Attitudes and Pro-environmental Consumption Behaviour:

An Application of a Choice Experiment in the Netherlands

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This document represents part of the author's study programme while at the Institute of Social Studies. The views stated therein are those of the author and not necessarily those of the Institute.

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List of Acronyms

CE	Choice experiment
CM	Choice modelling
FAO	Food and Agriculture Organization
GHS	Green House Gas
ISS	Institute of Social Studies
IIA	Independence of Irreverent Alternatives
IID	Independently Identically Distributed
ITC	International Trade Center
MRS	Marginal Rate of Substitution
OECD	Organization for Economic Co-operation and Development
PEB	Pro-Environment behaviour
RP	Revealed Preferences
SP	Stated Preferences
UN	United Nations

Abstract

In this research we examine whether individuals consider environmental issues in their consumption behavior and also identify characteristics which shape pro-environmental behavior in the three areas of food consumption, recycling, and transportation.

We bring microeconomic consumer theory together with a wide range of characteristics and attitudes identified in socio-psychological texts including: general characteristics (e.g. sex, age), environmental knowledge/attitudes, social attitudes/norms, personal traits, political affiliations, and religious beliefs. In order to elicit consumers' preferences we utilized choice experiment methodology to observe consumers' behavior. We applied three choice experiments in the three areas of food consumption, recycling, and transportation choice through a web-based survey of a well-educated population, that is, one more likely to be informed about climate change.

Our results show that individuals do not consider the pollution generated by food production when they decide between organic and non-organic food. However, they do consider the environmental impact when they make decision regarding recycling (vs. not-recycling), and for transportation choice. Moreover, the determining factors of pro-environmental behavior are not only general characteristics, but also environmental, social and political attitudes.

Relevance to Development Studies

Sustainable development is introduced and defined by Brundtland World Commission on Environment and Development in 1987 as "development that meets the needs of the present, without compromising the ability of future generations to meet their own needs." (Cited by Marrewijk 2003) Greenhouse gas emissions which could lead to climate change might be a threat for sustainable development. Household consumption has a considerable weight in GHS emission. While consumers' choices can influence pollution level, studies on pro-environment consumption behaviour could suggest ways to make sustainable development accessible.

In this research, we focus on personal motivation aspect of pro-environment consumption behaviour. Identification of characteristics that shape pro-environment consumption, bring new insights to policy design for environment.

Keywords

Climate change, pro-environment consumption behaviour, personal motivations, attitudes, choice experiment, organic food, recycling, transportation

Chapter 1 :
Introduction

There is considerable consensus among scientists that global warming[1] may be attributed to the greenhouse effect which is the process of absorption and emission of gases[2] in the atmosphere which tends to warm a planet's lower atmosphere and surface (Lindzen 1997: 8335). While warming is global, climate change is local and involves other factors such as an increase of the sea level, changes in the amount and pattern of precipitation and extreme weather events ('What is the difference between global warming and climate change' 2009). The United Nations Framework Convention on Climate Change (UNFCCC) (1992) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".

Typically, studies on climate change focus at country level and deal with issues such as trends in pollution, growth and the level of development and end by displaying that in advanced countries emissions level are high and in developing countries it is lower with a high speed of increase (Adaman et al 2011:689). Another approach to the subject could be a micro level investigation by observing how households change their consumption behaviour due to environmental concerns. Since individuals are the final consumer of goods and services, their preferences shape the demand for pollution, eventually. The level and pattern of consumption influences the pressure from households on the environment. Furthermore based on a life cycle perspective, production eventually supplies for consumption. Hence, all emissions and resource use during production are assigned to final consumption. The resource and emission intensity of consumption depends on the methods engaged to produce the goods and services (UNEP 2010: 49). Hertwich and Peters (cited in UNEP 2010:48) using a global multiregional input-output model find that at the global level, 72% of greenhouse gas emissions are caused by household consumption, 10% due to government consumption and 18% due to investment (e.g. construction of a buildings) Figure (1.1) demonstrates the contribution of final demand categories by region. In the figure, direct household refers to emission from the household (e.g. heating, cooking, and car use), indirect emissions are caused in the life cycle of products (e.g. electricity which is used for production of a home appliance)

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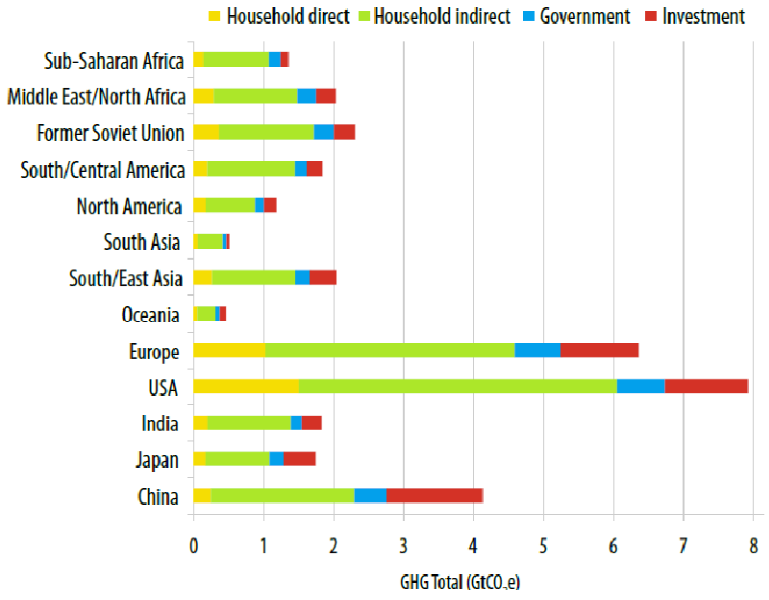
[1] - Global warming is the increase of the earth atmosphere temperature. The average temperature of the Earth's surface raised by about 0.8°C over the past century, with about 0.6°C (two-third) of this warming occurring over just the past three decades (after 1980).(National academies press 2011:15)

[2] - Among greenhouse gases Co2 attract more attention of scientists due to its interaction chemically buffered carbonate system in seawater and also its vital role in photosynthesis and vegetation. (Keeling 1997:8273) Greenhouse gases trap more and more of the Sun's energy and drive the average temperature of Earth upward.

Figure 1.1
Greenhouse gas emissions arising from household consumption, government consumption and investment in different world regions



Source: UNEP 2010:48

Based on another classification, Huppes et al. (cited in UNEP 2010:53) studied the relative contribution of different areas of consumption related to global warming. Most important factors are food, beverage and tobacco (31%), housing, furniture, equipments, utility use (24%) and transport with a 19% share. Moreover, food production has significant influence on water resources, land use and emission of greenhouse gasses. Chemical fertilizers, pesticides and livestock waste are causes of CH4 and N2O emission (UNEP 2010:78).

Understanding the importance of household consumption in greenhouse gases emission and consequently climate change led to the introduction of terms such as 'sustainable', 'green', 'ecological' or 'pro-environment' consumption behaviour, which are in some ways similarly conceived. The Oslo Symposium on Sustainable Consumption (1994) defined such terms as:

'The use of services and related products which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life-cycle of the service or product so as not to jeopardise the needs of future generations'. (Cited by Seyfang 2006: 384)

While consumption behaviour is mostly discussed in the economics literature, it is an interdisciplinary issue with social and psychological aspects. In other words, price and income are not the only factors determining consumption behaviour and there are other sources of heterogeneity among consumers and their consumption behaviour. . Source of heterogeneity among consumers may be due to taste but also due to a wide range of socio-psychological issues include values, consciousness, norms and emotions which may determine individuals' choice. These factors may sometimes overcome market signals while a consumer prefers a product with a 'fair trade' sign to a similar product with lower price for moral issues, as well as, when an informed person prefers to recycle even when she has to pay for it for the sake of environment.

The first objective of this research is to investigate whether individuals consider environmental issues in their consumption behaviour. We will try to identify a wide range of variables that maybe important in determining the choices, including personal characteristics, environmental info/attitudes, social norms and personal values and political affiliation. Since consumers might behave differently with regard to different items of consumption[1]., this paper will focus on three areas, namely, consumption choices with regard to transportation, food (as mentioned above, transportation and food consumption constitute 50% of total emissions) and recycling. The second aim is to identify factors that shape demand for environmentally friendly goods/services (organic food, bike and tram, recycling). We apply three choice experiments based on a web-administered questionnaire in order to elicit individuals' choices toward environment. The data for the research is based on a sample of relatively well-educated individuals who are likely to be more knowledgeable about the environment. This also allows us to observe if knowledge translates into environmentally friendly behaviour. This paper is original in the sense that it brings socio-psychological literature on consumption behaviour together with microeconomics of consumption and also considering time cost in the model along with monetary cost.

This paper is organized in 6 sections. The next section provides a literature review of consumption behaviour which draws on the economics, sociology and psychology literature. This section also provides a theoretical framework to model choices. Chapter three is devoted to a detailed methodology of the research and discusses the structure of the questionnaire, and the specification of the econometric model. A descriptive analysis of the data is provided in chapter four, results and discussion in chapter five and finally chapter six concludes the paper.

[1] - For instance OECD (2008) proposed different household characters for pro-environment behaviour in utilities use compare to recycling.

Chapter 2 :
Literature review

The objectives of this paper are to examine whether individuals consider environmental issues in their consumption behaviour and to identify the determining factors of demand for environmentally friendly goods and services in the three areas of food, recycling, and transportation. In this chapter we review the literature on consumption behaviour and the environment from the perspective of economics, sociology and socio-psychology in order to identify some common traits shared by individuals who engage in pro-environmentally consumption (section 2.1). Consumption studies in economic largely utilize the microeconomic framework[1] and analysis of the determinants of demand are limited to general characteristics of individuals such as sex, age, income, and education. On the other hand, in socio-psychological texts, the determining factors of demand are investigated in broader detail, but the literature lacks models that adequately quantify their effect on demand or are sufficiently abstract to provide simple predictions about demand behaviour. This paper combines socio-psychological ideas about pro-environmental behaviour (PEB) together with choice experiment, which is one of the best methods in economics to observe individuals' preferences. Therefore, in section 2.2 we include a theoretical framework of choice modelling. This framework will help us to develop the interdisciplinary research methodology we present in the following chapter.

2.1. Literature on consumer behaviour and environment

Empirical studies on consumption behaviour and the environment have been flourishing in the last decade (Jackson 2005; Peattie 2010a). Kim (2002) emphasizes the insufficiency of production side studies to target environmental problems and examines the relation between consumption patterns and emissions of carbon dioxide (CO2) and sulfur dioxide (SO2) in Korea during 1985–1995. He found that households are the most significant contributor to these emissions because of their direct energy consumption and use of 'energy intensive instruments'. Lebel and Lorek (2008) suggested an integrated study of the production-consumption cycle to capture the full impact of economic activity on the environment.

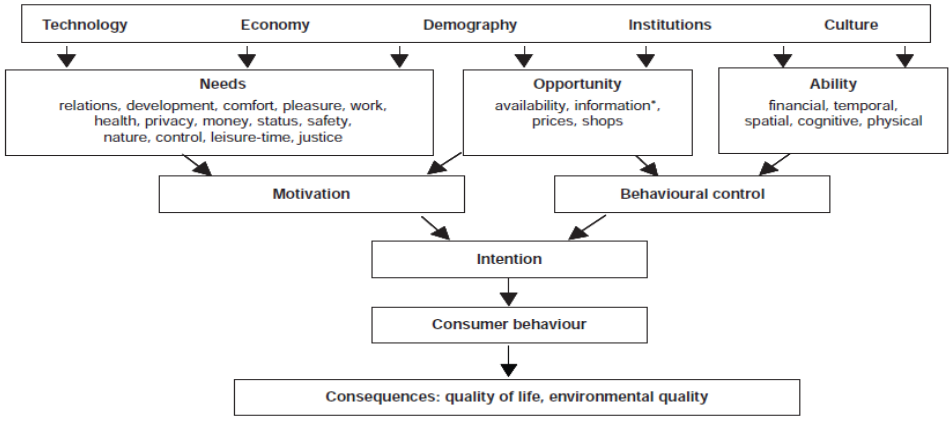
The Organization for Economic Co-operation and Development has produced a series of reports in 1999, 2002 and 2008 in this area. OECD (2002) explored how daily life of households increasingly put pressure on the environment especially over the last three decades because of rising per capita income, demographic changes (more working women, more single-person households, a larger retired population) and lifestyle changes, as well. Addi-

[1]- The foundation of the microeconomic framework is individual utility maximization subject to a budget constraint.

tionally they examined the effectiveness of the sustainable consumption policy framework implemented during the period 1999-2001.

OECD (2008), using an improved methodology, suggested research on consumption behaviour using disaggregated consumption to provide insight into the main sources of environmental pressure. Using a comprehensive framework with insights from other social sciences like psychology and sociology, the authors concentrated on five important areas of environmental impact: energy and water use, food consumption, transport choices, and waste generation and recycling in OECD countries. Figure (2.1) illustrates the drivers of consumption identified in the paper. In addition to the role of socio-demographic characteristics, attitudinal or non-economic factors defined by social psychology as 'the valuation of a concept or an object', were also examined. (OECD 2008: 99) We will come back to this paper again in more detail as it relates to our discussion on food, recycling and transportation choice.

Figure 2.1
Consumer's behavior configuration



Source: OECD (2008:67)

Adaman (n.d.) inspects the factors conditioning the extent of household consumption pressure on the environment and also the amount of willingness to pay for reductions in CO2 emissions. Using the contingent valuation methodology, he found that age, income, and residence in rural areas had a positive effect on CO2 emissions from residential energy use. Similarly, Adaman found that age, income and education had a significant positive effect on CO2 emissions from transportation. In addition he found a direct relationship between educational level and willingness to pay for CO2 reduction programs.

In line with consumption behaviour studies, researchers have scrutinized the role of socio-demographic features in motivating sustainable consumption. Liddle (2011) investigated the influence of age structure on consumption behaviour within OECD countries during the period 1960-2007 in two areas. Using cointegrated panel data he found that age has a significant effect for both residential electricity utilization and transportation, although with a decreasing trend for the latter and a U-shaped impact for electricity use, with the youngest and oldest cohorts using the most. Robinson and Simth (2002) did not find clear support that demographic characteristics including sex, household annual income, and educational level influenced purchases of sustainably produced

food, though those who were married/partnered were more likely to buy sustainable foods.

Diamantopoulos et al (2003) reviewed studies on sustainable consumption behaviour during 1969-1995 in different countries (mainly in Europe and North America) and found considerable variation in their results. I summarize the results in Table (2.1). The number values signify the number of studies.

Table 2.1
Summery of meta analysis on socio-demographic and environment

Characters		*Env. knowledge*	*Env. attitudes*	*Env. behavior*
Sex	*Positive effect*	*1*	*14*	*11*
	Negative effect	*7*	*1*	*1*
	Not significant	*0*	*7*	*10*
	Total	*8*	*22*	*22*
Marital status	*Positive effect*		*1*	*2*
	Negative effect		*0*	*0*
	Not significant		*2*	*1*
	Total		*3*	*3*
Age	*Positive effect*	*0*	*2*	*8*
	Negative effect	*2*	*10*	*5*
	Not significant	*3*	*6*	*14*
	Total	*5*	*18*	*27*
Child number	*Positive effect*	*1*	*1*	*3*
	Negative effect	*0*	*0*	*0*
	Not significant	*0*	*0*	*0*
	Total	*1*	*1*	*3*
Education	*Positive effect*	*8*	*15*	*15*
	Negative effect	*0*	*0*	*2*
	Not significant	*0*	*6*	*6*
	Total	*8*	*21*	*23*
Social class	*Positive effect*	*3*	*4*	*12*
	Negative effect	*0*	*0*	*1*
	Not significant	*2*	*4*	*4*
	Total	*5*	*8*	*17*

Source: findings of Diamantopoulos et al (2003:468-470)

They made hypotheses based on the results of previous studies (the second column of the table above) in order to construct a profile[1] for green consumers. For instance, since in 7 out of 8 cases sex had appeared with a negative sign in relation to environmental knowledge and in 14 out of 22 cases had showed with a positive sign in relation to environmental attitudes, the authors proposed the following hypotheses: women tend to have less environmental knowledge; and women tend to have more conscientious attitudes toward the environment, compared to men. In order to examine the hypotheses they undertook fieldwork research in the UK using a bivariate and multivariate analysis in order to create a profile for green consumers. They found sex, number of children, education, and social class had a positive effect on environmental attitudes but none of the mentioned variables showed any impact on environmental knowledge or behavior. So they concluded that constructing a profile

[1]- The construction of a green consumer profile refers to the identification of socio-economic characteristics that shape green consumption behavior.

for green consumers is complex and all aspects of environmental consciousness, including knowledge, attitude and behavior should be considered.

Studies that assessed environmental information as a driver for pro-environment consumption behaviour mostly indicated a positive correlation between environmental knowledge and behaviour. Kaiser et al (1999a) measured three concepts including environmental knowledge, environmental values, and PEB and showed environmental knowledge and values could explain a considerable part of PEB. (Schultz and Oskamp 1996; Bartkus et al. 1999; Aman et al. 2012) revealed the same conclusions. Although no significant or strong relationships have been reported by (Davies et al. 2002; Scott and Willits 1994)

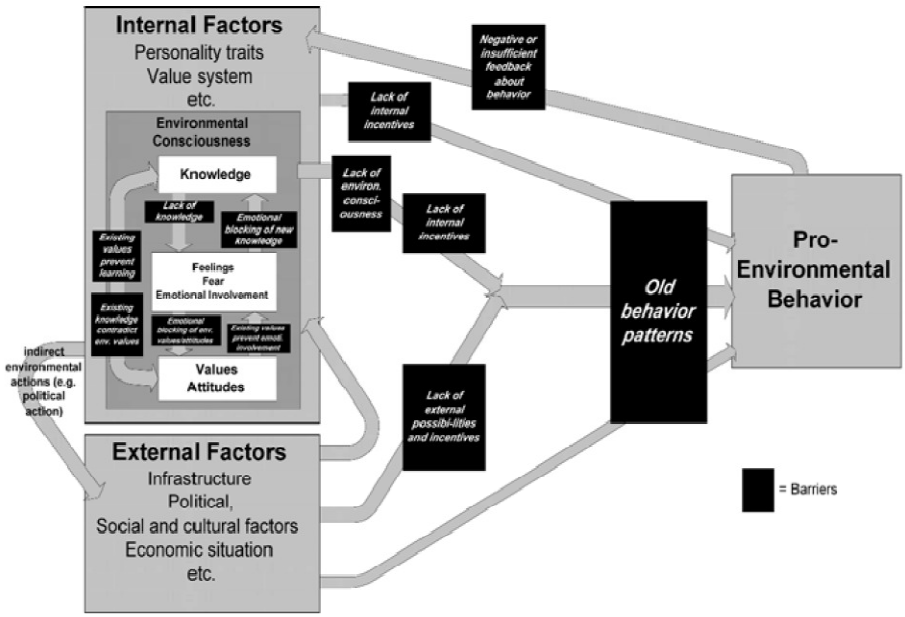
Einstellung and Werte (as cited in Kollmuss and Agyeman 2002) criticized the idea that information directly is followed by pro-environmental behaviour and countered that knowledge is functioning as nothing more than a modifier and can influence behaviour only when it transforms attitudes and values in the presence of the joint functioning of other factors including the possibility to take pro-environmental actions, incentives for behaviour (e.g. social desirability), and the perceived consequence of behaviour (same example). In the same vein, Kollmuss and Agyeman (2002) tried to clarify the gap between knowledge and behaviour designing a comprehensive framework including internal factors (e.g. knowledge, attitudes, and personal traits) and external factors (e.g. infrastructural, political, and cultural situations). The relationship among elements has been illustrated in figure (2.2) and explained by them as:

> "... environmental knowledge, values, and attitudes, together with emotional involvement as making up a complex we call 'pro-environmental consciousness'. This complex in turn is embedded in broader personal values and shaped by personality traits and other internal as well as external factors... The biggest positive influence on pro-environmental behavior, indicated by the larger arrow, is achieved when internal and external factors act synergistically"

Correspondingly Carrus et al. (2008) apply recent developments in social neuroscience which point to a central role of anticipated emotions in the regulation of cognition revealing that emotions can explain ecological behaviour in areas of transportation choice (public versus private) and recycling. However there are few studies to investigate the association between personal traits/emotions and ecological behaviour (Peattie 2010a:207)

Instead, Giddens defined consumption as a set of social practices which are influenced by social norms and emphasized the role of external drivers versus individual agency (Jackson 2005: x). Zukin and Maguire (2004) described consumption as an '*institutional field*' which bridges economic and cultural institutions. Jackson (2005:59) defined two kinds of social norms, *descriptive* norms which refer to the perception of what is normal or regular in a specified situation versus *injunctive* social norms which are related to the moral rules of a social group. It encourages and constrains individuals' actions through social rewards or sanctions to act or not to act in certain ways. Social norms are influential factors on ecological consumption behaviour. (Peattie 2010a: 211) Stern (2000) tried to classify behaviour causes and effects and enhance theoretical coherence with a *value-belief-norms* structure.

Figure 2.2
Model of pro-environmental behavior



(Kollmuss and Agyeman 2002: 257)

Nevertheless, there is strong support for the influence of values and attitudes in pro-environmental behaviour but there is evidence that they do not affect all types of behaviours nor in the same way. (Peattie 2010a: 207) For example, UK consumers with high levels of expressed support for the environment *did* recycling but were actually less likely to buy organic food (ibid). Ferry and Oberholzer-Gee (1997) proposed a challenging hypothesis: economic incentives do not only accompany attitudes but they also undermine them. They econometrically show that financial compensation crowded out motivations for a locally unwanted project.

Furthermore, Neumayer (2004) stated that since scepticism towards unregulated markets is a general feature of left –wing parties, it is plausible to assume that left-wing orientation accompanies pro-environmental behaviour. He examined the relationship between individuals' political orientation and environmental beliefs, attitudes and self-reported behaviour (among a sample dominated by developed countries) and found significant direct relations.

In summary, according to literature on consumption behaviour there are a wide range of characteristics/attitudes /values/norms which can influence PEB. We categorized them in five groups: General characteristics (e.g. sex, age, income), environmental knowledge/attitudes, social attitudes/norms, personal traits and political affiliations. We will use all groups in our empirical study.

According to OECD (2008) in different consumption areas, individuals behave differently. Hence a short review of literature on behavioural studies of consumption regarding food, recycling and transportation services is provided.

This review will help illustrate not only to how different characteristics influence individual consumption behaviour but it also introduces empirical methods used in the study of each specific area.

Food consumption

One of our three interest areas in this research is organic food consumption. Organic farming can potentially decrease emissions of greenhouse gases (ITC 2007; FAO 2011), Lindenthal et al. (2010), applying a life cycle assessment found CO2 emission for organic dairy products, wheat and vegetables are 10-21%, 25% and 10-35% less than non-organic products in Austria. Based on a European commission (2010) report, in the Netherlands 2.6% of agricultural area was farmed with organic methods in 2008 and about 5% of producers were organic producers. On the demand side 1.8% of household expenses for food belongs to organic goods. This amounts to about 31 euros per capita in 2007.

There is broad literature on organic food consumption by applying choice modelling which is mainly marketing-oriented. Consumers usually prefer organic food due to health related effect (absence of chemicals), environmental friendliness, animal welfare and better taste. Schifferstein and Ophui (1998) undertook a national study in the Netherlands and found organic food consumers considered themselves more responsible for their own health compared to the general population, however, the authors could not address organic food consumers intentions regarding the environment unconnected to health issues.(Schifferstein and Ophui 1998: 129) In many studies health and environmental attributes were ranked as the most important attributes (among all attributes) by respondents (Wier et al. 2005; Baker et al. 2004; Makatouni 2002; Davies 1995).However in the study by Wier et al (2005), respondents ranked environmental and animal welfare before health, taste, and freshness at the end of the list of attributes. Based on this research about 17% of respondents acknowledged only environmental and animal welfare attributes while about 70% recognized all attributes including animal welfare and environmental (public attributes), health, taste and freshness (private attributes). Then they compare the results with revealed preferences in real market in recent year. They found households who had acknowledged both private and public attitudes had spent more on organic food compared to those who stated just public attitudes (about half of the former group). In addition, the authors found personal characteristics including income, age and having children younger than 15 years significant in explaining the share of organic food consumed by households. That food expenditure was used as proxy for income brings into question the authors' results regarding the income effect. (OECD 2008) conducting a meta analysis over studies for organic food concluded that it is mainly women who tend to buy more organic food, while income and having children less than 18 years old have positive effects and age and household size have negative effects on organic food choice. Education's effect is not clear.

With the same purpose, some studies, mainly within the socio-psychological framework, have investigated the relationship between consumer values and norms and organic purchasing (Magnusson 2001; Tsakiridou 2008) Aertsens et al. (2009) explore how different types of values and norms influence organic

consumption. They find positive and significant association between subjective norms and values and organic purchases; however, different types of values are associated with different effects. Similarly, Vermeir and Verbeke (2006) explain the gap between positive attitudes toward organic (dairy) food and purchasing by the availability of organic dairy products. In addition, they find social norms (social pressure from peers) to be very strong, even explaining intentions to buy, despite rather negative personal attitudes. Baker et al. (2004) comparing the relatively higher share of organic food in Germany compared to the UK tried to explain the difference between UK and German consumers. The authors found the environment as the lost piece and concluded that despite similarities, different levels of values regarding the environment play influential roles in decision-making over food choice, and it is this difference which is the cause of differing organic food demand.

Recycling

Studies on recycling mainly focus on how socio demographic characteristics shape recycling behaviour. Carrying out a meta study, OECD (2008) found that income has a negative effect on recycling that might be due to the high value of time for higher income households. Age and education had positive effects on recycling. However, the role of values, norms and attitudes are rarely examined (OECD 2008: 183)Sterner and Barteling (1999) took into account attitudinal factors beside economic incentives on waste reduction and increases in recycling in Sweden. They found economic incentive policy effective and attitudinal factors significant, as well. But association between economic tools and attitudes-norms could be debatable i.e. incentives can weaken or strengthen the attitudes-norms. Some researchers believe economic incentives undermine personal attitudinal factors such as the (Ferry and Oberholzer-Gee 1997) study about the non-consistency of economic incentives and attitudes. Additionally, Thogersen (cited in OECD 2008) found economic incentives crowd out attitudes for recycling after government intervention.

Transportation

The Netherlands has the highest percentage of bicycle use (26%), followed by Denmark (19%) and Germany (10%) owing to natural conditions and infrastructure facilities. The Netherlands implemented the Dutch bicycle master plan during 1990-1997 and now has the longest and safest bicycle lane and fewer reported fatalities than Spain and Greece, for example, despite higher numbers of cyclists (European Parliament 2010).

The literature on transportation choice usually compares public options (bus, train, etc) and private car use and it is focused heavily on the ability of the transportation policy to persuade households to use public transportation. (OECD 2008:61) McFadden (1974) stated that demand for transportation is a set of simultaneous decisions about mode, destination time of travel and trip frequency. Donnea (1972) suggested that decision making regarding transportation involves choosing a given combination of money and time (which are required for a trip) in order to produce a given consumption activity and time could be a function of comfort of the trip; hence transportation models should include cost, time and comfort. Quarmby (1967) suggested cost, time, comfort,

safety and reliability as features of travel choice but he used only cost and time in his model due to measurement problems with other three features. Asensio (2002) applied a nested logit model for suburbanised commuters in Barcelona. Cost, transfer time, transfer distance, waiting time and frequency were included as attributes. Results showed low elasticises for car use and high values for travel time (3 times of cost elasticity). Additionally, public transport users value waiting time more than in-vehicle time. Rong-Chang Jou et al. (2010) examined transportation choice switches from private to public modes in Taiwan, applying a multinominal probit model. They considered parking cost, travel cost, and travel time as attributes. Results showed that the tendency to switch increases with the increase in time and costs of travel for each trip. Also, commuters' characteristics including sex, age, residential location, and trip characteristics are statistically significant. Steg et al. in 2001 (cited in OECD 2008:66) find that in the Netherlands, being male, income, level of educational attainment, and being single increased the incidence of car usage, and that age has a concave effect on car usage. Dieleman et al. (cited in OECD 2008:69), using a multinomial mode choice model for the Netherlands in 2002, found income, level of educational attainment, and household size increased the probability of using public transport. The most important factors, however, are residential location and car ownership. Those without a car and those living in large cities are the most likely to use public transport. In recent decades some researchers have examined environmental information/attitudes and social norms on transportation choice, as well. Seethaler and Rose in 2003 (cited in OECD 2008:75) claim that information-based campaigns cannot influence individuals' behaviour adequately; however, persuasion techniques rooted in social psychology can change behavioural patterns. In Sweden, Nordlund and Garvill suggested that personal values and awareness about environmental consequences influenced car usage (cited in OECD 2008:75).

After reviewing studies on food consumption, recycling and transportation it seems they mainly focused on general characteristics and other attitudinal factors which usually do not get enough attention. In this paper, we try to address the broadest set of individuals' characteristics. Moreover, with respect to food studies using choice experiment methodology, one can find health, the environment, animal welfare, and taste as commonly-used attributes. In transportation studies, safety, and comfort are commonly used attributes. Certainly, cost and price should be considered as attributes. In following section we will discuss the theoretical framework of choice experiments which we apply to model individuals' choices in food consumption, recycling and transportation to investigate the degree to which environmental issues enter into their consumption behaviour.

2.2. Literature on Choice experiment

It is almost 30 years since the first choice experiments were developed by Louviere and Hensher (1982) and Louviere and Woodworth (1983), followed by the simultaneous advancement in psychology (axiomatic conjoint measurement and information integration theory), economics (random utility theory-

based models) and statistics (discrete multivariate models). (Hoyos 2010:1595) First choice theory was applied in transportation and marketing, until Adamovicz et al (1994) utilized it within the context of environmental resources. (ibid) Choice experiments are preoccupied with the generation of choice and asking respondents to choose among options through a hypothetical market using a survey. In this section, we review theoretical framework of choice experiment[1] in following order. First, elements of choice modelling (CM) and different type of it is discussed then the procedure of CE includes questionnaire design, survey implementation and estimation are reviewed.

2.2.1. Choice experiment elements

Generally choice modelling contains the same elements of traditional consumer behaviour in microeconomics; however the following discussion highlights the essential points of departure of traditional theory.

Characteristics theory of value

Based on utility maximization theory, consumers maximise the utility they achieve from consumption of goods. Lancaster (1996) proposed that utility is derived from properties of goods not goods per se, so individuals consume goods for the collection of characteristics of goods; in the other words, goods' characteristics or properties are objects of consumer utility or preference but utility derived by each consumer is subjective and depends on individuals' preference functions. Hence given the same amount of attributes of goods, different users draw different levels of utility while the amount of attributes subject to one unit of a good is fixed. Accordingly for describing any option for consumption decision- making, it is necessary to identify the characteristics or properties of the option. Applying Lancaster's theory does not violate neoclassical theory when one describe marginal rate of substitution between attributes as a replacement for MRS between goods.

Random utility model

Random utility theory, which was developed by McFadden in 1974, allows us to model preferences for multi-dimensional goods. On this basis, utility is a latent construct in the mind of consumer and cannot be observed directly; researchers should design and apply a preferences elicitation procedure to explain a considerable part of individual utility but always a proportion of it should stay unexplained. (Louviere 2001) (Hanley et al 2001) (Hoyos 2010)

According to Louviere (2001) and Cameron and Trivedi (2009) we can formulate a random utility function as

$$U_{ij} = V_{ij} + \varepsilon_{\mathrm{ij}} \qquad (2-1)$$

where U is latent, unobserved utility, V is the explained part of utility and ε is an unobservable, stochastic component of utility. i represent each individual

[1] - Typically, in economic texts choice modelling and choice experiment are used instead, however if we want to be more precise choice experiment is one type (more popular one) of choice modelling as it described in present section.

and j represents each option. Hence the probability is associated with the explained and unexplained components of utility.

$$P(y_j = j) = P[(V_{ij} + \varepsilon_{ij}) > (V_{ik} + \varepsilon_{ik})] \qquad (2-2)$$

Equation (2-2) expresses that the probability that consumer i chooses option j among all options k in their choice set is equal to the probability that the systematic and random components of option j for consumer i is greater than the systematic and random components of all options k.

Random utility theory like traditional utility theory, and in the line with the neoclassical consumer theory generally, assumes individuals act rationally and choose options with the uppermost level of utility i.e. each individual is a utility maximizer. While researchers cannot observe individuals' true utility functions, a probabilistic utility function can be and is used. The probabilistic model depends on an assumption about random parameters that we will discuss later in this chapter.

Manski (cited in Kjaer 2005:33) identified four sources of randomness: Measurement error and imperfect information; use of proxy variables; unobserved attributes; and heterogeneity in preferences; which all are key elements in randomness.

Stated preference approach

However, the stated preferences (SP) approach is not one of the elements of choice modelling i.e. it is possible to implement a choice modelling with revealed preferences but mainly researchers use SP especially in environmental economics. Because individuals' revealed preferences (RP) are complex and it is difficult or impossible to distinguish what part of the choice is made by environmental factors among other features or there is no market to observe revealed preferences, the stated preferences approach is an alternative way for preferences elicitation based on a hypothetical market. In this method consumers are asked about their preferences so they are not committing money, time, or other resources. The question then is how reliable stated preferences can be when it is not based on actual behaviour. According to Louviere (2001:18) and Louviere (2000:12), since 1990 relatively large numbers of studies by economists and psychologists addressed this question by examining two methods and found that both methods provide similar information about preferences.

In Louviere et al (2000)'s point of view the stated preferences approach is not just an alternative for RP but economists and other social scientists 'should be' interested in it due to the applications and capabilities that it provides such as the possibility of estimating demand for new goods with new attributes. In addition, RP elicitation by market observation has limitations for scientists. Explanatory variables have little variability and are highly collinear in marketplaces. RP data cannot satisfy model assumptions and the most important goods are not traded in markets so it's impossible to observe true consumer behaviour. In Louviere's words, the stated preferences method can go beyond the technological frontier through flexible choice definitions to fulfil the researcher's objectives.

Choice modelling has four variants which are differentiated by ways to measure preferences. The method of preference measurement influences the quality

of information provided and the ability to generate willingness to pay measurements of welfare change. (Hanley et al 2001:438)

Choice experiments are the most popular method in which respondents choose between two or more options while one of them is baseline option. According to Hanley et al. (2001: 440) in this case choice experiment is consistent with utility maximization and demand theory. (i.e. we can measure and interpret WTP). Other variant of choice modelling are explained in appenix1.

2.2.2 Choice experiment procedure

CE procedure could be done in 3 stages: designing a questionnaire; survey implementation; and estimation. First stage (questionnaire design) is main part of a CE. According to Louviere(2001:14) questionnaire design consists of a set of choice options; a set of attributes that describe potential differences in choice options; a set of levels and values assigned to each attribute to provide a range of variation in the line of study objectives. Attributes can be quantitative or qualitative and need to be assessed through literature review and pilot surveys. Usually cost or price is one of the attributes.

Choice sets are made by attributes and assigned levels. Statistical design theory helps to combine the attributes and levels. Full factorial design allows the maximum number of alternatives (l^a), in which *l* is the number of levels and *a* is the number of attributes. For example in the case of a good with 4 attributes and each attribute has 2 levels, full factorial design resulted in 16 possible alternatives. Since increasing the number of options may lead to cognitive difficulties, fractional factorial design can reduce them to (l^{a-p}) (Hanley 2001: 437). Only options which are useful for research objective are kept and other removed. Then options are clustered (in pair or group) to different sets to be ready to presents to respondents. Usually baseline option[1] included in each choice set. "... it is because one of the options must always be in the respondent's currently feasible choice set in order to be able to interpret the result in standard welfare economic terms" (Hanley 2001:438)

Since information about the preferences of consumers is derived from the options of the questionnaire, it is important that the choice experiment captures the main attributes for the majority of consumers to avoid concerns about omitted attributes. But there is a trade-off between omitted attributes bias and task complexity and cognitive burden. Researchers should find a balance between setting enough attributes and cognitive ability. Pilot tests can help to ensure that respondents understand the task. Although some studies suggest that cognitive burden is not a serious problem in designing choice experiments. For example, Chintakayala et al (2010) studied the effect of number of attributes and choice sets on the results of choice models and showed the impact of design complexity may be somewhat lower than what has been previously predicted.

Second stage is implementation of survey and measurement of the preferences. Respondents are asked to choose best option.

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[1] - 'Baseline option' or 'status quo' or 'do nothing' or 'none of the options'

And finally, third stage is estimation procedure. As it is discussed, random utility model is the core of CE estimation. The random nature of choice experiments can be analysed by researchers through some simple assumptions: the distribution of error term and functional form of utility. Linear utility functions are the most popular due to the simplicity of calculation while flexible functional forms carry more complications. But still most choice experiment studies use linear utility functions. (Hanley et al (2001)

In order to develop an empirical model, 'Independence of Irrelevant Alternatives' (IIA) is assumed very often, which implies that the relative probabilities of choosing one option over others is not influenced by the presence or absence of other options. This assumption makes the model computationally convenient while we do not need re-estimation in the case of introduction or elimination of options. (Louviere et al (2000:44)). According to Louviere et al (2000:44) it is not a desirable or non-desirable axiom and should be accepted or rejected on the grounds of empirical tools. The Independence Irrelevant from Alternatives property entails that the random term of utility (ε) is independent and identically distributed (IID) with Weibull distribution (Extreme Value (type I)). If we rewrite Eq. (2-2) as below

$$P(y_j = j) = P\left[(V_{ij} - V_{ik}) > (\varepsilon_{ik} - \varepsilon_{ij})\right] \qquad (2-3)$$

and define EV1 or the Weibull distribution for the error term as

$$P(\varepsilon_j \leq \varepsilon) = \exp(-exp - \varepsilon) = e^{-e^{-\varepsilon}} \qquad (2-4)$$

This means that the probability of choosing any option j as the most preferred option can be expressed in terms of logistic distribution which is stated in equation (2-5) (Hanley 2001:439)

$$\mathrm{P}(\mathrm{U}_{ij} > \mathrm{U}_{ik}, \forall\, \mathrm{j} \neq \mathrm{k}) = \frac{\exp\,(\rho \mathrm{V}_{\mathrm{ij}})}{\sum_{\mathrm{j}} \exp\,(\rho \mathrm{V}_{\mathrm{ij}})} \qquad (2-5)$$

where ρ is a scale parameter, inversely proportional to the standard deviation of error distribution and cannot be separately identified and usually assumed to be one. (ibid) As it is said, the implication of this distribution for the error term is the IIA property of options due to independency of the Weibull error term across the different options in a choice set. In the absence of the IIA hypothesis when the distribution of error tem is neither independent nor identical then multinominal probit models will be appropriate. (Louviere 2001: 16)

The maximum likelihood procedure is the common method for estimation. Log-likelihood functions expressed in equation (2-6) where y_{ij} is an indicator variable that takes on the value 1 if respondent i choose option j and 0 for other cases. (Hanley 2001: 440)

$$\log L = \sum_{i=1}^{N} \sum_{j=1}^{J} y_{ij}\, log \left[\frac{\exp\,(V_{ij})}{\sum_{j=1}^{J} exp(V_{ij})}\right] \qquad (2-6)$$

Chapter 3 :
Methodology and Empirical model

In this chapter, we discuss how the questionnaire components are designed and how they help answer the research questions (in section 3.1). Then in 3.2 survey administration and sampling is discussed. Subsequently, empirical model and estimation methods are provided in 3.3.

This research is carried out for the sake of the two main objectives: to investigate whether individuals consider environmental issues in their consumption behaviour, and to identify characteristics which cause pro-environmental behaviour in food consumption, recycling and transportation. Typically two methods are applied in environmental economic to elicit preferences toward environment: contingent valuation method (CVM) and choice modelling (more specifically choice experiment). According to Alpizar et al. (2001:4) choice experiment is superior method in three aspects. First, some of the potential biases of CVM are reduced, second, in the process of CE more information are produced and finally, there is a possibility to test internal validity (consistency). Thus we have chosen CE to apply in this research.

So in line with research objectives, we bring together socio-psychological theories of consumption with choice experiment. This arrangement is based on the theoretical framework which is discussed elaborately in chapter 2 and is consistent with microeconomic welfare maximization theory.

3.1 questionnaire development

The questionnaire is provided in two parts: individuals' characteristics/ attitudes/norms/beliefs (detailed in section 3.1.1) and three choice experiments in the second part (detailed in section 3.1.2)

3.1.1 Questionnaire development- Characteristics

As it is explained in 2.1 consumption behaviour depends on a range of social, psychological and economic aspects that can be categorized into five groups. Additionally, we include religious beliefs as a sixth group,and take into consideration that moralities might be rooted in religious beliefs. Hence, based on the (Kollmuss and Agyeman 2002; Steren 2000; Peattie 2010b) studies we put forward 6 groups of factors that shape individuals' consumption decision-making. The first part of the questionnaire below is devoted to questions regarding these six groups of characteristics:

General characteristics: mainly are the only characteristics asked about in consumption behaviour studies such as(Diamantopoulos et al2003) in which sex, age, marital status, education, having children younger than 2 years old, income, owning home, expenditure, health status (self-reported) are examined.

Environmental information/attitudes: According to (Kaiser et al 1999b; Schultz and Oskamp 1996; Aman et al. 2012) environmental information and attitudes can explain ecological behaviour, however, (Kollmuss and Agyeman 2002) suggest that environmental knowledge and environmental attitudes do

not generally coexist. In order to measure climate change related information, some questions about causes and consequences of consumption are asked and basedon the answers to these questions the environmental information variable is defined. Attitudes are quantified in two ways. First, respondent are asked if they agree with the priority of environmental issues to more consumption, economic growth acceleration, job creation, all of these economic goals, and none of economic goals. Second, they are asked to state the seriousness of climate change in a Likert scale.

Social attitudes/norms: In the line with Jackson (2005) attitudes toward society are captured by questions about trust in social institutions (eg. Judicial system), feeling integrity to society, believe in election in society are examined. Moreover while social norms (group norms) are acknowledged as behavioural determinants by Zukin and Maguire (2004) and Vermeir and Verbeke (2006) two questions: 'care about neighbour behaviour for recycling' and 'care about neighbour perception about your recycling behaviour' have been proposed.

Political views: Along with Neumayer (2004) who suggested that political views influence PEB, questions about political affiliation and participation in elections are proposed on the grounds of capturing political views in this study.

Personal traits/attitudes: Carrus et al. (2008) and Peattie (2010a) acknowledged that personal traits and feelings influence pro-environment behaviour. Personal feelings like being optimistic or being happy are explored.

Religious views: If we assume religious issues such as religiously based moralities then according to Krol (2001) moralities can explain environmental protection behaviour; however, some authors found it limited to theology and not applicable to environmental concerns. (Sheng and Chen 2011:7533)

In the second part of questionnaire, three choice experiments for food choice, recycling, and transportation are presented. We choose choice modelling as the best method because it provides the possibility to observe pro-environmental behaviour indirectly. Also, we avoid direct questions because they could bias stated preferences to environmentally sustainable options. Moreover, choice experiments produce broader information for options. Since we are interested in eliciting individuals' preferences about the environment we try to limit or eliminate the influence of economic incentives to observe attitudes toward the environment in the absence of economic incentives or even in contrast to financial stimulus. In the other words, 3 choice experiments are designed in order to examine how individuals behave while monetary or time cost increases are posed against environmentally friendly goods/services.

3.1.2 Questionnaire development- Choice experiments

In order to apply the choice experiment method which was discussed in Section 2.2 the questionnaire has been developed in two main parts. The first part contains questions about personal information and other five groups of attitudes. The second part consists of three choice experiments related to the three areas of food, recycling, and transportation choice. Before moving to the choice experiments' features, it should be mentioned that attributes are assigned to proposed goods/services (food, recycling, transportation) as regards to the manner explained in the literature review in chapter 2 and in regards to

pre-interviews with individuals. In each choice experiment, the main attributes have been applied, first, because the objective of this research is not marketing, that different levels of the large range of attributes are required to plan for marketing, and second, because extending the number of choice sets and length of questionnaire adversely affects the cognitive ability and patience of respondents. The first choice set of each experiment (food, recycling, and transportation) is in the appendix and the questionnaire will append as a separate document.

Food choice experiment design

In the line with literature, identification of the most important attributes and assigning a level to each attribute is the first step. Cost, health, animal welfare, the environment, taste and freshness are common attributes in organic food research. Based on the (Wier et al 2005) study and pre-interviews three attributes include cost, health and (our interest attribute) pollution levels, and are employed in the choice set construction. Cost is conditioned with 4 levels indicated by monetary terms, pollution with 2 levels indicated by categorical variables, and the health effect with 2 levels presented as categorical variables. Based on the full factorial design, we have $4\,2^2 = 16$ possible choices. Nonetheless, fractional factorial design helps us to reduce number of choices by leaving out options that do not provide information for the research objective. The options shrank to 5, which are those categorized in four paired choice sets which the organic food with conventional food (as a baseline option) are compared. Table 3.1 shows the attributes and levels for the food choice experiment.

Table 3.1
Elements of scenarios for food choice

Attributes	*Levels*
Cost (euros/basket of food)	*organic: 97, 116, 131* *base line option: 68*
Health	*organic: neutral, positive* *base line option: neutral*
Pollution	*organic: low* *baseline option: medium*

Source: research choice experiment design for food

In order to assign monetary values to the cost of attributes of 32 food staples which are available in both organic and non-organic varieties are included. To avoid problem of different brands and shop prices[1] , foods have been chosen from the same brands and the same markets. In different choice sets, the cost of organic food has been raised by 15, 30 and 50 percent while non-organic cost has been kept fixed in order to observe the resistance of consumers to organic-food. Table 3.2 illustrate first choice set in food CE.

[1]-In some cases the non-organic price of a brand was more than the organic price of the good from another brand.

Table 3.2
Illustration of a food choice set

Food choice				
Choice set 1				
Which option would you prefer?				
		Average cost (Euros for a basket of food)	*Pollution level*	*Effect on Individual's Health*
Option A	*Conventional Food (Non- Organic)*	*68 €*	*Medium*	*Neutral*
Option B	*Organic Food*	*97€*	*Low*	*Neutral*
I prefer:	*Option A*	*Option B*		

Source: research choice experiment design for food

Recycling

To observe the extent of pro-environmental behaviour of respondents, we design a hypothetical market through which consumers have to pay (in monetary terms or time spending) for recycling services while not-recycling does not draw any cost. Options for recycling are defined with 3 attributes: cost (with 4 levels indicated by monetary terms), pollution (with 2 levels indicated by categorical variables) and time (with 3 levels presented in minutes). It results in $4\ 3\ 2 = 24$ potential options that are reduced to 5 options and designed in five paired choice sets. In each choice set recycling and not-recycling (as the base line alternative) are compared.

Table 3.3
Elements of scenarios for recycling choice

Attributes	*Levels*
Cost (euros /month)	*Recycling:16, 32, 59* *base line option: 0*
Time (minutes)	*Recycling: 5,30,45* *base line option: 0*
Pollution	*recycling: low* *baseline option: high*

Source: research choice experiment design for food

Assigned costs come from different percentages (1, 2 and 4%) of mean consumption expenditure per adult. Time levels in options are 5, 30 and 45 minutes. Table 3.2 shows attributes and levels for recycling and table 3.4 illustrate first choice set in recycling CE.

Table 3.4
Illustration of a recycling choice set

Recycling				
Choice set 1				
Which option would you prefer?				
		Cost (euros per month)	*Pollution level*	*Time Required each time you recycle (minutes)*
Option A	*Recycling*	*16 €*	*Low*	*5*
Option B	*Not- Recycling*	*0 €*	*High*	*0*
I prefer:	*Option A*	*Option B*		

Source: research choice experiment design for food

Transportation

Based on Quarmby (1967) and Donnea (1972) and pre-interviews, five main attributes of transportation are derived through the literature of transportation choice modelling: Cost (with 4 levels indicated by monetary terms), pollution (with 4 levels indicated by categorical variables), time (with 4 levels presented in minutes), safety (with 3 levels presented as categorical variables) and comfort (with 3 levels as categorical variables). Chosen attributes and levels produce a full factorial design with $4^2 3^3 = 432$ possible transportation choices. Since it is not feasible to present all possible choices, fractional factorial design reduced the number of alternatives to 18 options. They are offered in 8 choice sets with baseline alternative (none of the proposed options). As we discussed in the theoretical framework, reducing options and designing choice sets is based on research objectives.

The first choice set is designed to compare 5 possible alternatives including 'no option'. Determining the average cost is predicated on using available data and simplifying assumptions. For car usage, using a list of ten top car sellers in Europe and the amount of sales, related prices in the Netherlands, car lifespan in NL, the benchmark interest rate in NL in 2011, together with annual average cost were all estimated. For bike and electric car (e-car) usage, a similar process has been applied. Tram and train costs are estimated based on tram tickets in The Hague. For other choice sets, the price of some options has been increased by 20, 35 and 70 percent depending on the design of the choice set. We also tried to see the effect of time cost in transportation choice. Table 3.5 shows the attributes and levels of model. A sample of transportation choice set is in the table 3.6.

Table 3.5
Elements of scenarios for transportation choice

Attributes	*Levels*
Cost (euros /month)	*12,15,17,21,90,224, 313, 330* *base line option: -*
Time (minutes)	*10, 15, 20,30, 45, 60,90,150* *base line option: -*
Safety	*Low, medium, high* *base line option: -*
Comfort	*Low, medium, high* *base line option: -*
Pollution	*Non polluter, low, medium, high* *baseline option: -*

Source: research choice experiment design for food

Table 3.6
Illustration of a transportation choice set

Transportation Choice						
Choice set 1						
Which option would you prefer for transportation?						
		Average cost (Euros per months)	*Pollution level*	*Time required to reach destination(minutes)*	*Safety*	*Comfort*
Option A	*Bike*	*12 €*	*Non- Polluter*	*20*	*Low*	*Low*
Option B	*Tram*	*90 €*	*Low polluter*	*15*	*High*	*Low*
Option C	*Car*	*224 €*	*High polluter*	*10*	*Medium*	*High*
Option D	*e-Car*	*313 €*	*Medium polluter*	*10*	*Medium*	*High*
I prefer:	*Option A*	*Option B*	*Option C*	*Option D*	*None of the above options*	

Source: research choice experiment design for food

3.2. Sampling and survey administration strategy

Choice of survey population obviously is regard to survey objective. Since we need population with acceptable level of knowledge about environment, we intentionally chose a community composed of relatively well-educated persons who apparently are more informed about the environment and for which we can better observe the potential influence of environmental knowledge/attitude on pro-environment behaviour. Additionally we preferred a multi-national sample. ISS staff, Erasmus- Rotterdam University staff, employees of a multi-national company all make up our research population. This community apparently is more interested and aware of consumption's adverse effect on the environment, so we chose them as most useful for our project to

investigate consumers consider pollution when making decisions about consumption.

Academic sampling strategy entails consideration of relevant population size but always budget and time are constraints to sample size. So in this case due to budget and time limitations we utilize a sample size which is sufficient for identification of parameters. One advantage of CE is that each respondent answers to several choice sets. Thus the number of observations will be much larger than sample size (Alpizar 2001:22). For example while 100 respondents answer to 5 choice sets, 500 observations are produced.

Face to face, telephone and web-based surveys are all possible methods for survey administration. Since the questionnaire includes very personal questions, I chose a web-based method due to its anonymity despite the fact of low response rates for web-based surveys.

The questionnaire had been implemented on a survey website[1] and was available for forty days and about 1750 invitation letters for participation were sent to email addresses or posted on web pages of the relevant community. Finally we received 146 completed usable answers, which reflects the typical problem of low response rates of web-based questionnaires.

3.3. Empirical model

3.3.1. Data preparation

In discrete choice experiments, one common feature is each respondent answers several choice sets, leading to multiple observations for each respondent. In each choice set, two or more options are defined while only one of those has been chosen by the respondent. So the number of observations in each dataset is determined by the number of respondents, number of choice sets, and number of options in each choice set. For example, for food choice, each respondent was presented with 4 choice sets and each choice set contains 2 options. In this case, the dataset should be expanded with (4*2=8) rows for each respondent, so finally we will have 1168 observations (with 146 respondents) which should be prepared in *long* form[2] for estimations by STATA. Similarly, we have 1460 observation for recycling option and 5840 observations for transportation choice. It should be mentioned that the number of columns depends on number of individual characteristics, number of attributes plus one column for choice group identification.

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[1]-http://www.keysurvey.co.uk

[2]- Typically databases are in *wide* form which indicates each individual has a separate row and his choices are presented in columns in front. In order to apply conditional logit models we must reshape data from *wide* to *long* form which means each choice should be located in one row (which implies multiple rows for each respondent).

3.3.2. Other practical issues using Stata

By assumption of a linear utility function in equation (2-5) conditional logit model, where x_i is the matrix of alternative-specific regressors (attributes) and β is the matrix of coefficients of attributes. (Cameron and Trivedi 2009:490)

$$p_j = \frac{\exp(x'_j\beta_j)}{\sum_j \exp(x'_j\beta_j)} \qquad (3-1)$$

The model ensures that $0<p_i<1$ and $\sum_j p_j=1$ and the model identification as well by assuming $\beta_{j=}0$ for one of the categories and other coefficient are interpreted with respect to the base category. This model is called the fixed effect conditional logit while it cannot estimate the effect of individuals' characteristics when they don't change over alternatives unless by their interaction with alternative specific variables. To observe individuals' characteristics (case-specific variables) together with attributes (alternative-specific variables) McFadden's Attribute-specific conditional logit (asclogit) which is specified in (3-2) is useful. It is a type of mixed logit. (ibid)

$$p_{ij} = \frac{\exp(x'_{ij}\beta + z'_i\gamma_j)}{\sum_j \exp(x'_{ij}\beta + z'_i\gamma_j)} \qquad (3-2)$$

where x is the matrix of alternative-specific variables and z is the matrix of case-specific variables. The same model is then used but for whichγ_j is set to zero. To apply asclogit, data should be transformed to long form, as we discussed in 3.3.1.

3.3.3. Empirical model specification

General specification of the model is presented in the (3-3) equation.

$$Choice = \alpha + \beta\ Attributes + \gamma\ General + \delta\ Environment + \zeta\ Social + \theta\ Political + \mu\ Personal + \varphi\ religious + \varepsilon \qquad (3-3)$$

The model presented is linear in parameters, where choice is the matrix of choice with 1 for the option that the respondent has chosen and 0 for other options. $\beta$is the matrix of coefficients of attributes of each good/service (or alternative-specific variables) $\gamma, \delta, \zeta, \theta, \mu, \varphi$ are the matrix of coefficients of general characteristics, environmental information/attitudes, social attitudes/norms, political affiliation, personal traits and religious beliefs, respectively. (These six recent regressors are case-specific or *generic*.). α is the constant term and ε is the error term, Independent and Identically distributed (IID) (with Weibull assumption. As we discussed in 2.2 this assumption is equivalent to the IIA assumption about alternatives.

The results of model estimation is presented in chapter 5 (results and discussion) but before that, a descriptive analysis of data is explored in next chapter.

Chapter 4 :
Data

Our data was collected anonymously through a web-based questionnaire from relatively well-educated communities. After sending about 1750 invitation emails, 146 individuals completed usable responses between August-September 2012. This chapter is devoted to describing this data obtained from the survey. The chapter is organized into three sections: a description of the characteristics of the sample in the first section; in section 4.2 we see association between characteristics and; environmental information and environmental attitudes; finally, in 4.3 we explain consumption behaviour in the three areas of food, recycling, and transportation based on respondents' choices.

4.1. Key Characteristics of the Sample

48% of our respondents were of Dutch nationality. On average our respondents lived in the Netherlands for 21.5 years, while the average for non-Dutch respondents was only 7.5 years. 26% of respondents left their name on the questionnaire. Individuals with graduate degrees (Masters and PhDs), who were 31-40 years old, who were healthy, who earned 2500-3500 euros in monthly disposable income, and who were married or partnered were more likely to be found within the sample. Details of the general characteristics of the sample are presented in table 4.1. According to (Statistics Netherlands 2012: 98) the average monthly disposable income of households was 2792 euros in 2011, which is the same as our sample mean. One should expect higher levels of income in the sample because of our sampling strategy (our intended community in this research was well-educated individuals) but it should be noted that a part of the academic staff surveyed in the study are PhD students who generally have lower income.

Based on their answers to questions about the causes and consequences of global warming and climate change each respondent received a grade in order to evaluate their level of environmental-related information. These grades are illustrated in table 4.2 which shows about 47% of the sample have above average environmental information. In the case of environmental attitudes, 55% verify the urgency of climate change but only 19% prioritize the environment overall economic goals and 53% prioritize it to none of the economic goals. It is apparent from our results that environmental information and attitudes are complementary and a large gap between knowledge and attitude, which was proposed by Diamantopoulos et al (2003), was not observed. (Graph 4.2) Although we still do not know if there is a gap between attitudes and behaviour, this question will be answered in chapter 5 after model estimation. In addition, 58% of respondents participated in environmental support activity (such as

demonstrations) and 16% of the sample self-identified as environmental activists[1].

Table 4-3 presents religious attitudes. More than half of the sample does not believe in God and do not consider themselves as religious.

A majority (80%) participate in elections. 52 percent of the sample has left-wing political views, while 30 percent has right-wing or centre political leanings (table 4-5)

More than 70% have trust in social institutions like the police and judicial system and feel integrity for society. 60% think that society helped them to achieve their goals in life and 30% perceive society's role as neutral. 80% believe in elections are beneficial for society. Sometimes environment-friendly behaviour, especially as with recycling, is caused by social (group) norms (Zukin and Maguire 2004). 56% of respondents feel upset if their neighbours don't recycle while 16% think that if they themselves don't recycle than their neighbours will be disappointed in them and 40% were unsure about how their neighbours would feel about their not recycling. (Table 4.4)

60 percent of respondents were optimistic but only 46% thought the future would be better. Interestingly 27% of optimists do not believe the future will be better. In general, a high level of happiness is reported; an average happiness score is 7.6 on scale of 1 to 10. (Table 4-6)

A surprising result regarding time preference is found and is presented in table (4.6). While 18% accept 10 percent as an acceptable interest rate for five year deposits, 40 percent reject 50% interest rates for deposits; thus, a considerable portion of the sample are individuals with extremely high time preferences.

[1] - We did not define environmental activist for the respondents so the number of responses was based entirely on self-perception. For example, a vegetarian called himself as activist simply because avoiding meat consumption helps to reduce CO2 emission.

Table 4.1
General Characteristics

	%in Total
Sex	
female	*60*
Male	*40*
Age (years)	
18-24	*10.3*
25-30	*24.7*
31-40	*27.4*
41-50	*18.5*
51-60	*15.1*
More than 61	*4.1*
Marital status	
single	*35.6*
married/partnered	*61.6*
other	*2.7*
Children	
yes	*58*
No	*42*
Household size	
1	*29.5*
2	*30.1*
3	*21.2*
More	*19.2*
Household Expenditure(Euros per month)	
less than 1000	*23.3*
1000-2000	*36.3*
2000-3000	*24.7*
3000-4000	*11.6*
more than 4000	*4.1*
Household Income (Euros per month)	
less than 1500	*17.1*
1500-2500	*21.2*
2500-3500	*23.3*
3500-5000	*21.2*
more than 5000	*17.1*
Health status(self-reported)	
not good	*8.2*
good	*30.8*
very good	*61.0*
Owning home	
Yes	*52*
No	*48*
Educational level	
Graduate (Master & PhD)	*63.7*
Undergraduate	*36.3*

Source : Research findings

Table 4.2
Environmental info/attitudes

	% in total
Environmental Information	
above average	*46.6*
average	*45.2*
below average	*8.2*
Climate change is serious	
no/ no idea	*45.2*
Yes	*54.8*
Agree with priority of environment to	
economic growth	*36*
more consumption	*45.2*
job creation	*22*
none of the goals	*52.7*
all of the goals	*18.5*
Environmental activist	
no	*83.6*
Yes	*16.4*
Supporting activities for environment	
no	*41.8*
yes	*58.2*

Source: Research findings

Table 4.3
Religious attitudes

	% in Total
Believe in God	
yes	*39.0*
no	*50.0*
no idea	*11.0*
Believe in Heaven	
yes	*32.2*
no	*54.1*
no idea	*13.7*
Believe in Hell	
yes	*19.9*
no	*69.9*
no idea	*10.3*
Being religious	
yes	*45.2*
no	*52.1*
no idea	*2.7*
practicing religious activities	
yes	*31.5*
no	*68.5*

Source: Research findings

Table 4.4
Social attitudes/norms

	% in Total
Trust in police	
yes	*74*
no	*10.3*
neutral	*15.8*
Trust in judicial system	
yes	*71.2*
no	*9.6*
neutral	*19.2*
believe in election in society	
yes	*79.5*
no	*8.2*
no idea	*12.3*
Integrity to society	
no	*28.8*
Yes	*71.2*
Society helpful to achieve aspirations	
yes	*60.3*
no	*7.5*
neutral	*32.2*
Care about neighbor behavior for recycling	
no	*44.5*
Yes	*55.5*
Care about neighbor perception of recycling	
yes	*16.4*
no	*39.7*
no idea	*43.8*

Source: Research findings

Table 4.5
Political attitudes

	% in Total
political view	
left	*52.1*
center or right	*30.1*
no idea	*17.8*
Participate in election	
no	*15.1*
Yes	*84.9*

Source: Research findings

Table 4.6
Personal traits

	% in Total
Being optimistic	
yes	*61.0*
no	*7.5*
neutral	*31.5*
future will be better	
yes	*46.6*
no	*13.0*
neutral	*40.4*
Happiness (scale of 1 to 10)	
3 to 5	*6.2*
6	*11.0*
7	*16.4*
8	*42.5*
9	*17.1*
10	*6.9*
Long term time preferences rate	
more than 50 percent	*40.4*
50 percent	*10.3*
40 percent	*6.2*
30 percent	*10.3*
20 percent	*14.4*
10 percent	*18.5*

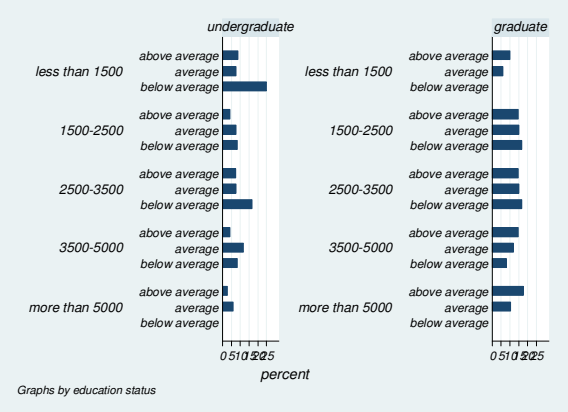
Source: Research findings

4.2. Environmental information and environmental attitudes

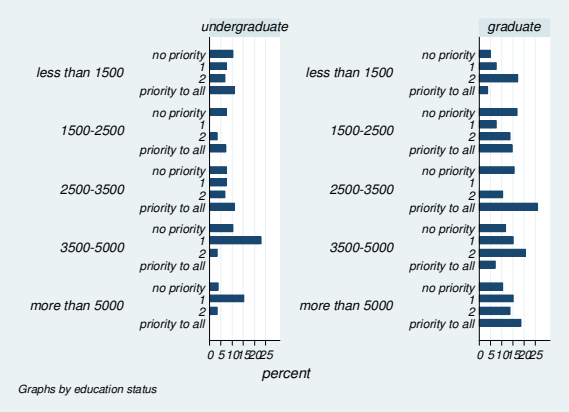
In this section we discuss the association between characteristics and environmental information and attitudes because some studies (Kaiser et al. 1999; Kollmuss and Agyeman 2002) suggest that environmental information and attitudes may have role in pro-environmental behaviour. We can illustrate and analyze associations among three categorical variables by applying cross tabulation. Below are graphs which demonstrate the relationship between selected characteristics of individuals, environmental information, and attitudes (which are quantified by prioritizing). Graph 4-1-a shows that "above average information" among undergraduates varied over income level, but among graduated respondents it does not fluctuate very much over income levels. Graph 4-1-b illustrates how income level influences prioritizing the environment differently subject to individuals' educational status. While the chance of giving absolute priority to the environment is reduced by the increase of income level for undergraduates but it has almost an increasing trend for graduated respondents.

Graph 4.1
Environment information/attitude, Income and Education status

4-1-a



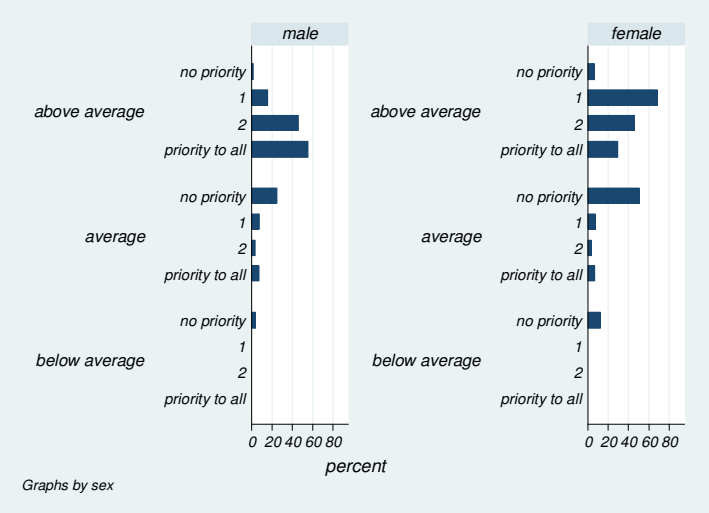
4-1-b



Source: Research findings

We can see the relation between environmental information and attitude in graph 4-2 by sex. For both groups (women and men) environmental attitudes are considerably less for low levels of environmental information. Instead, for higher levels of information, men show more favourable attitudes toward the environment compared to women. In another words, it seems the transformation of environmental knowledge to environmental attitude is stronger for men than for women.

Graph 4.2
Environment attitudes and Information by sex

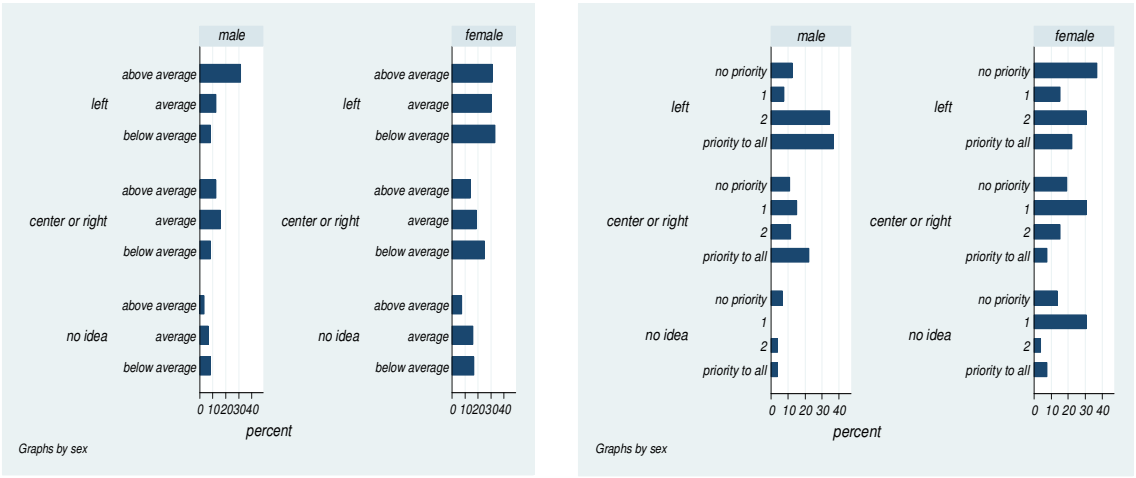


Source: Research findings

Political views also seem prominent as evidenced by graph 4.3. Males with left-wing affiliations clearly are more informed compare to right/centre-wing males and have more pro-environmental attitudes (i.e. they prioritize the environment more frequently). Left-wing women also are more informed about the environment compared to women with other political views, but this doesn't seem to translate into a higher prevalence of pro-environmental attitudes.

Graph 4.3
Environment information/attitude and political views by sex

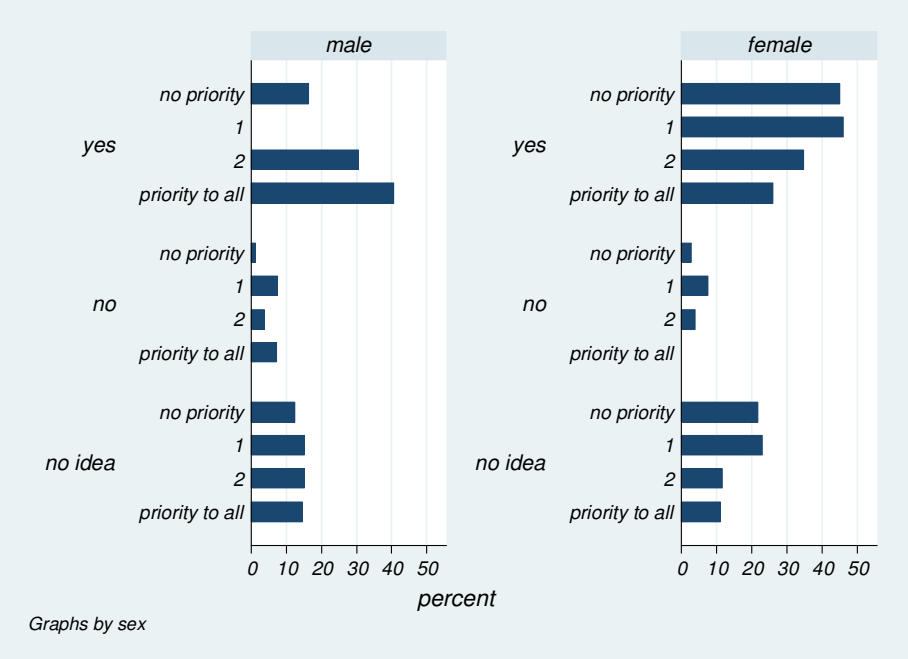
4-3-a **4-3-b**



Source: Research findings

Based on graph 4.4 male optimists more frequently exhibit pro-environmental attitudes compared to non-optimists but being optimistic doesn't have a clear influence on environmental attitudes for females.

Graph 4.4
Priority to environment and optimism by sex



In addition, being religious, a higher happiness score, and marital status don't have a clear relationship with information or attitudesregarding the environment.

4.3. Descriptive analysis of consumption behaviour

We already discussed environmental information and attitudes. In this section we briefly present a descriptive analysis of consumption behaviour in the three areas of food, recycling, and transportation and later in chapter five, the results of modelling of consumption behavioural will be provided.

Consumer theory is based on several assumptions such as that consumer's preferences are stable, and transitive. Moreover, in choice experiments we assume that consumers (respondents) can complete the CE without systematic error such as cognitive burden or getting tiered. We can assess these typical assumptions by internal validity tests (Alpizar et al. 2001: 21). Transitivity discussion is presented in this section and the result of stability test (which performed after model estimations) is provided in chapter 5.

We perform a transitivity test in our research in the following way. If a respondent rejected option A with cost C or time T in one choice set she should not accept it with higher cost or time (when other alternatives are the same). For example, if a respondent rejects an organic food basket with 97 euros compared to a non-organic food basket (as the baseline option) in his first choice set but accepts it with 116 euros compared to the same baseline option in next choice set, there is a violation of transitivity.

Food consumption choice

Respondents were asked to choose between organic and non-organic options for food with different attributes in four choice sets. Table (4.7) presents the results of the decisions made by the 146 respondents.

Table 4.7
Food consumption choice

	Choice set 1	*Choice set 2*	*Choice set 3*	*Choice set 4*	*Total*
Option A (Conventional food)	*85*	*66*	*103*	*109*	*221*
Option B (Organic food)	*61*	*80*	*43*	*37*	*363*
Change in demand for organic food	*-*	*19*	*-37*	*-6*	
Percentage of change in demand for organic food	*-*	*0.31*	*-0.46*	*-0.14*	
Percentage of change in price (health level)	*-*	*(1.00)*	*0.20*	*0.15*	
Elasticity of price(health) for organic food	*-*	*(0.31)*	*-2.31*	*-0.93*	

Source: Survey findings

In 37.8% of cases i.e. among all options for food choice (584 observation), respondents chose organic food over non-organic food. As the health effect of organic food increases, demand for it is raised. The health elasticity of demand, defined as the percentage change in demand divided by the percentage change in the 'effect on individual's health' status, is equal to is 0.31. While the average price elasticity of demand is greater in absolute value, equal to -1.62 (average of -2.31 and -.93). If we compare the changes attributed to price and health (move from choice set 1 to 2 and then to 3) we can conclude that almost half of the negative price effect has been compensated by health effect.

We test transitivity in the manner we explained above and did not find any violation to transitivity.

Recycling options

In order to observe how individuals realize the importance of recycling, respondents were asked to choose among recycling and not recycling. Recycling entails monetary costs and/or time costs. Table 4.8 shows the results of respondents' selections.

In 61% of situations (730 observations), recycling is selected versus not-recycling. The average price elasticity of demand for recycling is -0.86 (average of -0.28 and -0.57). The time elasticity of demand is -0.54. Both indicate a relatively inelastic demand for recycling that could be a sign of environmentally friendly behaviour in the proposed price and time cost range within the observed sample.

We test transitivity in above mentioned manner and found no sign of violation to transitivity for recycling CE.

Table 4.8
Recycling choice

	Choice set 1	*Choice set 2*	*Choice set 3*	*Choice set 4*	*Choice set 5*	*Total*
Recycling	*116*	*83*	*42*	*118*	*86*	*445*
Non-recycling	*30*	*63*	*104*	*28*	*60*	*285*
Change in demand for recycling	*-*	*-33*	*-41*	*-*	*-32*	
Percentage of change in demand for recycling	*-*	*-0.28*	*-0.49*	*-*	*-0.27*	
Percentage of change in price (time)	*-*	*1*	*0.86*	*-*	*(0.5)*	
Elasticity of price(time) for recycling	*-*	*-0.28*	*-0.57*	*-*	*(-0.54)*	

Source: Survey findings

Transportation choice

Table 4.9 shows the transportation choice of respondents among 4 options and baseline option (none of the options). The average price elasticity of demand for bike options is 0.3 (average of -0.2, 0.58 and -0.07) which is very small and unusually positive, however if we consider the context of the research which is Dutch cities (with all the infrastructure for bike use), and the absolute range of changes (12, 15, 17 and 21 euros per month) the small positive sign of price elasticity looks sensible and demonstrates that respondents don't prefer to change the bike option regardless of price increases due to other important attributes. The average time elasticity for bike demand is very high, -22.1 (the average of -36.8, -16 and -13.5) which illustrates the sensitivity of respondents to time cost compared to monetary cost.

We performed transitivity test for transportation CE and we find no indication of a strong violation to transitivity[1].

[1]- We found 3 cases of transitivity violation but owing to the number of attributes and options, this number is trivial.

Table 4.9
Transportation choice

	Choice set 1	*Choice set 2*	*Choice set 3*	*Choice set 4*	*Choice set 5*	*Choice set 6*	*Choice set 7*	*Choice set 8*
Bike	*100*	*96*	*103*	*101*	*98*	*52*	*36*	*27*
Tram or Tram+train	*22*	*23*	*21*	*22*	*26*	*36*	*29*	*26*
Car	*5*	*6*	*4*	*4*	*9*	*15*	*40*	*49*
E-car	*10*	*8*	*7*	*6*	*8*	*12*	*37*	*41*
None of them	*0*	*1*	*2*	*1*	*5*	*5*	*4*	*3*
Change in demand for bike	*-4*	*7*	*-2*	*-3*	*-*	*-16*	*-9*	*-4*
Percentage of change in demand for bike		*-0.04*	*0.07*	*-0.02*	*-*	*-0.47*	*-0.31*	*-0.25*
Percentage of change in price (time) for bike		*0.2*	*0.13*	*0.26*	*-*	*(1.25)*	*(1)*	*(0.67)*
Elasticity of price (time) for bike		*-0.2*	*0.58*	*-0.07*	*-*	*(-36.8)*	*(-16)*	*(-13.5)*

Source: Survey findings

Chapter 5
Results and discussion

In this chapter, consumption behaviour is modelled using the data has been discussed in the previous chapter. In each section, the results of modelling food choice, recycling, and transportation are discussed. In order to answer the research question, we examine the significance of environment attribute which is defined as "pollution" in the choice sets of CE in each of three areas food, recycling, and transportation. If the coefficient of that attribute appears significant, environmental concerns (pollution) could be an issue in consumers' minds when making decisions regarding consumption. Moreover, we uncover the determining factors of 'environmentally-friendly good/service' in the three areas mentioned above. As it is discussed in chapter 3 (i.e. methodology) choice experiments and Stata econometrics packages have been applied to estimate the model specified by equation (3-3). Estimations for choice experiments have been done by 'Alternative-Specific Conditional Logit' to be able to see not only the effect of attributes of choice but also to observe the individuals' characteristics and attitudes which form the demand for 'environmentally friendly good/service'

5.1. Food choice

Results for the estimation of parameters from applying a Mc-Fadden alternative-specific logit model for food choice is presented in table 5.1. In the upper part, parameters of attributes of food are demonstrated. Cost has an expected negative sign and shows that a 1 euro increase in the cost will decrease demand of organic food by 0 .97%. Also, health shows significantly positive effect, revealing that an increase in health level leads to an expansion of the demand for organic food as much as 9.1%. However, pollution is insignificant.

In the second part of the table, parameters of individuals' characteristics are provided. Based on the literature on consumption behaviour, characteristics are proposed in six categories. Looking at the general characteristics shows that females are more likely to buy organic food. Also age and education has positive effect, however, education coefficient is not significant. Surprisingly income has negative effect. Owning a home improves the chance of buying organic food by 13%. Moreover, for individuals who reported their health status as 'not good', the chance of buying organic food is 24% more than individuals with 'good' health status. It might owe to more health concerns among persons with 'not good' health, which leads them to tend to buy more organic food.

In the line with (Kaiser et al 1999b; Schultz and Oskamp 1996; Bartkus et al. 1999; Amen et al. 2012) who acknowledge that environmental knowledge can explain pro-environmental behavior, above average environmental information (compared to an average level) and being an environmental activist increase the chance of selecting organic food by 10 and 14% respectively.

Table 5.1
Food model estimation results

	Marginal effect[1]	*Std. Err.*
Cost	*-0.0096****	*(0.0019)*
Health	*0.0912**	*(0.0518)*
Pollution	*0.2784*	*(0.2328)*
General Characters		
Sex (female=1)	*0.193****	*(0.047)*
Marital status (single)	*0.055*	*(0.06)*
Marital status (other)	*-0.343****	*(0.028)*
Age	*0.036**	*(0.022)*
Household income/household size	*-0.035**	*(0.021)*
Owning home (yes=1)	*0.134***	*(0.058)*
Have kid younger than 2 years (yes=1)	*0.151*	*(0.114)*
Educational level (graduate=1)	*0.046*	*(0.051)*
Health status (not good)	*0.242***	*(0.096)*
Health status (very good)	*0.021*	*(0.059)*
Environmental info/attitude		
Environmental info (above average)	*0.101***	*(0.049)*
Environmental info (below average)	*-0.004*	*(0.092)*
Environmental activist (yes=1)	*0.14**	*(0.074)*
Political affiliation		
Political view (right or center)	*-0.071*	*(0.058)*
Political view(no idea)	*0.133**	*(0.076)*
Social attitudes		
Believe in election (no)	*-0.252****	*(0.063)*
Believe in election (neutral)	*0.066*	*(0.078)*
Personal traits		
Happiness score	*0.051***	*(0.021)*
Optimistic (yes)	*-0.358****	*(0.11)*
Optimistic (neutral)	*-0.322****	*(0.084)*
Religious views		
Being religious (no)	*-0.004*	*(0.05)*
Being religious (no idea)	*0.018*	*(0.143)*
Predicted probability (for organic food)	*0.3794*	*(0.2171)*
Log pseudo likelihood	*-308.1218*	
*Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*		

Source: research findings

A third group of variables regarding political views, illustrates that individuals with right and center political attitudes are less likely to buy organic food compared to left-wing persons, though this effect is not statistically significant. In-

[1] - Presented results are marginal effects for organic food compare to conventional (non-organic) food as baseline option.

dividuals who do not believe in elections in society are significantly less likely to buy organic food (25%) (This is similar to the findings of Aertsens et al 2009, who explores the role of social values in organic food buying). We also include personal traits and feelings in our food choice model, and find that the happiest individuals prefer organic food more; a 1 unit increase in happiness (on a scale from 1 to 10) raises the probability of organic food selection by 5 %. But optimists (compared to non-optimists) are less likely to buy organic food. Religious attitudes have not been shown to have any significant effect.

One may conclude that individuals do not consider the pollution level associated with a given food basket when they decide between organic and non-organic food while they do care about the relative cost and health benefits associated with food baskets. Additionally, in the line with literature on consumption behaviour focusing on general characteristics, environmental information, social attitudes, and personal traits influence demand for organic-food. However, political affiliation and religious beliefs have not been shown to have a significant influence on organic-food demand.[1]

We can also examine the ability of the model to predict the probability of organic-food choice. In our sample, the probability of organic food choice is 37.8% while it is predicted by our model as being 37.9%.

5.2. Recycling choice

Recycling models have been estimated using data from five choice sets to compare recycling vs. non-recycling behaviour. In this hypothetical case, recycling involves monetary or time cost so we observe how individuals' behaviour changes with regards to monetary and time cost. Results of applying a McFadden alternative-specific logit are illustrated in table 5.2. All attributes are significant. Increasing one euro in the cost or one minute in time will reduce the chance of recycling options, by 1.4 and 1.5 percent respectively. Increases in the pollution level will increase recycling chance by 6.3 %.

In recycling choice, sex is not significant; individuals who own their own homes tend more to do recycling by 9%. Income has an insignificant positive sign, but educational level appears to have a significant negative sign. The negative sign of education might be the result of the high cost of time (opportunity cost) of well-educated individuals. Below average or average environmental information compared to above average level of information decreases the chance of recycling, however, they are not significant. But being a self-identified environmental activist raises the chance of recycling by 19% significantly. Consistent with Neumayer (2004) point we found individuals with right or center political affiliation are less likely to recycling, compare to left wing individuals. In line with Zukin and Maguire (2004)'s the arguments regarding social norms, we included neighbours' behaviour and neighbours' perceptions

[1] - A stability test was performed in the manner suggested by Carlsson and Martinsson (2001:187). We divide the data into two parts and estimate models for each part then perform a Hausman test to compare estimated coefficients. Based on the result of this test we could not reject the null hypothesis that the coefficients were not different.So stability holds for parameters of food model.

(of respondents' behaviour) in the model. These variables come out significant with high a magnitude. Individuals, who mind if neighbours do not recycle, choose the recycling option with higher probability (17%). Also, individuals who do care what neighbours think of them regarding recycling (compared to individuals who don't care) tend to choose recycling 14.5% more frequently. This look has wide-ranging effects since even individuals who don't know what their neighbours think about recycling (compared to individuals who don't care) choose recycling with a higher probability (10.4%). Religious beliefs and personal traits have not shown to be significant.

While 'pollution' attribute is significant one may conclude that individuals do consider environmental issues in recycling behaviour.[1]

Presently, we examine the ability of the model to predict the probability of recycling. The probability of recycling in our sample is 60.9% while it is predicted by the model to be 61.1% with a standard deviation of 0.26.

[1] - Based on stability test in the manner suggested by Carlsson and Martinsson (2001:187) stability of parameters in recycling model holds.

Table 5.2
Recycling model estimation result

	Marginal effect[1]	*Std. Err.*
Cost	*-0.014****	*(0.0013)*
Time	*-0.0147****	*(0.0019)*
Pollution	*0.0629****	*(0.0038)*
General Characters		
Sex (female=1)	*0.023*	*(0.044)*
Marital status (single)	*0.052*	*(0.044)*
Marital status (other)	*-0.332*	*(0.221)*
Age	*-0.004*	*(0.018)*
Household income/household size	*0.002*	*(0.018)*
Have kid younger than 2 years (yes=1)	*-0.082*	*(0.107)*
Educational level (graduate=1)	*-0.185****	*(0.045)*
Owning home (yes=1)	*0.097***	*(0.047)*
Environmental info/attitude		
Environmental activist (yes=1)	*0.199****	*(0.044)*
Environmental info (average)	*-0.023*	*(0.047)*
Environmental info (below average)	*-0.056*	*(0.102)*
Climate change is highly serious (yes)	*0.057*	*(0.048)*
Political affiliation		
Political view (right or center)	*-0.105**	*(0.054)*
Political view(no idea)	*-0.047*	*(0.071)*
Social attitudes/norms		
Believe in election (no)	*-0.05*	*(0.096)*
Believe in election (neutral)	*0.028*	*(0.072)*
Care if neighbor not recycling	*0.177****	*(0.048)*
care about what neighbor think of you if you do not recycle (yes)	*0.145****	*(0.053)*
care about what neighbor think of you if you do not recycle (don't know)	*0.104***	*(0.047)*
Personal traits		
Optimistic (yes)	*-0.095*	*(0.081)*
Optimistic (neutral)	*-0.002*	*(0.096)*
Religious views		
Being religious (no)	*-0.058*	*(0.044)*
Being religious (no idea)	*-0.076*	*(0.165)*
Predicted probability (for recycling)	*0.6115*	*(0.2618)*
Log pseudo likelihood	*-297.932*	
*Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*		

Source: research findings

[1] - Presented results are marginal effects for recycling compare to not-recycling as baseline option.

5.3. Transportation choice

Transportation data is based on 8 choice sets. This choice experiment is different than the previous (food and recycling) in terms of the overall number of options (the former experiments included paired choices and we compared an option with a baseline option but in transportation choice experiments 5 options were offered in each choice set). Thus we can see the cross-effects as well as the own-effect. Cross-effects show the substitution between options[1]. Among the five options (including the baseline alternative) we present parameters of bike and tram-train transport, which are environmentally-friendly options in table 5.3. In the upper part of the table, the estimated marginal effect of attributes (own effect and cross-effects) are provided. The cost own-effect appeared with a negative sign which shows that when cost increases demand for the option will reduce; however, it is insignificant. The non-significance of cost could be originated from the context. The Netherlands facilitates using bike transport by providing infrastructure, so in 57% of cases in our sample respondents choose bike transport even when we increased bike cost by 25, 40 and 70% compared to its initial cost (i.e. 12 euros/month) in the choice experiment design. Moreover, it should not be ignored that, no matter how we raised bike cost up to 70%, the absolute amount of cost was not large (i.e. 21euros/month) especially relative to the cost of other options.

The cross effect of cost for all options are positive i.e. by increasing the cost of, for instance, bike transport, the demand for tram, car and e-car increases; however, all of them are insignificant. The own effect of pollution comes out negative and significant, which shows that the options with more pollution will lose demand. The cross effect of pollution shows if the pollution of one option increases then the demand for other options will increase, significantly.

Time has a significant negative sign just the same as the own effect. An increase of a minute of time of bike transport reduces bike transport demand by 1%. For tram/train transport, it is reduced by 0.8%. Instead, cross effects demonstrate that increases of a minute for the bike option will significantly expand demand for car by 0.2%, for electric car by 0.1%, and expand demand for tram/train by 0.7%. So by each extra minute time for bike transport, its demand reduces and raises tram demand more than car demand i.e. extra demand shifts more to tram compared to car. On the other hand, by increasing of one minute for the tram option, bike demand raises by 0.7% which is considerably more than increases in car demand (0.07%).

In our model, safety and comfort attributes receive an unexpectedly negative sign and these effects are insignificant. It might be due to a higher number of cases in which individuals chose bike transport, and bike transport is by definition of a lower comfort and safety level compared to car and e-car.

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[1] - For instance, cost cross-effect of bike and car shows while the cost of bike increases (and subsequently the demand for it reduces) how much the demand for car will raise due to substitution effect.

Table 5.3
Transportation model estimation result

	Bike				Tram-train			
	Bike (own effect)	car	e_car	tram_train	bike	car	e_car	tram_train (own effect)
Cost	*-0.00019*	*0.00004*	*0.00002*	*0.00012*	*0.00013*	*0.00001*	*0.00001*	*-0.00015*
Pollution	*-0.3172***	*0.0662***	*0.0396***	*0.2113***	*0. 2114***	*0.0221***	*0.0132***	*-0.2468***
Time	*-0.0103****	*0.0021****	*0.0013****	*0.0068****	*0.0068****	*0.0007****	*0.0004****	*-0.0079****
Safety	*0.00015*	*-0.00003*	*-0.00002*	*-0.0001*	*0.0001*	*0.00001*	*0.00001*	*-0.00012*
Comfort	*-0.0118*	*0.0024*	*0.0014*	*0.0078*	*0.0078*	*0.0008*	*0.0004*	*-0.0092*
		Marginal effect	S.E.			Marginal effect	S.E.	
General characters								
Sex (female=1)		*-0.059*	*(0.039)*			*-0.011*	*(0.035)*	
Age		*-0.04***	*(0.018)*			*0.019*	*(0.015)*	
Marital status (single)		*-0.782****	*(0.047)*			*-0.174****	*(0.042)*	
Marital status (married/partnered)		*-0.787****	*(0.079)*			*-0.167***	*(0.073)*	
Educational level (graduate=1)		*0.085***	*(0.041)*			*-0.057*	*(0.036)*	
Have kid younger than 2 years (yes=1)		*-0.067*	*(0.085)*			*0.043*	*(0.078)*	
Household income/household size		*-0.015*	*(0.016)*			*0.021*	*(0.014)*	
Travelling abroad		*-0.027*	*(0.067)*			*-0.056*	*(0.064)*	
Owning home (yes=1)		*0.049*	*(0.043)*			*-0.025*	*(0.037)*	
Health status (not good)		*-0.139**	*(0.083)*			*0.148**	*(0.078)*	
Health status (good)		*-0.048*	*(0.043)*			*-0.015*	*(0.036)*	
Environment info/attitude								
Environmental info (above average)		*-0.071**	*(0.04)*			*-0.044*	*(0.033)*	
Environmental info (below average)		*0.004*	*(0.082)*			*-0.172****	*(0.034)*	
Climate change is highly serious (yes)		*0.104****	*(0.039)*			*-0.04*	*(0.033)*	
Environmental activist (yes=1)		*0.14****	*(0.048)*			*-0.034*	*(0.045)*	
Social attitude								
Integrity to society		*0.038*	*(0.044)*			*-0.054*	*(0.039)*	
Political view								
Political view (left)		*0.206****	*(0.054)*			*-0.088**	*(0.047)*	
Political view (right or center)		*0.044*	*(0.058)*			*-0.068*	*(0.046)*	
Religious view								
Being religious (no)		*0.158****	*(0.038)*			*-0.129****	*(0.034)*	
Being religious (no idea)		*-0.03*	*(0.161)*			*-0.18****	*(0.033)*	
Predicted probabilities		*0.5812*	*(0.2687)*			*.1822*	*(0.1037)*	
Log pseudo likelihood				*-860.21*				
*Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*								

Source: research findings

We also can see how characteristics of individuals change the option of bike and tram. Sex and income are not significant factors in choosing bike or

tram. Married/partnered and singles compared to 'other' marital status are less likely to choose bike by 7.8% and are less likely to choose tram by 1.7%, as well. But income has a negative sign on biking though it is insignificant. Education has positive significant effect on choosing bike, though it has negative (insignificant) effect on tram choice. Since health can be a factor to impede using bike, self-reported health status is included in the model. Individuals who described their health as 'not good' compared to 'very good' as a reference level, are less likely to choose bike transport (-13.9%); while 'Not good' health increases the chance of using tram/train, as much as 14.8%, significantly. Above average environmental info reduce probability of choosing bike transport (-7%) and below average reduces the chance of using tram by 17%. Being environmental activist or high pro-environmental attitudes increase chance of choosing bike by 1%. Social attitudes variables (integrity to society) reveal an insignificant positive effect for bike and insignificant negative effect for tram. Consumers with left-wing political affiliations are 21% more likely to choose biking and 8% are less likely to choose tram. Additionally, non-religious individuals are 16% more likely to use bike transport and 18% less likely to choose tram.

Based on the results of this model, we can conclude that consumers consider the environment when making decisions about transportation choice. Moreover, the substitution effect between two environmentally friendly goods (bike and tram) is higher than the substitution effect between other options (for instance tram and car) which indicates that an increase in the cost and time of one environmentally-friendly option (for instance bike transport) mainly leads to an increase in the demand of the other environmentally-friendly choice (tram), and outweighs any effect to other relatively more polluter options. This point highlights the result that individuals consider environmental issues in their transportation choice.[12]

We can assess the prediction ability of the model. Predicted probability of bike is 58.1% while the probability in sample is 56.8%. Predicted probability for tram, is 18.2% while probability in sample is 18.9%.

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[1] - In order to test the violation to the IIA for transportation (IIA could be defined for choice experiments with more than two options.) two similar tests (Hausman and Suest) are applied. These tests compare if two estimators are statistically not different. We performed both tests but the data fails to meet the asymptotic assumption. This problem is very common for the IIA test as Cheng and Long (2007) in a paper on the IIA test '... conclude that tests for IIA assumption that are based on the estimations of a restricted choice sets are unsatisfactory for applied work'. So we are not able to test the IIA assumption statistically in this research with the available statistical packages.

[2] - Based on stability test in the manner suggested by Carlsson and Martinsson (2001:187) stability of parameters in transportation model holds.

Chapter 6
Conclusion

Our research objective is to examine whether individuals consider environmental issues in their consumption behavior and to identify characteristics which cause pro-environmental behavior in food consumption, recycling, and transportation. In economic literature, consumption behavior determinants are limited to prices and income, whereas in sociology and socio-psychology literature, consumption is defined more broadly to the point where Zukin and Maguire (2004) called consumption an *institutional* bridge between economics and cultural institutions and Stern (2000) suggested a value-belief-norms framework for consumption studies. We identified six groups of characteristics which shape consumption behavior in socio-psychological literature: general characteristics (e.g. sex, age), environmental knowledge/attitudes, social attitudes/norms, personal traits, political affiliations, and religious beliefs.

On the other hand, the socio-psychological literature on consumption behavior has failed to produce quantitative models for predicting consumer behavior. We tried to fill this gap by combining microeconomic consumer theory together with the wider range of characteristics and attitudes identified in socio-psychological texts. In order to elicit consumers' preferences we utilized choice experiment methodology. Choice experiments have been suggested by environmental economists as a superior method to observe consumption behavior. Three choice experiments were designed to illustrate pro-environmental behavior in three areas of food consumption, recycling, and transportation choice. In CE design, we illustrated a hypothetical market in which environmentally friendly goods are presented which is relatively burdened by time and monetary costs[1]. We designed 4 paired choice sets to compare organic food[2] with conventional food (as the baseline option); 5 paired choice sets to compare recycling versus non-recycling (as the baseline option), and 8 choice sets with 5 options including bike, tram/train, car, e-car, and none of the options (as the baseline option).

We implemented a web-based questionnaire for a well-educated population who are more generally informed about climate change. We presented the questionnaire in two parts. The first part was devoted to questions on characteristics and attitudes including all the above mentioned groups, and in the second part our choice experiments were presented. Of the 1750 invitation emails, 146 completed responded with usable answers. Appling a McFadden attribute-specific conditional logit model, which permits capturing the parame-

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[1] - Our choice sets were designed such that monetary and time cost were weighted against environmentally friendly goods to give the burden of proof against showing decision-making in favour of the environment to isolate choices made for the sake of environment and not owing to any economic incentives; otherwise what we captured could have been an ambiguous combination of reactions to market prices and pro-environmental sentiments.

[2] - Organic farming can potentially decrease emissions of greenhouse gases (ITC 2007; FAO 2011)

ters of attributes of each good alongside of individuals' characteristics, estimation was carried out.

The result of the food CE showed that in 38% of cases, organic food vs. non-organic food (as the baseline option) was selected. Pollution attributes appeared insignificant while other attributes, cost and health, came out statistically significant, showing that individuals do not consider the environment when making decisions regarding food consumption. However, they do decide based on cost and health effects. In addition, we found females, individuals who own their own home, and who are not in good health are more likely to buy organic food. Also, age and educational level have positive effect of organic food choice; however, education coefficient is not significant. Income appeared with unexpectedly negative sign. Above average environmental information, being environmental activist, and positive attitudes to society, and having a higher degree of happiness, as well, increase the chance of buying organic food. We found optimistic individuals are less likely to buy organic food. This could be the result of their underestimation of the health effect of organic food compared to conventional food.

Based on recycling choice experiment results, in 61% of cases individuals have chosen recycling vs. not-recycling. Cost, time and pollution appeared significant. Due to the significance of the pollution attribute, it could be concluded that individuals consider the environment in decision-making about recycling. We found individual who own their home and self-identified environmental activists tend to recycle more. Income had an insignificant positive effect but education came out with a negative effect. It could be caused by the high cost of time (opportunity cost) of well-educated persons. Additionally, along with similar studies of social norms (or peer pressure), our results showed a significant strong role of norms in determining recycling behavior. Individuals with right or center political afflation were less likely to recycle but these effects were not statistically significant.

In transportation CE, We found time and pollution significant and cost insignificant. The reason of non significance of cost may be the context of the study. In the Netherlands due to geographical features (a flat country) and infrastructure which facilitates biking, a majority of the sample have chosen biking even when we increased up to 70% the biking cost within choice sets. Also safety and comfort attributes were insignificant. Since transportation CE had a multiple options design, we could observe cross-effects (substitution effect) as well as own effects. Cross effects were observable when substitution between two environmentally friendly goods (bike and tram) were stronger than the substitution effect between the other options (for instance tram and car) which implies that an increase in the cost and time of one environmentally-friendly option (for instance bike) mainly leads to an increase in the demand of another environmentally-friendly choice (tram) compared to the relatively more polluting options. This point highlights the result that individuals consider environmental issues in their transportation choice.

In order to test internal validity we applied transitivity and stability tests. Given the results of the transitivity and stability tests we can conclude that the internal validity of all three choice experiments holds.

Reviewing the results of these choice experiments shows we cannot aggregate pro-environmental behavior because individuals behave differently in dif-

ferent areas of consumption. Also, influential factors in determining pro-environmental behavior in each area are different. But we can draw some general remarks. First, individuals consider environmental issues in some areas of consumption behavior. Second, characteristic factors which shape pro-environmental behavior are not limited to general characteristics but include a wide range of environmental, social, and political attitudes. These attitudes can be prominent in the absence of economic incentives or even when market costs work against environmentally friendly goods and services, and thus they should not be ignored in policy design regarding the environment. Third, the time cost compared to monetary cost may play a stronger role against pro-environmental behavior when an environmentally-friendly behavior is time consuming. The policy implication of this result is that it is important to consider the time reduction of environmentally-friendly goods and services in policy design.

Appendices

Appendix 1

Other variant of Choice modeling

Contingent ranking which is done by ranking a series of options and has the advantage of providing more statistical information that leads to tighter confidence intervals. But the problem of cognitive difficulty in this case is more serious. Many researchers found unreliability and inconsistency across ranks especially when they are ranked with low priority.(Ben-Akiva et al, Chapman and Staelin, Hausman and Ruud cited by Hanley et al 2001:442) Moreover, while the status quo is chosen, other following choices should be discarded to stay consistent with the welfare theory structure. Therefore depending on these two statements; this technique could be consistent with utility maximization theory. (ibid)

Contingent rating is presented to respondents to rate proposed options and does not involve direct comparison, so this technique is not consistent with welfare theory and extracting WTP is not possible. That's why rating the exercise is less applied in environmental valuation except in marketing studies. (ibid: 444)

Paired comparisons are when there are a set of two choices and respondents specify the strength of their preferences on a numeric basis. It provides more information compared to just choosing an option but it has the same problem of contingent rating of inconsistency with the utility maximization framework. (ibid)

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