	0.54		
Total	8415	4612			

Appendix B

Table 7: *Ordinal logit model coefficients on sustainable consumption after adding a scale parameter for country*

	Dependent variable:
	sustainable consumption
future pay-off	0.146^{***}
	(0.056)
risk taking	0.055^{*}
	(0.028)
extreme weather experienced	0.035
	(0.023)
extreme weather expected	0.089^{**}
	(0.038)
daily routine	0.039
	(0.024)
awareness of others	-0.004
	(0.026)
others willingness to spend money	-0.006
	(0.025)
teachers	-0.029
	(0.024)
parents	0.058^{**}
	(0.029)
friends	-0.027
	(0.024)
other people	-0.019
	(0.021)
news	-0.051^{*}
	(0.026)
movies	-0.023
	(0.023)
mathematics skills	0.091^{**}
	(0.038)
English knowledge	0.031
	(0.025)
economic state	-0.050^{*}
factor	(0.026)

GDP/c	0.426***
	(0.156)
government expenditure	−0.405***
on education	(0.147)
life expectancy at birth	−0.182***
	(0.070)
urban population	0.071*
	(0.039)
awareness	0.128***
factor	(0.048)
age	0.007
	(0.023)
male	−0.134**
	(0.062)
scale effects:	
Andorra	0.049
	(0.368)
Angola	−0.435
	(0.343)
Antigua and Barbuda	−0.558
	(0.344)
Armenia	−0.444
	(0.351)
Australia	−0.701
	(0.399)
Austria	−0.478
	(0.345)
Bangladesh	−0.388
	(0.403)
Lebanon	−1.193**
	(0.457)
The Netherlands	−0.572
	(0.352)
USA	−0.413
	(0.338)
thresholds:	
0—1	−0.612
	(0.207)
1—2	0.438
	(0.151)
Observations	3,801
Log Likelihood	-3,953.410
Note:	*p<0.05; **p<0.01; ***p<0.001

Appendix C

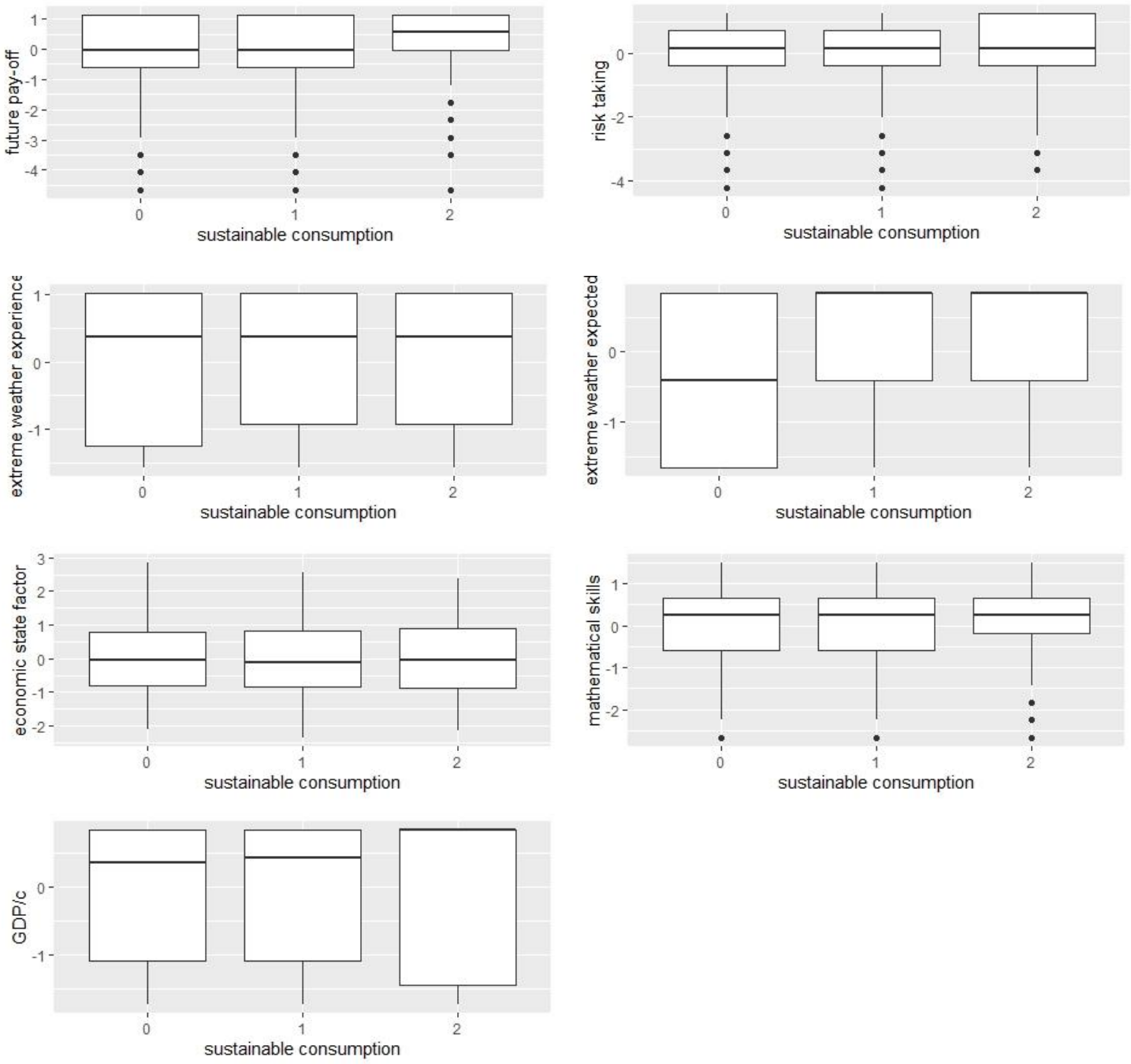

Figure 7: *boxplots showing the distribution of the positive significant independent variables for each category of sustainable consumption*