Targeting Eco-Friendly Consumers:

A Segmentation Study

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ABSTRACT

In the last 40 years, many effort have been made to define the environmentally friendly consumer. As more corporations enter the eco-friendly product market, the urgency for applicable segmentation and positioning strategies increases. This paper aims to identify these consumer segments through using a revealed preference method. Factors that determine the willingness to pay for green products are found to be variables in the categories demographics, knowledge, values, attitudes and behaviour. A Principal Component Analysis further grouped these explanatory variables into the categories Caring, Motivation, Responsibility, Effort and Social. Caring for the environment and being social were found to significantly influence the willingness to pay for green goods. The motivation consumers had, their feeling of responsibility for the environment and the effort they were willing to invest in behaving environmentally friendly on the other hand did not influence the WTP.

KEYWORDS

Willingness-To-Pay, Environmentally friendly products, revealed preference, BDM mechanism, Principal Component Analysis.

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1. INTRODUCTION

If today is a typical day on planet Earth, we will lose 116 square miles of rainforest, or about an acre a second. We will lose another 72 square miles to encroaching deserts, as a result of human mismanagement and overpopulation. We will lose 40 to 100 species, and no one knows whether the number is 40 or 100. Today the human population will increase by 250,000. And today we will add 2,700 tons of chlorofluorocarbons to the atmosphere and 15 million tons of carbon. Tonight the Earth will be a little hotter, its waters more acidic, and the fabric of life more threadbare. It is not too much to say that the decisions about how or whether life will be lived in the next century are being made now. We have a decade or two in which we must make unprecedented changes in the way we relate to each other and to nature.

David Orr, 1992

These 'typical days' of which Orr (1992) speaks of, are heavily influenced by consumer behaviour. Household consumption is responsible for 40% of environmental damage. Consumers therefore have a significant impact, which can be limited through green consumption (Grumert, 1995). Environmentally friendly products are "products which do not harm the environment whether in their production, use or disposal" (All Recycling Facts, 2016). Therefore, if we assume the quality standards are the same, green products do not just add value through satisfying the needs of consumers – they also help to preserve the environment. In that sense they are environmentally speaking superior over their standard counter parts (Joshi & Rahman, 2015).

Although the relative consumption of these goods increases in popularity, green production only has a meagre estimated 1 to 3% of the entire market share (Bray, Johns & Kilburn, 2011). Since nearly 70% of consumers claim to be concerned about environmental problems, this is a surprisingly low number. Mohr, Webb and Harris (2001) conclude that environmental friendliness thus only plays a marginal role in the actual consumer decision process. Before we reach that conclusion, let's first take a look at the 'evolution' green production has gone through:

A Brief History: How it all began

Back in 1962, Rachel Carson published *Silent Spring,* a book revealing how careless human beings were dealing with the environment. To enhance their own standard of living, people

were harming the planet with an endless need for production. Her story was ground breaking, as most people were not aware of the ecological issues. Carson (1962) illustrated this by using Albert Schweizer's quote: "Man can hardly recognize the devils of his own creation" (Carson, 1962, p.12). In her book, she exemplified what was going on with a story about the chemical war against insects. Insects were – in the eyes of the people – unwanted. They threatened their quality of life and therefore had to be exterminated. However, this was easier said than done. Insects constantly adapted to the chemicals used to kill them, so that the chemicals became obsolete. More, and stronger chemicals were required for the extinction of unwanted bugs. Laboratories were producing over 500 new chemicals a year. What the public did not realize, were how harmful these chemicals were for them and the environment. Carson (1962) was able to convince the public that this kind of excess business behaviour was an assault on the environment. The chemicals were a direct attack on the planet's earth, air, rivers and sea and thus had great implications for the ecological system. Slowly but steadily people began to change their behaviour and forced organizations and the government to behave greener as well.

Post-*Silent Spring*

Triggered by Carson's publication, the post-1962 years witnessed several fundamental shifts. The general public's attitude regarding the environment shifted, which had to be translated into the government's policy. New policies were implemented to limit the devastation caused by the business excess. These fundamental shifts are now known as the Green Revolution. The Green Revolution resulted in a sharp increase of interest for the topic and led to worldwide debates on environmental and green marketing (Iyer, 1994).

Nowadays, consumers are substantially more environmentally conscious than about 50 years ago. People are increasingly aware about their impact on ecological issues. Evidence of their subsequent "ecologically favourable consumer behaviour" (Laroche, Bergeron, Barbaro-Forleo, 2010, p. 503) can be found in willingness to pay for environmentally friendly products statistics. Trends show social responsibility within corporation being of greater influence recently. Moreover, consumers are also paying more attention to social responsibility of companies, reading up more frequently on reports (Elliott,Jackson, Peecher & White, 2012). Nielsen (2015) presented a report which revealed there was a 5 percent increase in 2011

compared to the previous two years in the willingness to pay for companies that produced socially responsible.

However, the problem with most statistics regarding the willingness to pay of consumers for green products is that they elicit WTP through the use of stated preference methods. These methods offer no incentive to the respondent and are therefore considered to be less reliable. When respondents are not incentivized to tell their true valuation of a product, results may get influenced by the social desirability bias. This means subject might feel the need to answer in a manner that shows they are ecologically responsible, although in reality they do not behave in the way they stated (Getzner & Grabner-Kräuter, 2004). Segmenting the market for green product through stated preference methods thus does not provide optimal results, therefore this paper tries to reveal the WTP of consumers. Through the Becker-DeGroot-Marschak procedure, consumers are encouraged to "tell the truth". This revealed preference method should lead to a better identification of environmentally friendly consumers.

The research question that is to be answered in this paper is "Which consumer groups are most willing to purchase environmentally friendly products?" Getting an answer to this question would be beneficial for several reasons. First of all, if consumer groups could be targeted more accurately, we could reach a larger part of the total population and thereby limit the damage done to the environment. Secondly, corporations would be more inclined to invest in socially responsible practices when they know their investments would be more effective. My motivation to answer this question comes from believing environmental problems are the biggest challenge we face right now, and I want to contribute to that solution. Moreover, I believe the green market is not utilized to the fullest and could potentially be a gold mine. Gaining insights in green consumer behaviour sparks my entrepreneurial mind.

To answer this research question, this paper undertakes a series of steps to address the problem. First of all the factors that influence the variations in the willingness to pay of consumers are presented. The variables are chosen based on previous findings and both theoretical and empirical relevance. A survey is constructed based on these carefully selected variables. However, due to the large number of variables, it is unclear what the relative effect of those variables is and how they contribute to the bigger picture. A Principal Component Analysis is used as an exploratory tool to group variables into components and analyse the

variance which is explained by the original variables. These groups of variables, referred to as 'components' are later regressed on the dependent variable in this paper: the percentage premium consumers are willing to pay for a green product. As has been already briefly been touched upon in the introduction, this is all done through a different research method which distinguishes this paper from others. The revealed preference procedure named after Becker, De Groot and Marschak is used to elicit consumers' willingness to pay. This approach should lead to a better identification of consumer segments.

The reader will be presented with a literature review next, in which variables that determine whether a consumer can be considered to be green are discussed. In the following, third chapter, the methodology that should lead to more reliable results is examined. WTP can be elicited through a variety of techniques, and as can be seen in this part of the paper, perhaps a combination of several techniques could work out the best. Chapter four then describes the data we will work with in the fifth chapter that presents the results. A Principal Component Analysis is conducted, after which a regression follows. Finally we end the paper with a discussion in chapter six and the conclusion in the seventh chapter.

2. LITERATURE REVIEW: THE GREEN CONSUMER

According to a 2012 *Forbes* article, many business leaders want to take responsibility and produce more sustainable, but are in doubt about the effect of their investment (Klein, 2012). Economic considerations are mostly the cause for them holding back (Kamani, 2012). They are therefore interested to know how their potential investments make the best return (Klein, 2012). It is thus important for the future success of green markets that corporations know which factors increase the WTP of a consumer the most (Tully & Winer, 2014). The variables that are hypothesized to influence consumers' willingness to pay for green products are discussed in this chapter. The first section discusses the considerations CEO's make before going green in more detail. Afterwards, the five factors that determine environmentally friendly willingness to pay are discussed: demographics, knowledge, values, attitudes and behaviour.

2.1. Background

Before profiling consumers, it is beneficial to look at the development of green consumption throughout the years. The arguments that were raised just after the Green Revolution started

still stand today. And with the small market share of green consumption being between 1 and 3% the following trends in business are particularly interesting (Bray, Johns & Kilburn, 2011). The first traces of researchers profiling consumers with an environment friendly personality date back to the 1970s (Berkowitz & Lutterman, 1968; Anderson & Cunningham, 1972). They sought to identify consumers of a socially responsible nature. Anderson and Cunningham (1972) used a Social Responsibility Scale [SRS] developed by Berkowitz and Lutterman (1968), which according to them would predict product purchasing behaviour. The underlying thought was that the SRS scale was "to measure an individual's traditional social responsibility; i.e. the willingness of an individual to help other persons even when there is nothing to be gained for himself" (Anderson & Cunningham, 1972, p. 25). Individuals that scored high on this scale were thus identified as socially conscious, and their orientations should be reflected in other socially responsible behaviour as well. Such as in situations like consumption purchasing decisions (Anderson & Cunningham, 1972). Therefore, it was assumed individuals with a high SRS scale were more likely to purchase products that take into account the preservation of the environment.

At the time of both these publications, corporations were debating whether the additional costs associated with producing in a social and responsible manner were offset by the benefits. Their foremost concern was whether this 'social activism' was profitable. Moreover, they believed the responsibility should instead be taken by the governments. However, others were of the opinion that although corporations would perhaps not profit from this shift immediately, it would be crucial to be recognized as a sustainable firm in the future (Anderson & Cunningham, 1972). This same point was raised in more detail by Kelley (1971):

> "With growing consumer sensitivity to social and environmental problems, market segmentation based on consumers' societal orientation is emerging; markets will be evaluated [increasingly] according to the degree to which consumers […] buy as individuals concerned not only with their personal satisfactions, but also with societal [and environmental] well-being. It is through the analysis of [social and] environmental developments and through new marketing policies that management responds to the pressures and opportunities presented by social environmental change." (Kelley, 1971, p. 1).

According to Kelley (1971), businesses must adapt to the needs of consumers. They do not just care about their own self-interest anymore, but increasingly find societal well-being more important. Corporations are to adapt to this and contribute towards improving the environmental state (Kelley, 1971). Moreover, Kelley (1971) also states profits continue to be a necessity and are essential to the survival of any corporation. However, as Anderson and Cunningham (1972) also pointed out – it might become a requirement in the changing business environment for businesses to meet societal needs. Kelley (1971) predicted firms to be appraised based on their "environmental performance and their contributions to social change." (Kelley, 1971, p. 1).

Following this argument, corporations should listen to the changing demand of consumers for more social and environmentally safe products. In that case, corporations would have to position their goods and "communicate their environmental efforts to members of the populations who are likely to be concerned about environmental issues" (Bohlen et al, 1993, p. 415). Thus, in essence they were looking for potential green product purchasers (Anderson & Cunningham, 1972). Marketers can do this by focussing on how consumers value environmental problems. Several studies have profiled consumers in such a way. Laroche, Bergeron and Barbaro-Forleo (2001) have for instance made an effort to identify characteristics of consumers that influenced their valuation of environmental problems. In economic terms, they studied the premium consumers were willing to pay for environmentally friendly products. The conceptual framework developed by Laroche et al. (2001) will be leading in this paper. However, it will be an adaptation, where variables that are suggested to influence the WTP by others are also regarded. This framework, which is displayed in Figure 1, are the five factors in which variables will be grouped. By following this framework, green consumer segments with the highest pro-environmental purchasing behaviour can be identified. By relating the variables to the WTP for green products, a certain segmentation of the market should become visible. Through this, corporations can position their products better and more effectively communicate their environmental efforts to consumers.

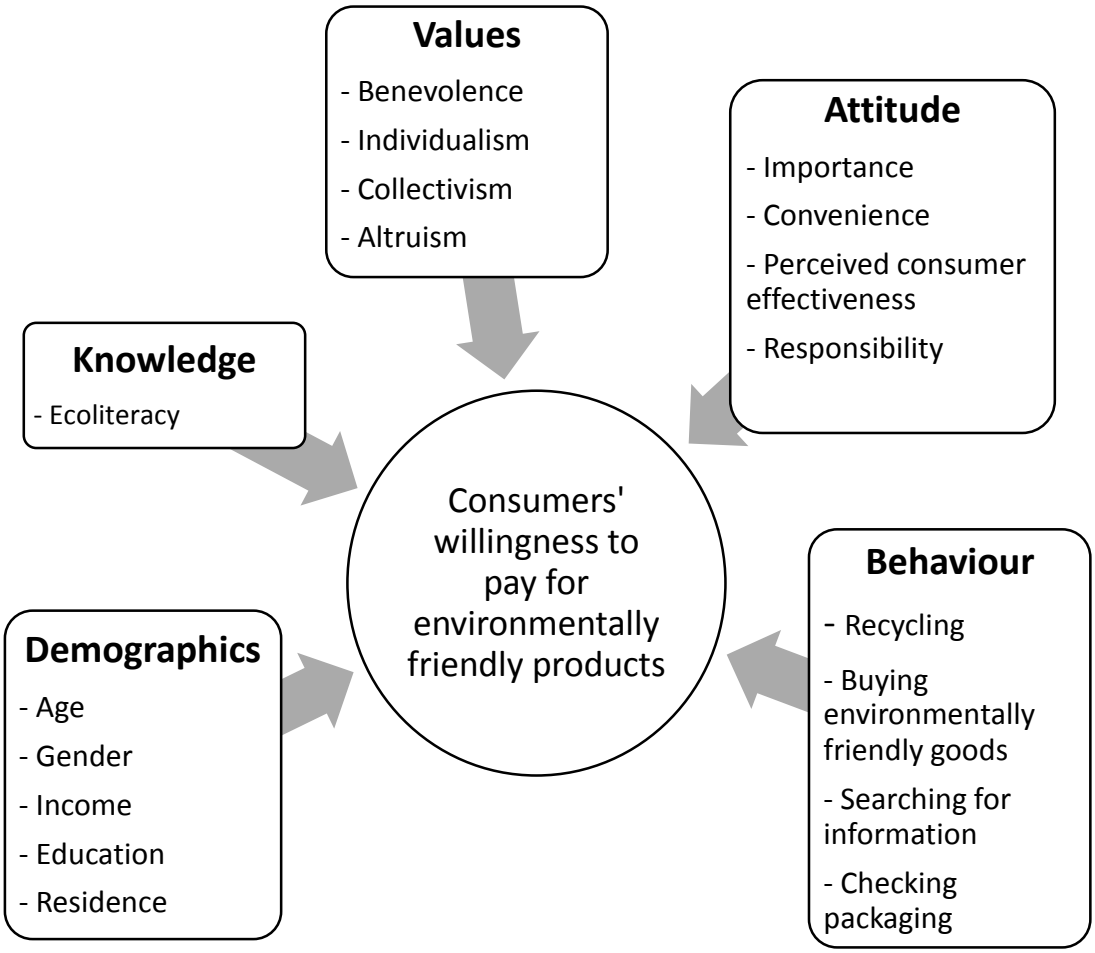

Figure 1. Factors which determine consumers' willingness to pay for environmentally friendly products. Adaptation from Laroche et al. (2001).

2.2. Factors influencing willingness to pay for environmentally friendly products

2.2.1. Demographics

Traditionally, socio-demographic indicators such as age, gender, education, income level and place of residence have been used as measurements to segment consumers. It is not surprising these variables have been measured most for profiling purposes given the ease of measurement. However, the value of measuring socio-demographic characteristics for profiling environmentally conscious consumers has been found to be low (Schlegelmilch, 1996). According to the authors, the explanation can be found in that environmental concern is no longer a marginal concern – "environmental concern is becoming the socially accepted norm" (Schwepker & Cornwell, 1991, p. 85). Hence, finding significantly higher levels of

environmentally friendly purchasing behaviour within certain demographical aspects of the total population is unlikely.

Still, quite a few studies tried to find correlations between demographic variables and environmental behaviour or attitudes. In the case of such significance, this would give marketers an efficient and easy way to segment the market and develop a compatible marketing strategy (Getzner & Grabner-Kräuter, 2004). Within green marketing research, age is an often examined variable. Roberts (1996) found the environmentally conscious consumer to be above the average age. However, Staughan and Roberts (1999) later found younger ages to be significantly correlated with green behaviour. The trend seems to be reversing recently. Nielsen (2015) in a wider perspective found the proportion of consumers that claimed they were willing to pay extra for 'sustainable offerings' was the highest among Generation Z, which is typically referred to as the generation below the age of 16. With 72% it has the highest share of consumers that are willing to pay a premium, versus 51% in the Baby Boomer category in 2015.

Another often considered demographic variable is gender. Anderson and Cunningham (1972) early on already found women were generally more environmentally conscious compared to men. Laroche et al. (2001) also found gender to be a statistically significant influence for consumers' their willingness to pay for green products. Women were found to be more environmentally concerned than men, with relatively 57% versus 40% of their subjects indicating to be concerned in 2001. Although not all results are conclusive, as MacDonald and Hara (1994) for instance found a reversed relationship, the general finding is that women are more environmentally conscious than men.

Other often used variables are socio-economic variables such as income and education. In general they are seen as variables that are positively correlated to environmental concern and behaviour. For income, the idea is that since green products are generally more expensive, consumers with a lower income have limited means to buy them. Higher incomes can incur these extra costs and thereby still favour green products (Straughan & Roberts, 1999). On the other hand, Nielsen (2015) found a larger proportion of individuals in the low income class are willing to pay extra for products offered by companies that are involved in positive environmental or social impact (68% versus 63% of higher income class). Again, the differences found can be due to the increased socially accepted norm to be green. The results

found in earlier studies might not be valid anymore as individuals across all income levels are now concerned with the environment. Laroche et al. (2001) assumed a relationship between income levels and education. Individuals with a higher income were assumed to be positively correlated with higher education. On their turn, higher educated individuals were assumed to be more sensitive to social problems and therefore be more environmentally friendly. However, Laroche et al. (2001) did not find statistical support for this claim.

Another variable regarding the environment is the living situation of individuals. Consumers' environmental consciousness is influenced by whether they live in a rural or urban area. It is hypothesized individuals living in urban areas are more aware of environmental issues as they are confronted with higher levels of several types of pollution within cities. Samdahl and Robertson (1989) indeed found this relationship to be statistically significant.

It can be seen many of these demographic and socio-economic variables are far from conclusive. However, it is clear they do influence consumers' the environmental attitudes, knowledge, values and behaviour of individuals. Therefore, these variables can partly serve to identify consumer segments that are willing to pay a premium for environmentally friendly products. But although these demographic and socio-economic characteristics play a role, they are not as influential as psychographic or behavioural variables. Environmental knowledge, behaviour, values and attitudes are considered to be better indicators for pro-environmental purchase behaviour. Studies therefore often combine demographic, psychographic and behavioural variables to find correlations.

2.2.2. Knowledge

The effect of environmental knowledge ("*Ecoliteracy")* on environmental purchases is the most frequently studied variable. Joshi and Rahman (2015) analysed 53 empirical articles published between 2000 and 2014, all of them focussed around the topic of environmental purchasing. Out of 53 studies, 18 explored the effect of ecoliteracy, of which 15 found environmental knowledge to positively influence green purchase behaviour. The other three found there to be no statistical relationship.

Findings in consumer research state that knowledge of consumers is a crucial benchmark which influences consumers in all stages of their buying decision process (Getzner & Grabner-Kräuter, 2004). Through knowledge, consumers determine how they organize and gather

information, together with how much of that information they use to make a decision. Moreover, it affects how products and services are evaluated by the consumer.

However, other papers (which were not included in Joshi & Rahman's analysis) found different results. For instance, Laroche et al. (2001) also hypothesized environmental knowledge would positively influence the willingness to pay for eco-friendly products. To test this, they developed a test where subjects had to define or identify ecological concepts and symbols. This objective measure of ecoliteracy is supposedly more accurate than subjective measurements other researchers used. Vining and Ebreo (1990) for instance worked with reported knowledge. However, Laroche et al. (2001) did not find ecoliteracy to statistically be a criterion for consumers' their willingness to pay for eco-friendly products.

Moreover, other research (Bang, Elinger, Hadjimarcou & Traichal, 2000) found that even though consumers know the positive effect of wind power, they did not have a favourable attitude towards projects regarding wind power. They also found environmental knowledge did not influence behaviour in the purchase of fuel-efficient vehicles.

Research on environmental knowledge is thus neither conclusive. However, there is reason to examine the influence of ecoliteracy on willingness to pay of consumers further.

2.2.3. Values

In their same survey, Laroche et al. (2001) sought to find out which ethical values consumers have that influence environmental concern. As stated by McCarty and Shrum (1994): "the values one holds […] influence behaviours that work for a common or societal good." Especially altruism and benevolence are values found to positively influence purchase intentions and behaviour of environmentally friendly products (Joshi & Rahman, 2015).

Related variables which Laroche et al. (2001) adapted from Triandis (1993) are individualism and collectivism. The distinction between the two concepts is made on whether an individual is focussed on their independent self or also considers the goals of the group. Triandis (1993) defines individualism as how dependent a person is on him- or herself. Even in groups, individualists remain to themselves and they often compete for status. Through these characteristics, individualists seem unlikely to behave environmentally friendly. Collectivism on the other hand implies helpfulness, cooperation and consideration for the group their goals. This implies that an individual may sacrifice their own goals for the ultimate benefit of

the group. Therefore, consumers with collectivist values should be more likely to behave environmentally friendly as they will keep in mind the goals of the greater good – which is preservation of the environment. And will thus act on those values by means of purchasing environmentally friendly goods. This in contrary to individualistic people that are considered to be more environmentally unfriendly.

One of the behaviours that translate from these values are the extent to which individuals recycle. Through recycling, there are no immediate individual rewards (benevolence). Although there are more incentives to recycle, it can be seen as selfless behaviour coming from a concern for others (altruism). So individuals that recycle generally do not do it as it benefits their own goals or desires (individualism) but do it as they prioritize the group (collectivism). Values are therefore a determinant of environmentally friendly behaviour.

2.2.4. Attitudes

Undoubtedly, consumers' attitudes are a determinant to predict whether an individual will behave in an environmentally friendly way. Including McCarty and Shrum (1994), Chan (1999) and Laroche et al. (2001) found consumer attitudes as a very good predictor of environmentally friendly behaviour. Amyx et al. (1994) state importance and inconvenience as attitudes to determine eco-friendly behaviour. They define importance as the degree to which a person is concerned about ecological issues. In other words, the importance they perceive the environment to have. This concern for the environment can both stern from individual reasons, or for society as a whole. Inconvenience on the other hand is the extent to which an individual perceives behaving in an environmentally friendly way to be a burden. Thus, the consumer might be aware of the consequences of its purchasing behaviour, but might prefer not to behave in the desired way because of inconvenience. In this light, McCarty and Shrum (1994) looked at the inconvenience of recycling. It does not come to a surprise that the more an individual perceives recycling as being inconvenient, the less they will recycle. However, even when consumers perceive recycling to be very important, their perception of inconvenience is dominant and has a greater influence on their actual behaviour. Laroche et al. (2001) found inconvenience to be one of the strongest factors in determining whether an individual would consume in an environmentally friendly or unfriendly way. They found consumers stating they did not find it inconvenient to behave in an eco-friendly way to be willing to pay more for these products, whereas for unwilling consumers the contrary was

found. Changing consumers' perceptions and stressing the convenience of green products is therefore an important task for marketers. Lastly, another important attitude Balderjahn (1988) discovered was that when consumers feel they have power as individuals, this increases their green consumption. Kinnear, Taylor and Ahmed (1974) named this attitude 'perceived consumer effectiveness', which he measured by the extent consumers thought they could control pollution.

It must be noted that even though an individual has attitudes that predict environmentally conscious behaviour, it does not necessarily mean their purchasing behaviour aligns to this attitude. Interestingly, Chan (2001) defines the concept of green purchasing not just as buying environmentally friendly products, but also as avoiding products that are harmful to the environment. Moreover, green purchasing also includes purchase intentions. Green purchase intentions are factors that encourage the purchasing behaviour of consumers. They therefore refer to the 'willingness to purchase' of green products (Ramayah, Lee & Mohamad, 2010). Green behaviour is defined as an ethical kind of decision making behaviour (Joshi & Rahman, 2015). The main problem in the market for green products is that there is a huge inconsistency between green purchase intentions and actual purchasing behaviour. This is referred to as the 'green attitude-behaviour gap' or 'values-action' gap (Vermeir & Verbeke, 2008). To give an example, 30% of UK consumers expressed to be 'very concerned' with environmental issues, but this was hardly ever converted into actual purchases (Young et al., 2010).

2.2.5. Behaviour

In the end knowledge, values and attitudes should predict actual behaviour of consumers in environmentally friendly or unfriendly purchasing decisions. Feeling responsible for ecological problems, consumers try to behave in an environmentally friendly manner. This in turn is an important determinant for consumers to be willing to pay a premium price for eco-friendly products because they believe environmental issues will not fix themselves. In general, green consumers even have the belief the conditions of the environment are getting worse (Banerjee & McKeage, 1994). The green consumer, who is socially conscious, feels vigorously he influences or has an impact on pollution and thus acknowledges the impact of his purchasing behaviour (Webster, 1975). One of the indicators of willingness to pay is therefore the perception individuals have of how severe ecological problems are (Banerjee & McKeage,

1994). Consequently, Laroche et al. (2001) found those that considered ecological problems during the purchase decision, were more inclined to spend extra money on green substitutes.

Relating to this, not only is it important to what extent individuals are aware of how severe ecologically issues are, but also how they perceive their involvement in protecting the environment. Although some consumers may be concerned about the environment, they feel the responsibility is with corporations or the government. Therefore this factor might also influence the willingness to pay for environmentally friendly products.

In general, caution and suspicion are required analysing stated behaviour. As Laroche et al. (2001) noticed, the stated behaviours of for instance "recycling" and "buying environmentally friendly products" were not found to significantly influence the consumer's willingness to pay more for environmentally friendly products. Laroche et al. (2001) explain this as consumers are aware they should give an answer indicating they are behaving in an environmentally conscious way and therefore give desirable answers, partly driven by social pressure. Another explanation is that environmentally conscious behaviour does not necessarily lead to consumers being willing to pay a premium in consumption situations. Therefore, one environmentally conscious behaviour cannot be directly extended to other behaviours. This is another explanation for the attitude-behaviour gap. Attitude alone does not always correctly predict an individual's actual behaviour. Being aware of the consequences of purchasing behaviour (i.e. knowledge), a positive attitude towards the environment does not automatically mean this results in behaving environmentally conscious (Schlegelmilch, 1996).

3. RESEARCH METHODOLOGY

The purpose of the previous literature review was to find characteristics that define the green consumer. These variables were selected based on previous research. The goal was to get the best overview of which characteristics influenced the willingness to pay of consumers the most. The most common and most often used characteristics were considered and included in the literature review. Where this paper distinguishes itself is on the used research methodology to classify whether an individual is environmentally friendly or not. To justify the different approach, the following sections will define concepts, compare methods and eventually present a combination of several methods – which will be the method, and foundation of this paper. First the concept of willingness to pay is discussed.

3.1. Willingness To Pay

The foundation of this paper lays on the 'willingness to pay' of consumers. It will be used as the dependent variable later on in the upcoming empirical analysis. It is therefore important to first understand what willingness to pay is, and how it is measured.

Before going to the exact definition of willingness to pay, it is important to understand how the concept is measured. Most often the concepts of *reservation price* and *maximum price* are used to measure how much a consumer is willing to pay for a good or service (Breidert, 2005).

The first definition for willingness to pay is the economic term 'reservation price'. This term refers to the maximum amount an individual is willing to pay for a product or service. At that point, the consumer is exactly indifferent between purchasing the good and not purchasing it (Jedidi & Zhang, 2002). Another definition of the reservation price Hauser and Urban (1986) used was that it is the lowest price for which someone will not buy the good.

The second concept of the maximum price is determined by the value a consumer attributes to the differentiation of a product of interest on top of the price of a reference product. Formally this can be expressed as:

$$P_{max} = P_{ref} + P_{diff}$$

The reference price is determined by the cost of one unit of a product the consumer sees as the best alternative of the product of interest. The differentiation price on the other hand is the value the consumer attributes to the differences between the reference product and the product of interest (Breidert, 2005).

The concepts therefore differ from each other through the inclusion of a reference value. For the reservation price concept, there is no reference value required. As this value does not depend on a reference price, the reservation price is a monetary representation of what a product or service is really worth to someone. Stated differently, when you pay exactly the reservation price you have the same utility from purchasing and not purchasing it (Breidert, 2005).

The stated or revealed willingness to pay is therefore dependent on the circumstances a consumer is in. If a consumer believes there is no alternative to the product of interest, he will pay the reservation price – which equals the highest sum of money he is willing to pay. This

equals his utility. If the consumer instead does believe there is an alternative product, but that the alternative product has an economic value which is lower than his utility, then the highest price that consumer is willing to pay is equal to the maximum price – which equals the economic value. A consumer will thus be willing to pay the minimum of the reservation price, P_{res} and the maximum price P_{max}. Therefore, $P_{WTP} = \min (P_{max}, P_{res})$.

In this paper, the definition of *maximum price* is used. The advantage of this approach is that we can directly elicit the ethical, responsible element from the maximum revealed price. Through an Internet based survey, participants are asked to reveal their true willingness to pay for a green package of toilet paper. The decision to present subjects with a choice between toilet paper is made as the product has an easy environmental dimension to it. There are broadly two categories toilet paper can be classified in: the standard bleached paper or recycled, unbleached paper (Bennett & Blamey, 2001). One of the reasons for choosing toilet paper over other alternatives is that recycled toilet paper is not inferior to standard toilet paper. In most cases the difference in quality is almost non-existent, whereas the impact of using recycled toilet paper is significant. By using recycled toilet paper trees are saved, energy use is reduced, landfill space and water is saved and pollution is kept out of the air (Toilet Paper World, 2016). In the survey, the presented reference product is the standard package of toilet paper, with its given price. Thus, the maximum price minus the reference price equals the ethical, environmentally friendly element. The revealed reference price will be displayed as a percentage premium on top of the base price. Premiums are often expressed as percentages as they are easier to interpret. This method therefore uses a revealed preference method to determine the dependent variable. Other researchers, such as Laroche et al. (2001) for instance asked respondents whether they thought it was acceptable to pay a 10% premium for green products and categorized their respondents based on that statement.

3.2. Stated Preference versus Revealed Preference

To elaborate more on the debate about which research method leads to the most accurate willingness to pay of consumers, this section discusses the most common elicitation techniques.

Within decision theory, preferences play a vital role. The concept means that when individuals face several outcomes, they often prefer one over another (Dickenson, 2011). Generally, there are two types of preference measures: *stated* preference and *revealed* preference.

Stated preference methods refer to techniques that use statements to assess individuals' their preferences. To collect data, usually surveys are required with a clearly designed purpose (Kroes & Sheldon, 1988). Revealed preference methods on the other hand are meant to record actual behaviour of individuals (Experimental Economics Center, 2006). Which method is the most appropriate or best method to be used depends on the objective of the researcher (Breidert, 2005).

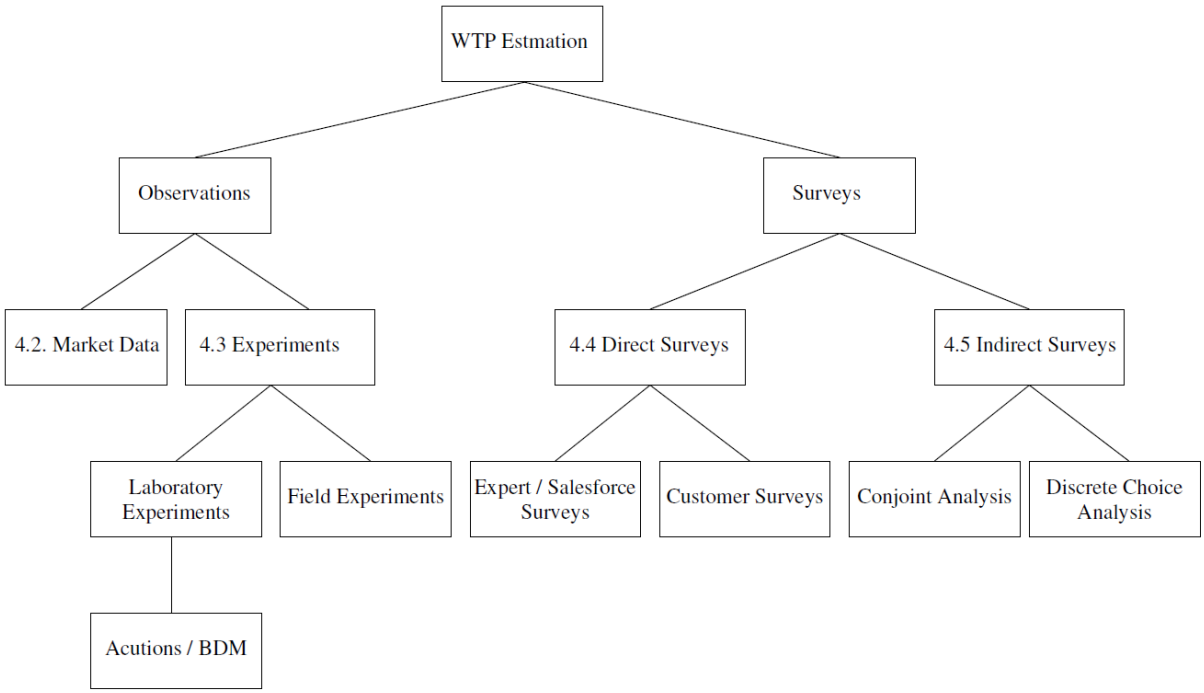

Figure 2. Willingness to pay method classification (Breidert, 2005).

Breidert (2005) first of all distinguishes willingness to pay estimation methods into 'observations' and 'surveys'. For observations, either real data such as market data can be used or experiments can be executed. These two methods can be classified as revealed preferences. Within surveys, which are stated preferences, researchers can choose to make use of direct or indirect surveys. Whereas in a direct survey respondents have to state the amount they are willing to pay for a product, within an indirect survey respondents are asked to rank or rate several products. A visual representation of the different WTP estimation techniques is presented in Figure 2.

3.2.1. Surveys

The direct survey is known as one of the first methods to estimate willingness to pay. Stoetzel (1954) introduced the psychological price method which consisted of just two questions. Individuals were asked to state a price above and below where they would definitely not buy the product. This direct approach where respondents state acceptable prices comes with several flaws. Breidert (2005) mentions five issues with the direct approach. First of all, he claims this approach has an unnatural emphasis on price. Secondly, there is no incentive for participants to reveal their true willingness to pay. Subjects may overstate their price due to prestige effects, or understate prices due to consumer collaboration effects. Nessim and Dodge (1995) explain this effect as that consumers will collectively understate prices in these surveys so that prices will be lower in reality. Thirdly, as Nessim and Dodge (1995) also pointed out, even in the case where participants reveal their true valuation, this does not necessarily mean they will behave the same in actual purchasing situations. Point number four raises the problem that it can be cognitively challenging for participants to state their willingness to pay for unfamiliar or complex products (Brown et al., 1996). Finally, buyers do not constantly value goods at the same price or misjudge a product. This especially happens for more uncommon purchases of goods (Marbeau, 1987). Combining all these points, the direct surveying method does not seem to be extremely reliable.

Indirect surveys differ from direct surveys in the sense that they do not directly ask how much individuals are willing to pay. Instead, the method presents multiple products which the participant has to rank or rate. Product prices are stated and participants are asked if they would buy it at that particular price. By presenting a higher number of product offerings together with prices, indirect surveys more realistically replicate a purchase situation. Moreover, it is cognitively easier to indicate whether a price is acceptable than to state an acceptable product price (Brown et al., 1996).

3.2.2. Observations

Observations instead reveal consumer preferences. The two types of observations Breidert (2005) mentions in Figure 2 are experiments and using market data. The ‘problem’ with market data is that the information only reveals whether the willingness to pay of an individual is higher (buys the product of interest) than the price of the product. If the willingness to way

was lower than the product price the consumer does not buy the product of interest and is thus not included in the sales data (Breidert, 2005). Therefore this method only generates limited information.

Experiments offer the opportunity to reveal a wider array of information. Within the category of experiments, we can distinguish between laboratory experiments and field experiments. Laboratory experiments are often used to extract purchasing behaviour. This can for instance be simulated by giving the participant a sum of money and subsequently asking them how they would spend that money on a particular set of goods (Breidert, 2005). Bias might occur as the participants do not use their own money and do not actually purchase the goods. Low external validity results (Nagle & Holden, 2002). Auctions are a special category within laboratory experiments. They are useful to reveal the true valuation of consumers for a good. One of the first documented auctions was an offer Johann Wolfgang von Goethe made in 1797 to a possible publisher of his poem *Hermann and Dorothea*. He sent the following letter:

> "I am inclined to offer Mr. Vieweg from Berlin an epic poem, Hermann and Dorothea, which will have approximately 2000 hexameters. …Concerning the royalty we will proceed as follows: I will hand over to Mr. Counsel Böttiger [Goethe's lawyer] a sealed note which contains my demand, and I wait for what Mr. Vieweg will suggest to offer for my work. If his offer is lower than my demand, then I take my note back, unopened, and the negotiation is broken. If, however, his offer is higher, then I will not ask for more than what is written in the note to be opened by Mr. Böttiger." (Fisman & Sullivan, 2016).

Goethe did not choose to sell his poem to the highest bidder, a so-called "English" auction where the participant with the highest bid determines the selling price (Fisman & Sullivan, 2016). Instead, Goethe proposed a mechanism to give Vieweg an incentive to truthfully reveal his willingness to pay. Goethe's 'Second-Price Auction' component formed the basic mechanism for Vickrey auctions. In Vickrey auctions ("second price sealed bid auction"), the participant with the highest bid wins the auction, but buys the good at the price of the second highest bid. In such a way participants are incentivized to reveal their true valuation. For Vickrey auctions, the dominant bidding strategy is to bid your true valuation (Breidert, 2005).

To exemplify the Vickrey auction, let me go back to the example of Goethe selling his manuscript to Mr. Vieweg. If Vieweg believes the poem will earn him 2,000 talers it is in his best interest to bid exactly that value for the manuscript. If he decides to offer more he risks to pay a price above 2,000 which he believes will incur him a loss. If he instead offers less than 2,000 – say 1,800 he will only get the poem if the sealed price is lower than 1,800. However, if the sealed price is between 1,800 and 2,000 Vieweg will miss out. He will not be able to purchase Goethe's poem and will not be able to acquire it at a price that is less than he estimated it is worth (Fisman & Sullivan, 2016).

In Vickrey auctions, the purchase price is decided by the bids of other participants. Bidders thus compete with each other for a good with a limited stock. Therefore participants will not just be concerned with their true valuation, but they will also try to obtain the winning bid (Wertenbroch & Skiera, 2002). So although the dominant strategy is to offer the true valuation, bias can occur. This winning component in the classic Vickrey auction can make participants overbid to increase their likelihood of winning (Kagel et al., 1987). By bidding more than something is worth to participants, the incentive structure present in Vickrey auctions is violated (Wertenbroch & Skiera, 2002). They therefore decrease external validity. An interesting incentive-compatible procedure is the BDM, which was introduced by Becker, De Groot and Marschak in 1964.

3.3. Becker, De Groot and Marschak procedure

Sealed bid auctions reveal information to the seller. Goethe had carefully chosen his publisher, and knowing what his poem was worth to his publisher would give him leverage over his next manuscript negotiation (Fisman & Sullivan, 2016). The same principle holds for the BDM mechanism, which is very incentive compatible.

The BDM model is "designed to be theoretically incentive-compatible, realistic, transparent to respondents, and operationally efficient" (Wertenbroch & Skiera, 2002, p.7). The BDM mechanism allows to elicit the willingness to pay of individuals in more every-day purchase situations.

In BDM, subjects simultaneously cast their offer price for a selected product. The actual selling price is randomly selected by chance from a pre-selected distribution. The possible sale price ranges between an interval that goes in between zero and a price above the predicted

maximum price. Those participants that bid equal to or above the random number must buy the good at the price of the randomly chosen selling price. This mechanism is just like the Vickrey auction incentive compatible. An individuals' bid decides if the bidder has the right to buy the auctioned good. The price of the auctioned good is set by a mechanism which is supposedly lower than the valuation of the participant (Breidert, 2005).

3.4. Design

Reviewing all the methods to estimate the willingness to pay of individuals, all approaches have their advantages and disadvantages. Although observed data is very appealing, it generally comes at a greater cost and a bigger time effort. Survey data is easier to retrieve and lower costs are involved. However, the direct and indirect surveys used are the cause of some serious biases. Auctions on the other hand are considered to be a reliable way to elicit the true valuation of consumers. Whereas the Vickrey auction is more preferable in situations where the auctioned good has a limited stock, the BDM procedure is more applicable for every-day products.

This paper will combine the direct survey method with an incentive compatible BDM procedure. To avoid a cognitively difficult challenge for respondents, they are asked to reveal their willingness to pay for a familiar product which is purchased frequently. Respondents are asked to imagine they get an endowment of €8, which they can spend on either of the two products. By mentioning in the introduction that five respondents actually receive a product plus the rest of the money they did not spend, subjects are encouraged to imagine they are spending their own, real money and have the possibility to actually purchase the product. Moreover, by implementing an auction element respondents are incentivized to "tell the truth".

The BDM procedure is used to then make subjects reveal their true valuation of the green product. Participants were clearly instructed about the rules and the consequences of their valuations. Since the BDM model can be difficult to understand, several trials were ran in order for the subjects to understand the mechanism as well as possible. The instructions participants received are presented in Appendix A.

To be compatible with the *maximum price* method of willingness to pay, an adjustment of BDM is required. Instead of ranging between 0 and an arbitrary number, in this case the

possible value of the randomly generated number can vary between 4 and 8. These numbers represent the minimum and maximum amount a respondent can indicate to be willing to pay for the green package of toilet paper. If the revealed price of a subject is lower than the randomly generated number, he does not have the right to buy the green product. He instead buys the standard package of toilet paper for €4. On the other hand, if the revealed price of the subject is equal to or higher than the randomly generated number, he purchases the green product for a price equal to the randomly generated number. The value of €4 was chosen as a representative value for standard toilet paper in the Netherlands. The provided information was kept limited so that subjects would not compare prices to their 'own' product.

The value of €8 as a maximum bidding price was chosen as previous literature showed consumers were generally not willing to spend more than a 40% premium on green products (Nielsen, 2015). Therefore, it is thought subjects will have enough room to reveal their maximum willingness to pay for the green product and still receive a small amount for their left-over budget. This serves as an extra incentive.

Subjects are then asked to reveal how much they value the added ethical characteristics of the green package of toilet paper. They therefore bid between €4 and €8, revealing their maximum price. The differentiation price can then easily be identified, which serves as the price premium respondents are willing to pay for a green variant of a package toilet paper.

4. DATA

The literature review made an effort to identify variables that influence the willingness to pay for environmentally friendly products. This analysis revealed a large number of variables that potentially influence consumers' WTP. Within the categories of demographics, knowledge, values, attitudes and behaviour multiple variables were identified. This chapter will present the variables that were included in the survey through Qualtrics. The variables were mostly presented through statements, which respondents indicated to agree or disagree with based on a 7-point Likert scale.

4.1. Data collection

The data that is presented in this paper was collected through an online distributed survey. The main platform that was used to gather respondents was Facebook. In early October 2016, a total of 99 respondents started the survey. From these 99 responses, 81 were completed

and could be used for the analysis. The other responses were incomplete. It is important to exclude incomplete responses as even though partial data could be used, it shows a lack of motivation from the subject. This lack of motivation could then also play a role in throughout the rest of the survey. The survey was conducted in English to individuals living in the Netherlands. The survey can be viewed in Appendix B.

To limit the influence of demographic variables, the sample was tried to be kept as homogeneous as possible. Participants were targeted to be between 20 and 30 years old. Being born between the early 1980's and mid 1990's, this generation is referred to as 'Generation Y'. According to Ottman (2011), every generation has been brought up in a different time period and therefore have a different view on green behaviour. Generation Y is characterized as a technologically advanced generation, with the largest potential impact.

Other relevant demographic variables the literature review suggested were educational and income levels. Participants were asked to state their highest completed degree and cross the interval that included their monthly budget. However, as Generation Y is likely to include many student and recent graduates, the power of these variables diminishes. The highest obtained educational degree is likely to change in the near future of many respondents. Moreover, their monthly budget is often characterized as a starter wage. As a large proportion in this generation does not pay its own bills or receives grants, differences in monthly budget are unlikely to influence the WTP for eco-friendly products a lot.

The place of residence from respondents is only partially controlled for. Most research in this field has been American, where differences between living in an urban and rural area are more extreme than in the Netherlands. In the Netherlands, people are never far from urban areas, which will diminish the effects of residence. However, as most respondents were students, they are more likely to live in cities with a larger population as most higher education is concentrated there.

The final demographic variable gender was not controlled for in any way. Out of 81 respondents, 38 were female and 43 were male. The mean WTP percentage premium was 31.98%, where 96% of the respondents revealed to be willing to pay a premium for environmentally friendly products.

4.2. Variable description

This section presents all questions and statements respondents were presented in their survey (which can be found in Appendix B). The questions and statements were formed in such a way to represent the variables that were found to be of influence in the literature review.

Variable	Type of variable	Description
Dependent variable		
WTP percentage premium	Continuous	Percentage premium participant offers for green product
Independent variable		
Values		
1. I focus on my own achievements	Ordinal	Statement subject is asked to indicate 1 = Does not describe me, 2 = Describes me slightly well, 3 = Describes me moderately well, 4 = Describes me very well, 5 = Describes me extremely well
2. If others can benefit from my success, that makes me happy	Ordinal	Statement subject is asked to indicate between 1 = Does not describe me, and 5 = Describes me extremely well
3. I feel isolated from my community	Ordinal	Statement subject is asked to indicate between 1 = Does not describe me, and 5 = Describes me extremely well
4. With my actions I can improve the Environment	Ordinal	Statement subject is asked to indicate 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree nor disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly agree
5. My friends and/or family use green products	Ordinal	Statement subject is asked to indicate 1 = None at all, 1 = A little, 3 = A moderate amount, 4 = A lot, 5 = A great deal
Attitude		
6. I feel responsible for the environment	Ordinal	Statement subject is asked to indicate 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree nor disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly agree
7. If I had more money, I would buy more green products	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
8. I am convinced global warming is happening	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree

9. Controlling pollution takes more effort than it is worth	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
10. I do not understand why people are so worried about using too much water	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
11. Consumers are the cause of environmental problems	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
12. Corporations and governments are Responsible	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
13. I hate to clean my glass bottles before I trash them	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
14. Separating trash into different piles is too much of an effort	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
15. I am happy with how much I recycle and prevent pollution	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
16. It is convenient to recycle	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
17. It is important to recycle	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
Behaviour		
18. I recycle my waste	Ordinal	Statement subject is asked to indicate between 1 = Strongly disagree, and 7 = Strongly agree
19. I refuse to buy products of which I know they are produced in a polluting	Ordinal	Statement subject is asked to indicate 1 = Does not describe me, 2 = Describes me slightly well, 3 = Describes me moderately well, 4 = Describes me very well, 5 = Describes me extremely well.
20. I check if a product is wrapped in recycled paper before I purchase it	Ordinal	Statement subject is asked to indicate between 1 = Does not describe me, and 5 = Describes me extremely well.
21. I have bought green products before	Ordinal	Statement subject is asked to indicate 1 = None at all, 1 = A little, 3 = A moderate amount, 4 = A lot, 5 = A great deal
22. I search for information on environmental problems	Ordinal	Statement subject is asked to indicate 1 = None at all, 1 = A little, 3 = A moderate amount, 4 = A lot, 5 = A great deal

Ecoliteracy		
23. Knowledge	Ordinal	Number of questions answered correctly in quiz. Min = 0, Max = 9
Demographics		
24. What is your gender?	Categorical	Gender of respondent: Female = 0, Male = 1
How old are you?	Continuous	Age of respondent
What is your nationality?	Categorical	Nationality of subject: Non-Dutch = 0, Dutch = 1
What is the highest educational degree you have received?	Categorical	Highest obtained educational degree of subject. 1 = Less than high school degree, 2 = high school graduate, 3 = MBO, 4 = HBO, 5 = University bachelor, 6 = University master, 7 = Doctoral degree, 8 = Professional degree
What is your monthly budget?	Interval	Monthly budget of subject in Euro. 1 = 0-500, 2 = 500-1000, 3 = 1000-1500, 4 = 1500-2000, 5 = 2000-2500, 6 = 2500+

The numbered variables are included in the Principal Component Analysis that will be discussed next. The variables are characterized, where statements 1-5 apply to values, 6-17 are variables measuring attitudes, 18-22 are included for behaviour and statement 23 is for environmental knowledge. The category 'Knowledge' thus only comprises one variable, which is a score based on a 9 question quiz. The questions were mostly adapted from Coyle (2005) which tested the environmental literacy of Americans. Statement 24 is the only variable included from the demographical variables, for reasons previously discussed. The rest of the variables are not included in the result section, as they were only included to describe the sample or will be used later on in the discussion.

5. RESULTS

This chapter will discuss the results that are obtained from this research. The second chapter dealt with the characteristics green consumers are likely to have. It was argued that the approach previous researchers took was not optimal, besides, it was unclear what effect the several variables had on consumers' buying behaviour. With the data that followed, it made sense to perform a Principal Component Analysis (PCA). Both theoretically as empirically, many of the variables in the dataset measured the same thing, resulting in a high correlation among many of the independent variables.

Reviewing the characteristics of the green consumer and the data gathered, it becomes apparent that both theoretically and empirically many variables are correlated with each other. However, how the variables relate to each other between the categories is unknown. Therefore, this chapter starts with a regression from the four different categories (demographics is not included) as independent variables, on the dependent variable WTP percentage premium.

But still, many of the variables are thought to influence each other or measure the same characteristic, and can therefore be considered to be redundant. Moreover, although many variables theoretically play a role on the dependent variable, it is unknown which values, attitudes or behaviours weigh heavier on purchase decisions. The Principal Component Analysis (PCA) is a suitable test to uncover and explore patterns in the data set. It is a mathematical technique to restructure information.

5.1. Regression on categorized variables

First of all an overall score is computed for the categories 'values', 'attitude' and 'behaviour'. Grouping the variables together may give insights into what effect the categories have on the dependent variable 'WTP percentage premium'. These scores are then regressed on the dependent variable, of which the output can be seen in Table 1.

Table 1. *Regression with categories of independent variables.*

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
	6,189	10,397		,595	,553		
Values	,009	,933	,001	,009	,993	,755	1,325
Attitude	,704	,382	,234	1,843	,069	,700	1,429
Behaviour	1,120	,661	,200	1,694	,094	,812	1,231
Knowledge	-,757	1,207	-,067	-,627	,533	,990	1,010

Note: Dependent Variable: WTP percentage premium

Within regression analysis, problems arise when there are high correlations between more than one independent variable with several other IV's. In other words, when independent variables are 'overlapping' each other. Theoretically, this paper makes use of several

independent variables which are all grouped and measure the same thing – namely the values, attitudes and behaviour that determine the willingness to pay for a green product. Therefore, collinearity statistics are included. A tolerance value below 0.2 and a Variance Inflation Factor above 5 are considered to be a rule of thumb for evidence of multicollinearity (De Mars, n.d.).

As can be seen in the output of Table 1, no independent variable violates these scores, indicating no evidence for multicollinearity in this model. Therefore, we can say that the expected correlations will mostly happen within the categories, and not between variables in them. Moreover, we can conclude the independent variables Attitude and Behaviour are significant predictors for the willingness to pay of green products at the 10% significance level. With a beta coefficient of 0.234 for Attitude and 0.200 for Behaviour both variables have a similar impact on the WTP. Values and Knowledge are not found to be significant at the 10% level on the dependent variable.

5.2. Explanation Principal Component Analysis

PCA is most useful when there is a large number of variables. The method discovers new variables, which are called “Principal Components” (PCs). These components account for large parts of the variability in the data. The information is therefore described by far less variables than before (Davies & Fearn, 2004). This dimension reduction PCA is famous for makes it easier to analyse and interpret data, while most of the data is retained (Cangelosi & Goriely, 2007).

What PCA essentially does is look for linear combinations between variables (Atchley, n.d.). The first PC is computed by a line that goes through the data explaining most of the variability in the data (Davies & Fearn, 2004). It extracts the maximum variance from those variables and follows to search for a second linear combination in the remaining variance. Again, that combination will explain the maximum proportion of the remaining variance. This process, which is called the ‘principal axis method’, continues which results in orthogonal factors (meaning they are uncorrelated). The factors, or PCs, are thus linear combinations from the initial variables. However, based on how much they contribute in explaining the total variance, they are weighted. This is called the ‘eigenvalue’ ratio. Eigenvalues of components thus measure how much of the total sample variance that PC accounts for. Intuitively, low

eigenvalues therefore contribute little in explaining variance and can therefore be ignored (Atchley, n.d.).

Moreover, for PCA to work, all variables need to have a linear relationship between them. This assumption needs to hold as PCA is entirely based on correlation coefficients. Therefore it is also important that all variables are measured on the continuous level, although ordinal variables such as Likert scales can also be used (Lund Research, 2013). The correlated variables are then transformed into a smaller amount of uncorrelated PCs (Atchley, n.d.). The percentage of variance PCA explains is also considered to be an index for goodness of fit of the model (Lorenzo-Seva, 2013).

5.3. Correlation matrix

Before performing the PCA, correlations between variables need to be checked. Correlation matrices are essential as correlation coefficients are the basis of PCA. Each entry in Table 2 and Table 3 shows the correlation coefficient between two variables. They always take a value between -1 and 1, where negative correlations mean that as one variable goes up, the other one goes down. Positive correlations on the other hand mean that if one variable goes up, the other one goes down.

Table 2. *Correlation matrix statements 1-12.*

	1	2	3	4	5	6	7	8	9	10	11	12
1. I focus on my own achievements	1,000	,115	-,074	,031	,083	-,002	,001	-,009	-,067	-,266	-,123	,157
2. If others can benefit from my success, that makes me happy	,115	1,000	,023	,100	,020	,440	,356	,204	-,169	-,279	,136	-,113
3. I feel isolated from my community / culture / society	-,074	,023	1,000	-,334	-,176	-,182	,000	,059	-,011	,065	-,159	,014
4. With my actions I can improve the environment	,031	,100	-,334	1,000	,318	,437	,393	,080	-,030	-,332	,152	-,285
5. My friends and/or family use green products	,083	,020	-,176	,318	1,000	,117	,111	,300	,009	-,183	-,049	,126
6. I feel responsible for the environment	-,002	,440	-,182	,437	,117	1,000	,599	,266	-,277	-,332	,220	,018
7. If I had more money, I would buy more green products	,001	,356	,000	,393	,111	,599	1,000	,179	-,153	-,368	,168	,095
8. I am convinced global warming is happening	-,009	,204	,059	,080	,300	,266	,179	1,000	-,129	-,230	,261	,143
9. Controlling pollution takes more effort than it is worth	-,067	-,169	-,011	-,030	,009	-,277	-,153	-,129	1,000	,235	-,230	-,015
10. I do not understand why people are so worried about using too much water	-,266	-,279	,065	-,332	-,183	-,332	-,368	-,230	,235	1,000	-,154	,092
11. Consumers are the cause of environmental problems	-,123	,136	-,159	,152	-,049	,220	,168	,261	-,230	-,154	1,000	-,017
12. Not consumers, but corporations and governments are responsible for environment	,157	-,113	,014	-,285	,126	,018	,095	,143	-,015	,092	-,017	1,000
13. I hate to clean my glass bottles before I trash them	-,007	,039	,165	-,245	,010	-,170	-,121	,134	,115	,200	-,141	,069
14. Separating trash into different piles is too much of an effort	-,048	-,125	,117	-,037	-,122	-,275	-,062	,010	,130	,277	-,112	-,013
15. I am happy with how much I recycle and prevent pollution	,072	-,039	-,107	,074	,138	,006	-,092	-,048	,166	,027	-,107	-,024
16. It is convenient to recycle	,118	,130	-,239	,032	,120	,147	,069	-,057	,144	-,160	-,130	-,022
17. It is important to recycle	,048	,150	-,068	,056	,161	,313	,185	,178	-,213	-,275	,159	,015
18. I recycle my waste	,072	-,034	-,162	,176	,180	,208	,155	-,018	,046	-,306	-,147	,103
19. I refuse to buy products of which I know they are produced in a polluting way	-,087	,000	-,012	,118	,232	,310	,262	,185	,010	-,199	,105	,131
20. I check if a product is wrapped in recycled paper before I purchase it	-,021	,235	,117	,193	,302	,314	,338	,157	-,088	-,193	,085	,114
21. I have bought green products before	,053	,102	-,048	,206	,520	,224	,147	,117	,001	-,249	-,138	,001
22. I search for information on environmental problems	-,108	,046	,203	,072	,387	,174	,246	,216	-,175	-,286	-,047	,204
23. Knowledge	,020	,033	,163	-,087	,004	,030	-,159	-,016	-,164	-,002	-,079	,009
24. What is your gender?	-,178	-,159	,111	-,185	-,051	-,309	-,196	,057	,047	,206	,008	,076

Table 3. *Correlation matrix statements 13-24.*

	13	14	15	16	17	18	19	20	21	22	23	24
1. I focus on my own achievements	-,007	-,048	,072	,118	,048	,072	-,087	-,021	,053	-,108	,020	-,178
2. If others can benefit from my success, that makes me happy	,039	-,125	-,039	,130	,150	-,034	,000	,235	,102	,046	,033	-,159
3. I feel isolated from my community / culture / society	,165	,117	-,107	-,239	-,068	-,162	-,012	,117	-,048	,203	,163	,111
4. With my actions I can improve the environment	-,245	-,037	,074	,032	,056	,176	,118	,193	,206	,072	-,087	-,185
5. My friends and/or family use green products	,010	-,122	,138	,120	,161	,180	,232	,302	,520	,387	,004	-,051
6. I feel responsible for the environment	-,170	-,275	,006	,147	,313	,208	,310	,314	,224	,174	,030	-,309
7. If I had more money, I would buy more green products	-,121	-,062	-,092	,069	,185	,155	,262	,338	,147	,246	-,159	-,196
8. I am convinced global warming is happening	,134	,010	-,048	-,057	,178	-,018	,185	,157	,117	,216	-,016	,057
9. Controlling pollution takes more effort than it is worth	,115	,130	,166	,144	-,213	,046	,010	-,088	,001	-,175	-,164	,047
10. I do not understand why people are so worried about using too much water	,200	,277	,027	-,160	-,275	-,306	-,199	-,193	-,249	-,286	-,002	,206
11. Consumers are the cause of environmental problems	-,141	-,112	-,107	-,130	,159	-,147	,105	,085	-,138	-,047	-,079	,008
12. Not consumers, but corporations and governments are responsible for environment	,069	-,013	-,024	-,022	,015	,103	,131	,114	,001	,204	,009	,076
13. I hate to clean my glass bottles before I trash them	1,000	,288	-,233	-,003	-,119	-,204	,000	-,049	-,052	,117	-,009	,329
14. Separating trash into different piles is too much of an effort	,288	1,000	-,166	-,376	-,334	-,418	-,156	-,222	-,212	,019	-,110	,395
15. I am happy with how much I recycle and prevent pollution	-,233	-,166	1,000	,184	,146	,421	,040	,176	,189	,029	-,124	-,049
16. It is convenient to recycle	-,003	-,376	,184	1,000	,029	,304	,150	,058	,108	-,089	-,099	-,217
17. It is important to recycle	-,119	-,334	,146	,029	1,000	,276	,057	,223	,296	,151	,107	-,062
18. I recycle my waste	-,204	-,418	,421	,304	,276	1,000	,280	,243	,200	,169	,024	-,144
19. I refuse to buy products of which I know they are produced in a polluting way	,000	-,156	,040	,150	,057	,280	1,000	,589	,347	,388	-,106	-,235
20. I check if a product is wrapped in recycled paper before I purchase it	-,049	-,222	,176	,058	,223	,243	,589	1,000	,464	,548	-,060	-,223
21. I have bought green products before	-,052	-,212	,189	,108	,296	,200	,347	,464	1,000	,339	,077	-,318
22. I search for information on environmental problems	,117	,019	,029	-,089	,151	,169	,388	,548	,339	1,000	,029	,110
23. Knowledge	-,009	-,110	-,124	-,099	,107	,024	-,106	-,060	,077	,029	1,000	,076
24. What is your gender?	,329	,395	-,049	-,217	-,062	-,144	-,235	-,223	-,318	,110	,076	1,000

PCA basically summarises its information in the correlation matrix. When correlations are too high, it implicates that two variables might be measuring something very similar. The rule of thumb here is to remove one of the two variables when their correlation coefficient is above 0.9. The contrary applies for correlations which are too low. When correlations are very low, a variable risks to load only to one PC. When a variable creates its own PC this does not help the analysis, as the aim of PCA is to reduce the amount of variables. Correlations are considered to be too low when they are below the value of 0.1 (UCLA, 2014).

In the correlation matrix of Tables 2 and 3 there are no correlation coefficients that exceed the threshold of 0.9, therefore no variables are required to be removed. Low correlations, those below 0.1 are more common. However, these variables do not need to be removed. Their components will most likely not explain enough variability and will therefore not be retained.

Regarding this aspect, the correlation matrix reveals other useful information. For instance, we can easily calculate the total sum of variances by adding up the diagonal values which are all equal to 1. The total variance in this sample is therefore 24.

5.4. KMO and Bartlett's test

Broadly speaking there are two indicators that are used to check whether the implementation of PCA on a data set makes sense. These are the KMO index and Bartlett's Sphericity test. Both tests detect if the initial variables can summarise the information in a limited number of components.

Table 4. *KMO index of Sampling Adequacy and Bartlett's Sphericity test.*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,634
Bartlett's Test of Sphericity	Approx. Chi-Square	553,913
	df	276
	Sig.	,000

Bartlett's test checks whether certain variables are redundant by comparing the correlation matrix with an identity matrix. An identity matrix has a value of 1 in the diagonal elements, whereas all other elements have a coefficient of 0 (UCLA, 2014). The theory behind this is that when variables are perfectly correlated, they can be summarized in just one component.

Whereas if they are orthogonal, we require an equal number of variables and components. So if variables are orthogonal, therefore uncorrelated with a value close to zero, PCA is not useful (Tanagra, 2013). The null hypothesis in Bartlett's test is therefore that the correlation matrix and identity matrix are equal. For PCA to be efficient the null hypothesis thus needs to be rejected (UCLA, 2014). As 0.000 < 0.05, the null hypothesis is rejected and the use of PCA is still valid.

The Keyser-Meyer-Olkin measure (KMO) has an equal purpose. It also checks whether the initial variables can be efficiently summarized into components. KMO does not just accept that variables are correlated to a certain extent, but also states that correlation might be influenced by other variables. Partial correlations are therefore used to remove the effect of other variables. KMO therefore looks at the values from the between variables correlation and the partial correlation and compares them. The KMO index ranges between 0 and 1, where 0 means the PCA is irrelevant and 1 indicates PCA is efficient (Tanagra, 2013). The suggested minimum value is 0.6 (UCLA, 2014). With a value of 0.634, the KMO index is just sufficient in this model. As both tests passed the minimum standard, the PCA is eligible to be conducted.

5.5. Communalities

Communality refers to the proportion of variance that is explained from each initial variable by the components. PCA assumes the initial variables their total variance is able to be explained through the components. The starting value for these communalities is 1. However, we can assume variables do not just have common variance, they also have specific variance. Therefore the variances are usually lower than 1 (Walde, n.d.). The extraction part in Table 5 indicates how well variables are represented in the components. High values mean a variable is represented well by the components, whereas a low value means the variable is not well represented (UCLA, 2014). The variable 'Not consumers, but corporations and governments are responsible for environment' has the lowest communality in this sample, meaning this variable is less well explained than the other variables. When the number of factors is increased, the communality in all variables increases.

Table 5. *Communalities of original variables.*

	Initial	Extraction
I focus on my own achievements	1,000	,331
If others can benefit from my success, that makes me happy	1,000	,528
I feel isolated from my community / culture / society	1,000	,417
With my actions I can improve the environment	1,000	,627
My friends and/or family use green products	1,000	,445
I feel responsible for the environment	1,000	,654
If I had more money, I would buy more green products	1,000	,589
I am convinced global warming is happening	1,000	,331
Controlling pollution takes more effort than it is worth	1,000	,504
I do not understand why people are so worried about using too much water	1,000	,452
Consumers are the cause of environmental problems	1,000	,478
Not consumers, but corporations and governments are responsible for environment	1,000	,220
I hate to clean my glass bottles before I trash them	1,000	,497
Separating trash into different piles is too much of an effort	1,000	,601
I am happy with how much I recycle and prevent pollution	1,000	,442
It is convenient to recycle	1,000	,520
It is important to recycle	1,000	,478
I recycle my waste	1,000	,547
I refuse to buy products of which I know they are produced in a polluting way	1,000	,493
I check if a product is wrapped in recycled paper before I purchase it	1,000	,614
I have bought green products before	1,000	,501
I search for information on environmental problems	1,000	,683
Knowledge	1,000	,409
What is your gender?	1,000	,435

Extraction Method: Principal Component Analysis.

5.6. Total Variance Explained

The output shown in Table 6 shows the share each extracted component explains of the total variability in the data. As can be seen there are 24 components extracted, which equals the number of variables we originally put in. Again, eigenvalues stand for the contribution each PC has in explaining the total variance. As we calculated before the total variance is 24. This is as each variable is standardized in the correlation matrix, meaning they all have a variance of 1. The 'Total' column lists the eigenvalues attributed to each component. As is inherent to PCA, the first component explains most of the variability, followed by the second PC, and so on. The eigenvalues therefore get smaller each subsequent principal component. The '% of

variance' shows the percentage the corresponding component explains of the total variance in the model. This is equal to the attributed eigenvalue divided by 24. The 'cumulative %' adds up the percentage variance that is explained by the current component plus that of the larger PCs. The right side of Table 6 deals with the 'Extraction Sums of Squared Loadings', these three columns are identical to the left side of the figure. However, only those components with an eigenvalue above 1 are included (UCLA, 2014). This method is referred to as the Guttman-Kaiser criterion. The criterion states components are only retained when their eigenvalue is greater than 1, while those with an eigenvalue below 1 are excluded. The underlying rationale is that the average eigenvalue in the correlation matrix is 1. Components with an eigenvalue above this average thus account for at least the variance represented by an initial single variable (Cangelosi & Goriely, 2007; Koeldiep, 2009).

Table 6. *Total Variance Explained.*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4,465	18,605	18,605	4,465	18,605	18,605	2,662
2	2,294	9,557	28,163	2,294	9,557	28,163	1,908
3	2,132	8,884	37,046	2,132	8,884	37,046	1,747
4	1,569	6,538	43,584	1,569	6,538	43,584	1,609
5	1,333	5,555	49,139	1,333	5,555	49,139	3,036
6	1,318	5,491	54,630	1,318	5,491	54,630	2,369
7	1,260	5,249	59,880	1,260	5,249	59,880	1,385
8	1,092	4,551	64,430	1,092	4,551	64,430	1,764
9	1,048	4,368	68,798	1,048	4,368	68,798	2,091
10	,940	3,916	72,714				
11	,863	3,597	76,311				
12	,764	3,183	79,494				
13	,709	2,953	82,446				
14	,660	2,752	85,198				
15	,598	2,490	87,688				
16	,493	2,054	89,743				
17	,459	1,911	91,654				
18	,389	1,620	93,274				
19	,357	1,486	94,760				
20	,313	1,306	96,066				
21	,296	1,235	97,301				

22	,258	1,074	98,375				
23	,229	,955	99,330				
24	,161	,670	100,000				

Extraction Method: Principal Component Analysis.

Note: When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

If we would use the Guttman-Kaiser criterion, 9 principal components would be retained. However, another criterion that deals with component retention is the Scree Plot method.

5.7. Scree Plot

A helpful technique to retain the optimal number of components in PCA is the scree test. Although the scree graph is easily constructed, the interpretation is considered to be very subjective. Within the graph, the point on the line where the slope changes is called the 'elbow'. This point can be considered to represent the ideal number of components PCA should retain (Cangelosi & Goriely, 2007).

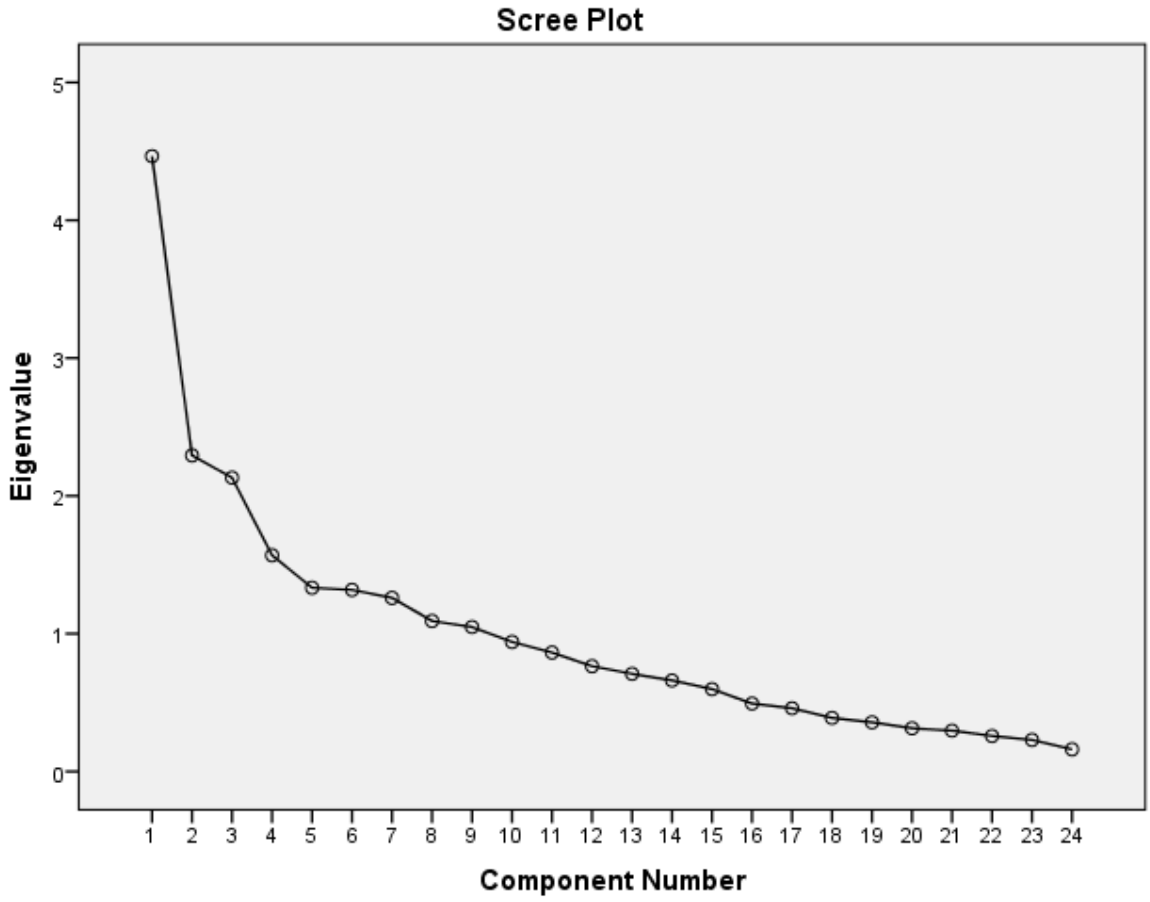

Figure 3. Scree graph.

However, as can be seen in Figure 3, there is more than just one break. In this case the 'elbow' in the scree graph is not clear. In the case where there is more than one break, the scree graph becomes difficult to interpret (Cangelosi & Goriely, 2007).

Although the interpretation of the scree graph in Figure 3 is subjective, we can observe a break after the second and fifth component. Because especially the eigenvalue of the second component is very high, it is chosen to use five principal components.

5.8. Component matrix

The following component matrix in Table 7 displays the component loadings, which is the key output of Principal Component Analysis. These are the correlations between the original variables and the components. The correlations can range between -1 and 1. However, as a rule of thumb, all correlations between -0.3 and 0.3 are removed so that the output is more meaningful and easier to read (UCLA, 2014).

Table 7. *Component Matrix.*

	Component				
	1	2	3	4	5
I feel responsible for the environment	,699		-,388		
I check if a product is wrapped in recycled paper before I purchase it	,658		,312		
I do not understand why people are so worried about using too much water	-,611				
If I had more money, I would buy more green products	,589		-,310		
I have bought green products before	,585		,395		
I refuse to buy products of which I know they are produced in a polluting way	,550		,316		
I recycle my waste	,497	-,388	,335		
Separating trash into different piles is too much of an effort	-,492	,428		,416	
My friends and/or family use green products	,482		,387		
It is important to recycle	,471			-,403	
What is your gender?	-,443	,391			
I search for information on environmental problems	,451	,559	,393		
It is convenient to recycle		-,485			,424
I am convinced global warming is happening	,324	,465			
I feel isolated from my community / culture / society		,456		-,346	
I hate to clean my glass bottles before I trash them		,454			,399
I am happy with how much I recycle and prevent pollution		-,430	,389		
Consumers are the cause of environmental problems			-,531		-,340

Controlling pollution takes more effort than it is worth			,417	,412	
Not consumers, but corporations and governments are responsible for environment			,307		
Knowledge				-,607	
With my actions I can improve the environment	,489			,507	
I focus on my own achievements					,448
If others can benefit from my success, that makes me happy	,381		-,399		,437

Extraction Method: Principal Component Analysis.

Note: 5 components extracted.

The five PCs that were chosen based on the Scree graph are listed and can be summarized based on the original variables which are highly correlated with the component. The interpretation of principal components is based on checking which variables have the strongest correlation with each component.

The first principal component is strongly correlated with 15 of the original variables. PC1 increases when the following variables increase: 'feeling responsible for the environment', 'checking if a product is wrapped in recycled paper', 'buying more products if I had more money', 'having bought green products before', 'refusing to buy polluting products', 'recycling waste', 'family or friends buying green products', 'the importance of recycling', 'believing in global warming', 'searching for information', 'believing your actions are influential' and 'making me happy when others benefit from my success'. Variables for which PC1 increases when they decrease are 'not being worried for using much water', 'believing separating trash is too much effort' and 'gender'. In this case, a decreasing gender means going from 1 (male) to 0 (female). These 15 variables vary together, if a certain variable increases, the others do as well (in absolute terms). The two variables that correlate the strongest with the first principal component have a correlation with PC1 of over +0.6. These are 'feeling responsible for the environment' and 'checking if a product is wrapped in recycled paper'. This means that when consumers indicate they agree more with a statement such as 'I feel responsible for the environment', this has a bigger impact on PC1 than the same increase in agreement with a statement such as 'I search for information on environmental problems'. If we would summarize the variables of PC1, we could say the first component increases when consumer characteristics such as caring for the environment and considering environmental issues before a purchase are increased. Moreover, believing you can make a difference and being well-informed also have a positive projection on this component. On the other hand, when

the score for not caring about using much water and thinking separating trash was too much effort increases, then the principal component decreases. This means there is a negative correlation between these variables and all the others. The first component therefore separates consumers in valuing environmental issues enough to behave in an environmentally friendly way, and by consumers thinking that takes too much effort. This component can thus be described by consumers "Caring" about environmental problems.

The second principal component, PC2, includes 9 variables that vary together. The following variables have a positive projection on the second principal component: 'being convinced global warming is happening', 'feeling isolated from my community', 'searching for information on environmental problems', 'hating to clean bottles before thrashing them', 'thinking it takes too much effort to separate trash' and 'gender'. In this case, the component increases when gender 'increases', meaning from 0 (female) to 1 (male). Variables that negatively project onto the component are 'being happy about how much I recycle and prevent pollution', 'recycling' and 'thinking it is convenient to recycle'. We could thus say this component increases when consumers become more individualistic, believe more in global warming and feel less like they should devote their time to recycling related activities. On the other hand, the component decreases when consumers increasingly recycle, believe it is convenient to recycle or when they become happier with how much they recycle. The second component therefore describes whether we believe in global warming and want to stop it, or lack the motivation and worsen the problem. The key word that summarizes this component is thus "Motivation".

Principal Component 3 includes 13 variables that vary together. Variables that positively affect PC3 are 'checking if a product is wrapped in recycled paper', 'having bought green products before', 'refusing to buy polluting products', 'feeling responsible for the environment', 'family or friends buying green products', 'recycling', 'searching for information on environmental problems', 'believing corporations and governments are responsible for environmental problems' and 'thinking controlling pollution takes too much effort'. Variables that negatively project on the third principal component are 'feeling happy when others can benefit from my success', 'buying more green products when having more money', 'thinking consumers are the cause of environmental problems' and 'feeling responsible for the environment'. The strongest variable in this component is 'Consumers are the cause of environmental problems'

with a value of -0.531. Therefore, variables that positively project on PC3 are about consumers being familiar with green products and are environmentally conscious. Variables that negatively project on PC3 deal with the responsibility issue, where believing more strongly that consumers are responsible for environmental issues decreases the component. Moreover, the individualistic consumer value is apparent in the third component. An increasingly 'being happy when others benefit from my success' negatively projects on the component. Thus, the result of this loading is that feeling increasingly individualistic makes an individual less environmentally conscious. Therefore, the third component describes consumers through being collectivistic and being familiar with green consumption, or through being individualistic and not believing consumers are the cause of environmental problems. This component thus deals with the "Responsibility" consumers feel for the environment.

The fourth component only includes 6 variables that vary together. Variables that positively project on PC4 are 'separating trash is too much effort', 'my actions can improve the environment' and 'controlling pollution takes more effort than it is worth'. Variables that decrease the principal component by increasing are 'feeling isolated from my community', 'thinking recycling is important' and 'knowledge'. Knowledge has the strongest negative value of -0.607. The fourth component thus separates consumers as believing they can make a change but not wanting to put any effort in it which results in little recycling, and those which have more knowledge and that diminish those thoughts. This component can therefore be summarized by the "Effort" of consumers.

The fifth and last principal component includes 5 variables that vary together. The variables that positively project on this component are 'thinking it is convenient to recycle', 'hating to clean glass bottles before trashing them', 'focusing on own achievements' and 'being happy when others can benefit from my success'. The only variable that negatively projects onto PC5 is 'believing consumers are the cause of environmental problems'. Thus, stating a lower agreement on that statement increases the component. The four positive variables are contradictory to each other. The first contradiction is thinking it is convenient to recycle but still hating to clean glass bottles before trashing them. As convenience has a higher value than cleaning a glass bottle (0.424 versus 0.399), convenience increases slightly more with the component. However, as cleaning glass bottles is only a small part of recycling, this is not a strong contradiction. In general, recycling will be considered as convenient, although they

hate to clean glass bottles. The second contradiction is to focus on your own achievements, but still be happy when others can benefit from you. Here the statement about focusing on your own achievements has a slightly higher value, with 0.448 versus 0.437 of being happy when others benefit. It seems the individualistic value of focusing on one's own goals, comes with a benevolent value of having a desire to do good. We can thus separate consumers in this component as not believing consumers are responsible for environmental problems, but recycle as they think it is convenient, perhaps driven by their individualistic but kind personality. And by consumers that believe consumers are the cause for environmental problems, but think recycling is inconvenient and perhaps through their lack of kindness do not want to contribute. This component can thus be summarized by the word "Social".

5.9. Regression

In this section, the principal components which were extracted through the PCA are transformed to independent variables and regressed on the dependent variable WTP percentage premium.

Table 8. *Regression output coefficient.*

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	31,981	2,202		14,525	,000
Principal Component 1 – Caring	3,758	2,245	,177	1,674	,098
Principal Component 2 – Motivation	-1,110	2,228	-,052	-,498	,620
Principal Component 3 – Responsibility	-1,579	2,251	-,074	-,701	,485
Principal Component 4 – Effort	-1,934	2,231	-,091	-,867	,389
Principal Component 5 – Social	6,779	2,292	,319	2,957	,004

Note. Dependent Variable: WTP percentage premium

The regression output in Table 8 shows component 1 "Caring" and component 5 "Social" to be significant on the 10% and 1% level with respectively 0.098<0.10 and 0.004<0.01. To recap, the first component separated consumers in valuing environmental issues enough to behave in an environmentally friendly way, and by consumers thinking that takes too much effort. The fifth component separated consumers based on believing consumers are not the cause of environmental problems, but recycle based on them judging it to be convenient, perhaps

driven by their individualistic but kind personality. And the contrary of believing they are responsible for environmental problems, but regarding recycling to be inconvenient and therefore not do it. This could be because they are not benevolent.

Both newly created latent variables have a positive standardized beta coefficient. PC1 has a beta of 0.177, whereas PC5 has a beta of 0.319. This means both components have a positive effect on the willingness to pay for environmentally friendly products. However, the principal component 'Social' has a stronger impact on the willingness to pay for a green product.

6. DISCUSSION AND LIMITATIONS

6.1. Discussion

This research paper investigated which consumer segments would be most receptive to green marketing practices. At an early stage, I discovered flaws in previous research in this field. Other researchers had (in my opinion) chosen for methodologies that were easy to implement but took a toll on the reliability of their data. Moreover, I thought their results were often meaningless – more variables than I could ever think of were found to be of significant influence on green consumption. Moreover, it was never clear how these variables related to one another. In this paper, I have tried to find the most relevant and often researched variables which made theoretical sense to me. Thereafter, with the help of the Principal Component Analysis I grouped them to make sense of how variables interacted with each other.

In my personal opinion, global warming is the biggest challenge of our time. Unfortunately, I came to realize that although many consumers state or reveal they are willing to pay a considerable premium for green products, the reality is different. The market share of green consumption is only a small 1 to 3% of the total market. The main reason seems to be price. Budget constraints play a large role in restraining consumers to buy environmentally friendly products. In a Qualtrics survey questions where respondents had to rank what characteristics they found most important in a product, this was exemplified.

Table 9. *Respondent ranking of product characteristics.*

Field	1		2		3		4		Total
Price	26.44%	23	49.43%	43	20.69%	18	3.45%	3	87
Availability	8.05%	7	8.05%	7	29.89%	26	54.02%	47	87
Environmentally friendliness	2.30%	2	13.79%	12	43.68%	38	40.23%	35	87
Quality	63.22%	55	28.74%	25	5.75%	5	2.30%	2	87

Respondents only very rarely stated that 'Environmental friendliness' was on the top of their list when making a purchase decision. As can be seen in Table 9, over 80% of the respondents placed it on the third or fourth spot, making environmental friendliness only of marginal influence. Respondents stated to give the most attention to the price and quality of products.

For firms to make an investment in different production forms and deliver greener products, the statistics are contradictive. At this moment, it does not seem like a gold mine for companies to invest in green production. The motivation in this paper from a Behavioural Economics perspective was also to find out whether there was a possibility certain consumers could be nudged into buying green goods. This came from a motivation to contribute to this issue. The case is that although most consumers have a positive view about green products, there is a huge attitude-behaviour gap. This gap can be closed by two scenarios: first, the price of green products decreases substantially. Or two, carbon taxes are implemented to close the price gap between standard products and green products. Results suggest that when prices are equal between the two product types, consumers will massively prefer green products. However, until this happens, it seems that the market for green products has the same perspective as the environment: a sad future where what is being done is only a dent in a (decreasing) ice berg.

6.2. Limitations

Although previous research was ought to be improved, this research was still far from perfect. The first problem arose with the collection of variables that explained the willingness to pay for green products. Because of the large number of explanatory variables, a selection of variables had to be made. This was done because including more variables in the survey would

ask for an even bigger time investment of the subjects. Test runs of the survey already led to participants complaining it took them too long to complete, with an average time of 10 minutes per survey. Future research could be more comprehensive, with a larger incentive for participants.

Regarding the research methodology, although I believe my approach is better than the standard direct survey stated preference methods, it is still not ideal. The average percentage premium that was revealed in this research was 31.98%, which is significantly higher than most other studies found. Although incentives were needed in this form of the BDM, it might have skewed willingness to pay upward. BDM procedures usually start by having the subject 'play' with their own money. Now they were asked to imagine they were given money before the procedure. Moreover, in real life situations it is easier to check whether participants understand the consequences of their choices by asking some follow up questions. A small pre-test of the BDM procedure pointed out the BDM used in this paper was understood well, however, we cannot be sure all participants did.

The next, often occurring limitation in student research was the relatively small sample size. Principal Component Analysis is typically conducted with an observations to variable ratio of at least 5 to 1, with a bare minimum of 3 to 1. The rule of thumb for the minimum number of subjects is said to be 100. To give the PCA extra power, a lower amount of variables was included than imagined. Although the rule of thumb for 100 participants was not met, this caused the observation to variable ratio to be stronger, raising the KMO index.

Moreover, the Principal Component Analysis is characterized as an exploratory tool. Therefore, it is not suitable to test hypotheses. In the literature review, many finding were not conclusive. It would therefore be interesting to test these inconclusive independent variables with the method used in this paper. Further research could take a different approach and obtain additional findings.

7. CONCLUSION

In this research paper, I tried to answer the question "Which consumer groups are most willing to purchase environmentally friendly products?" by reviewing the characteristics that defined the green consumer. Through the large extent of variables that influenced the variation in

WTP of consumers, it was chosen to perform a Principal Component Analysis. The data that was gathered to perform this test consisted of an adjusted Becker-DeGroot-Marschak mechanism which should reveal the WTP for a green package of toilet paper and thereby characterize relatively environmentally friendly and unfriendly consumers.

Through the PCA, five consumer groups were identified. The first component "Caring" separated consumers in valuing environmental issues enough to behave in an environmentally friendly way, and by consumers thinking that takes too much effort. The second component "Motivation" described whether consumers believe in global warming and want to stop it, or lack the motivation and worsen the problem. The third component "Responsibility" described consumers through being collectivistic and being familiar with green consumption, or through being individualistic and not believing consumers are the cause of environmental problems. The fourth and component "Effort" then separated consumers as believing they can make a change but not wanting to put any effort in it which results in little recycling, and those which have more knowledge and that diminish those thoughts. The fifth and last component "Social" dealt with consumers not believing they were the cause of environmental problems but recycling out of convenience, which could be driven by their individualistic but kind personality, and consumers that were the opposite and do believe consumers are the cause of environmental problems but consider recycling to be inconvenient.

Together, these five components explained 49% of the total variance in this sample. However, only caring for the environment and being social were found to positively impact the WTP for a green product. For marketing managers, it would thus be recommended to approach consumers in such a way to increase their feeling of behaving socially and caring up to their maximum potential. This should have the largest impact on the willingness to pay of consumers for green products. The level of motivation, responsibility and effort consumers are willing to invest in green behaviour on the other hand did not predict the willingness to pay for a green product. A possible explanation for the non-significant predictors could be that although consumers are willing to pay extra for a green product, they do not want to put in their time or effort into cleaning bottles or recycling. Another explanation could be that those that do recycle, might feel that through that effort they are less 'obligated' to buy green goods. It could well be that there is a certain crowing out effect between these two behaviours.

I started this paper with a story about *Silent Spring,* where Rachel Carson made people aware of their environmentally damaging behaviour in 1962. My initial thought was that roughly 60 years later, not much had changed. And where consumers in 1962 could kind of justify their behaviour as they were not aware of what they caused, in the current situation consumer behaviour is inexcusable. In that light, the results from the Principal Component Analysis give hope. The fifth component "Social" revealed that consumers that become more individualistic, become more environmentally conscious and are willing to spend a higher premium for green goods. In an increasingly individualistic world, this finding could be a big step towards a more sustainable future.

8. REFERENCES

All Recycling Facts. (2016). Eco-Friendly Products. Retrieved September 20, 2016 from http://www.all-recycling-facts.com/eco-friendly-products.html

Amyx, D. A., De Jong, P. F., Lin, X., Chakraborty, G., & Wiener, J. L. (1994). Influencers of purchase intentions for ecologically safe products: an exploratory study. In *Marketing theory and applications, proceedings on the 1994 AMA Winter Educators Conference* (pp. 341-347).

Anderson Jr, W. T., & Cunningham, W. H. (1972). The socially conscious consumer. *The Journal of Marketing*, 23-31.

Atchley. (n.d.). Introduction to Principal Components and Factor Analysis. Retrieved October 22, 2016 from ftp://statgen.ncsu.edu/pub/thorne/molevoclass/AtchleyOct19.pdf

Balderjahn, I. (1988). Personality variables and environmental attitudes as predictors of ecologically responsible consumption patterns. *Journal of business Research*, *17*(1), 51-56.

Banerjee, B., & McKeage, K. (1994). How green is my value: exploring the relationship between environmentalism and materialism. *NA-Advances in Consumer Research Volume 21*.

Bang, H. K., Ellinger, A. E., Hadjimarcou, J., & Traichal, P. A. (2000). Consumer concern, knowledge, belief, and attitude toward renewable energy: An application of the reasoned action theory. *Psychology & Marketing*, *17*(6), 449-468.

Bennett, J., & Blamey, R. (Eds.). (2001). *The choice modelling approach to environmental valuation*. Edward Elgar Publishing.

Berkowitz, L., & Lutterman, K. G. (1968). The traditional socially responsible personality. *Public Opinion Quarterly*, *32*(2), 169-185.

Bohlen, G., Schlegelmilch, B. B., & Diamantopoulos, A. (1993). Measuring ecological concern: a multi-construct perspective. *Journal of Marketing Management*, *9*(4), 415-430.

Bray, J., Johns, N., & Kilburn, D. (2011). An exploratory study into the factors impeding ethical consumption. *Journal of business ethics*, *98*(4), 597-608.

Breidert, C., Hahsler, M., & Reutterer, T. (2006). A review of methods for measuring willingness-to-pay. *Innovative Marketing*, *2*(4), 8-32.

Brown, T. C., Champ, P. A., Bishop, R. C., and McCollum, D. W. (1996). Which Cangelosi, R., & Goriely, A. (2007). Component retention in principal component analysis with application to cDNA microarray data. *Biology direct*, *2*(1), 1.

Carson, R. (1962). Silent Spring. Greenwich, Connecticut.

Chan, K. (2000). Market segmentation of green consumers in Hong Kong.*Journal of International Consumer Marketing*, *12*(2), 7-24.

Chan, R. Y. (2001). Determinants of Chinese consumers' green purchase behavior. *Psychology & Marketing*, *18*(4), 389-413.

Coyle, K. (2005). Environmental literacy in America: What ten years of NEETF/Roper research and related studies say about environmental literacy in the US. *National Environmental Education & Training Foundation*.

Davies, T., & Fearn, T. (2004). Back to basics: the principles of principal component analysis. *Spectroscopy Europe*, *16*(6), 20.

De Mars, A. (n.d.). Multicollinearity statistics with SPSS. Retrieved November 12, 2016 from http://www.thejuliagroup.com/blog/?p=1405

Dickenson, M. (2011). Stated vs Revealed Preferences: Health Care Edition. Retrieved October 15, 2016 from http://mattdickenson.com/2011/04/25/stated-vs-revealed-preferences-health-care-edition/

Elliott, W. B., Jackson, K. E., Peecher, M. E., & White, B. J. (2012). Mitigating the unintended effect of corporate social responsibility performance on investors' estimates of fundamental value. *Accounting Review, Forthcoming*.

Experimental Economics Center. (2006). Valuation Techniques: Revealed Preference. Retrieved October 15, 2016 from http://www.econport.org/content/handbook/Environmental/Valuation/Valuation-Models-Stated-Preference/Revealed-Preference.html

Fisman, R. & Sullivan, T. (2016). Johann Wolfgang von Goethe, Amateur Auction Theorist. Retrieved October 10, 2016 from http://www.themillions.com/2016/05/johann-wolfgang-von-goethe-amateur-auction-theorist.html

Getzner, M., & Grabner-Kräuter, S. (2004). Consumer preferences and marketing strategies for "green shares" Specifics of the Austrian market.*International Journal of Bank Marketing*, *22*(4), 260-278.

Grunert, S. C., & Juhl, H. J. (1995). Values, environmental attitudes, and buying of organic foods. *Journal of economic psychology*, *16*(1), 39-62.

Iyer, E. (1994). Book reviews-Environmental Marketing: Positive Strategies .*Journal of Marketing*, *58*(2), 127.

Joshi, Y., & Rahman, Z. (2015). Factors affecting green purchase behaviour and future research directions. *International Strategic Management Review*, *3*(1), 128-143.

Kagel, J. H., Harstad, R. M., and Levin, D. (1987). Information Impact and Allocation Rules in Auctions with Affiliated Private Values: A Laboratory Study. Econometrica, 55(6).

Kelley, E. J. (1971). Marketing's Changing Social/Environmental Role. Journal of Marketing, Vol. 35.

Kinnear, T. C., Taylor, J. R., & Ahmed, S. A. (1974). Ecologically concerned consumers: who are they?. *The Journal of Marketing*, 20-24.

Klein, P. (2012). Moving Beyond CSR: The Business of Social Change. Retrieved October 30, 2016 from http://www.forbes.com/sites/csr/2012/11/12/moving-beyond-csr-the-business-of-social-change/#544d668d3f43

Koeldiep, V. B. (2009). *Financial Liberalization and Portfolio Diversification: The Case of Latin America and South-east Asia* (Doctoral dissertation, Erasmus Universiteit).

Kroes, E. P. Sheldon (1988) Stated preference methods—An introduction. *Journal of Transport Economics and Policy*, 11-25.Experimental Economics Center, 2006

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of consumer marketing*, *18*(6), 503-520.

Lorenzo-Seva, U. (2013). How to report the percentage of explained common variance in exploratory factor analysis. *Available ftp: http://psico.fcep.urv*.

Lund Research. (2013). Principal Component Analysis (PCA) using SPSS Statistics. Retrieved October 10, 2016 from https://statistics.laerd.com/spss-tutorials/principal-components-analysis-pca-using-spss-statistics.php

MacDonald, W. L., & Hara, N. (1994). Gender differences in environmental concern among college students. *Sex Roles*, *31*(5-6), 369-374.

Marbeau, Y. (1987). What value pricing research today. *Journal of the Market Research Society*, *29*(2), 153-182.

McCarty, J. A., & Shrum, L. J. (1994). The recycling of solid wastes: Personal values, value orientations, and attitudes about recycling as antecedents of recycling behavior. *Journal of Business Research*, *30*(1), 53-62.

Mohr, L. A., Webb, D. J., & Harris, K. E. (2001). Do consumers expect companies to be socially responsible? The impact of corporate social responsibility on buying behavior. *Journal of Consumer affairs*, *35*(1), 45-72.

Myburgh-Louw, J. & O'Shaughnessy, N.J. (1994). Consumer perception of misleading and deceptive claims on the packaging of `green' fast moving consumer goods. AMA Summer Educators' Conference Proceedings, American Marketing Association, Chicago, IL, Vol. 5, pp. 344-53. Nielsen, 2015.

Nagle, T. T. and Holden, R. K. (2002). *The Strategy and Tactics of Pricing*. Prentice
Nessim, H., & Dodge, R. (1995). Pricing: policies and procedures.

Nielsen. (2015). Doing Well By Doing Good. Retrieved October 2, 2016 from http://www.nielsen.com/us/en/insights/reports/2014/doing-well-by-doing-good.html

Orr, D. W. (1992). *Ecological literacy: Education and the transition to a postmodern world*. Suny Press.

Ottman, J. (2011). *The new rules of green marketing: Strategies, tools, and inspiration for sustainable branding*. Berrett-Koehler Publishers.

Point of Purchase. Journal of Marketing Research, 39(2).

Ramayah, T., Lee, J. W. C., & Mohamad, O. (2010). Green product purchase intention: Some insights from a developing country. *Resources, Conservation and Recycling*, *54*(12), 1419-1427.

Response Format Reveals the Truth About Donations to a Public Good. Land Economics,
Roberts, J. A. (1996). Green consumers in the 1990s: profile and implications for advertising. *Journal of business research*, *36*(3), 217-231.

Samdahl, D. M., & Robertson, R. (1989). Social determinants of environmental concern specification and test of the model. *Environment and behavior*, *21*(1), 57-81.

Schlegelmilch, B. B., Bohlen, G. M., & Diamantopoulos, A. (1996). The link between green purchasing decisions and measures of environmental consciousness. *European journal of marketing*, *30*(5), 35-55.

Schwepker Jr, C. H., & Cornwell, T. B. (1991). An examination of ecologically concerned consumers and their intention to purchase ecologically packaged products. *Journal of Public Policy & Marketing*, 77-101.

Stoetzel, J. (1954). In P. L. Reynaud (Ed.), La Psychologie Economique, chapter “Le Prix Comme Limite”. Paris: P. L. Reynaud.

Straughan, R. D., & Roberts, J. A. (1999). Environmental segmentation alternatives: a look at green consumer behavior in the new millennium. *Journal of consumer marketing*, *16*(6), 558-575.

Tanagra. (2013). [KMO index and Bartlett’s sphericity test]. Retrieved October 28, 2016 from http://eric.univ-lyon2.fr/~ricco/tanagra/fichiers/en_Tanagra_KMO_Bartlett.pdf

Telegraph. (2009). Green goods cost nearly 50% more. Retrieved October 23, 2016 from http://www.telegraph.co.uk/news/earth/earthnews/7785705/Green-goods-cost-nearly-50-more.html

Toilet Paper World. (2016). Toilet Paper and the Environment. Retrieved November 10, 2016 from http://encyclopedia.toiletpaperworld.com/toilet-paper-history/toilet-paper-and-the-environment

Triandis, H. C. (1993). Collectivism and individualism as cultural syndromes.*Cross-cultural research*, *27*(3-4), 155-180.

Tully, S. M., & Winer, R. S. (2014). The role of the beneficiary in willingness to pay for socially responsible products: a meta-analysis. *Journal of Retailing*,*90*(2), 255-274.

UCLA. (2014). Annotated SPSS Output: Principal Components Analysis. Institute for Digital Research and Education. Retrieved from http://statistics.ats.ucla.edu/stat/spss/output/principal_components.htm

Vermeir, I., & Verbeke, W. (2008). Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values. *Ecological economics*, *64*(3), 542-553.

Vining, J., & Ebreo, A. (1990). What makes a recycler? A comparison of recyclers and nonrecyclers. *Environment and behavior*, *22*(1), 55-73.

Walde, J. (n.d.). Principal Component Analysis (PCA). University of Innsbruck: Department of Statistics. Retrieved October 25 from https://www.uibk.ac.at/statistics/personal/janettewalde/lehre/phd_biology/ss2011/principal_component_analysis.pdf

Wertenbroch, K. & Skiera, B. (2002). Measuring Consumers' Willingness to Pay at the

Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable consumption: green consumer behaviour when purchasing products. *Sustainable development*, *18*(1), 20-31.

APPENDIX A – INSTRUCTIONS

Standard products harm the environment in their production, use and disposal. Green products use materials that are safer to the environment, can be recycled and use less packaging. Therefore, consumer decisions have a direct impact on the environment.

- Imagine I give you €8. Two products are presented to you: a standard pack of toilet paper (worth €4) and a green alternative. Both products are identical in quality.
- I would like to sell you a package of green toilet paper, but the price is not fixed yet. It will be determined by chance in a game we are about to play.
- First, I will ask you to reveal the maximum price you are willing to pay for the green toilet paper.
- Secondly, I will draw a random number between 4 and 8, that number will represent the price for the green toilet paper.
- If the random number is less than or equal to your bid, you will buy the green pack of toilet paper and you will pay the price of the random number.
- If the random number I draw is greater than your bid, then you cannot buy the green toilet paper and instead you will buy the standard toilet paper for €4.
- You get to keep the amount of money you do not spend on the product.

Even if you do not understand the mechanism completely, it is important to know it is in your best interest to state your true willingness to pay for the green product.

- Please state the price you are willing to pay now.

APPENDIX B – SURVEY

What is your gender?

- ❍ Male
- ❍ Female

How old are you?

What is your nationality?

What is the highest educational degree you have received?

- ❍ Less than high school degree
- ❍ High school graduate
- ❍ MBO
- ❍ HBO
- ❍ University Bachelor
- ❍ Master's degree
- ❍ Doctoral degree
- ❍ Professional degree (JD, MD)

What is your monthly budget?

- ❍ € 0 - 500
- ❍ € 500 - 1000
- ❍ € 1000 - 1500
- ❍ € 1500 - 2000
- ❍ € 2000 - 2500
- ❍ € 2500+

	Extremely bad	Moderately bad	Slightly bad	Neither good nor bad	Slightly good	Moderately good	Extremely good
How do you consider your financial situation?	❍	❍	❍	❍	❍	❍	❍

Do you buy your own groceries?

- ❍ Yes
- ❍ No

Please indicate to what extent these statements apply to you

	Does not describe me	Describes me slightly well	Describes me moderately well	Describes me very well	Describes me extremely well
I focus on my own achievements	❍	❍	❍	❍	❍
If others can benefit from my success, that makes me happy	❍	❍	❍	❍	❍
I feel isolated from my community / culture / society	❍	❍	❍	❍	❍

What is the furthest distance you are willing to travel to go to a recycle bin?

- ❍ Less than 50 meter
- ❍ 50 - 100 meter
- ❍ 100 - 200 meter
- ❍ 200+ meter

Which of the following product characteristics are most important to you? Please rank the following characteristics by dragging them up or down.

_____ Price
_____ Availability
_____ Environmentally friendliness
_____ Quality

Please indicate to what extent you agree with the following statements

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I hate to clean my glass bottles before I trash them	❍	❍	❍	❍	❍	❍	❍
I am happy with how much I recycle and prevent pollution	❍	❍	❍	❍	❍	❍	❍
I feel responsible for the environment	❍	❍	❍	❍	❍	❍	❍
If I had more money, I would buy more green products	❍	❍	❍	❍	❍	❍	❍
With my actions I can improve the environment	❍	❍	❍	❍	❍	❍	❍

Please indicate to what extent you agree with the following statements

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I am convinced global warming is happening	❍	❍	❍	❍	❍	❍	❍
Controlling pollution takes more effort than it is worth	❍	❍	❍	❍	❍	❍	❍
I do not understand why people are so worried about using too much water	❍	❍	❍	❍	❍	❍	❍
Consumers are the cause of environmental problems	❍	❍	❍	❍	❍	❍	❍
Not consumers, but corporations and governments are responsible for environmental problems and must solve it	❍	❍	❍	❍	❍	❍	❍
Separating trash into different piles is too much of an effort	❍	❍	❍	❍	❍	❍	❍

Please indicate to what extent you agree with the statement

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I recycle my waste	❍	❍	❍	❍	❍	❍	❍
It is convenient to recycle	❍	❍	❍	❍	❍	❍	❍
It is important to recycle	❍	❍	❍	❍	❍	❍	❍

Please indicate to what extent you agree to the following statements

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I act in an environmentally friendly way	❍	❍	❍	❍	❍	❍	❍
It is important to act in an environmentally friendly way	❍	❍	❍	❍	❍	❍	❍
It is convenient to act in an environmentally friendly way	❍	❍	❍	❍	❍	❍	❍

Please indicate to what extent the statement describes you

	Does not describe me	Describes me slightly well	Describes me moderately well	Describes me very well	Describes me extremely well
I check if a product is wrapped in recycled paper before I purchase it	❍	❍	❍	❍	❍
I refuse to buy products of which I know they are produced in a polluting way	❍	❍	❍	❍	❍

Please indicate how much these statements apply to you

	None at all	A little	A moderate amount	A lot	A great deal
My friends and/or family use green products	❍	❍	❍	❍	❍
I have bought green products before	❍	❍	❍	❍	❍
I search for information on environmental problems	❍	❍	❍	❍	❍

Which of the following is a renewable resource?

- ❍ Oil
- ❍ Iron ore
- ❍ Trees
- ❍ Coal
- ❍ Don't know

What is the most common reason that an animal species becomes extinct?

- ❍ Pesticides
- ❍ Hunting
- ❍ Habitat destroyed by humans
- ❍ Climate change
- ❍ Don't know

Which of the following household wastes is considered to be hazardous?

- ❍ Plastic packaging
- ❍ Glass
- ❍ Batteries
- ❍ Spoiled food
- ❍ Don't know

Where does most of the garbage in the world end up?

- ❍ Burned
- ❍ Recycled
- ❍ Dump
- ❍ Landfills
- ❍ Don't know

Globally, what is the most common cause of pollution in streams, rivers and oceans?

- ❍ Garbage dumping of cities
- ❍ Surface water running off yards, city streets, paved lots, and farm fields
- ❍ Trash washed into the water from beaches
- ❍ Waste dumped by factories
- ❍ Don't know

Ozone forms a protective layer on the Earth's upper atmosphere. What does ozone protect us from?

- ❍ Acid rain
- ❍ Global warming
- ❍ Sudden changes in temperature
- ❍ Harmful, cancer-causing sunlight
- ❍ Don't know

What is the biggest human contribution to climate change?

- Power production
- Meat and dairy production
- Heating and cooling in buildings
- Deforestation
- Don't know

Which of the following would have the biggest impact on reducing carbon emissions?

- Growing our own vegetables
- Stopping deforestation
- Taking all fossil-fuel burning vehicles off the road
- Shutting down all fossil fuel power plants
- Don't know

How much of the world's water is available for human use?

- 97%
- 23%
- 3%
- Less than 1%
- Don't know

Thank you for participating in this survey. If you want to have the chance to win the product plus the (remainder) of the 8 euro, please leave your email address below. Your email address and answers are not linked to each other. I will choose one email address at random, which will receive the product.