Determinants of sustainable consumption in France: the importance of social influence and environmental values

Nathalie Lazaric°, Fabrice Le Guel *, Jean Belin°°, Vanessa Oltra°° Sébastien Lavaud °° and Ali Douai°

° University of Côte d'Azur, CNRS, GREDEG, °° GREThA CNRS, University of Bordeaux, * RITM EA 7360 University of Paris Sud, Sceaux, France.

Abstract:

Our article provides empirical findings for France related to sustainable consumption and what triggers sustainable behavior. We investigate various potential key explanatory variables including social influence and environmental values, among others. Our main contribution is to survey and to analyze a set of consumption practices (rather than the examination of single practices as in most of the literature) for a large sample of more than 3,000 households. The survey was conducted in France in 2012. We use cluster analysis to identify and describe the different consumer behavior profiles. This methodology identifies three clusters of consumers characterized by diverse concerns related to the environmental impact of their consumption. Based on these clusters, ordered Logit models are fitted on three levels of sustainable consumption behaviors. Our results emphasize the importance of age, gender, education, environmental concern and peer effects for spurring sustainable consumption. We discuss the role of peer pressure as a major determinant. Learning about sustainable behavior from peers seems to complement changing environmental values and stimulate pro-environmental behavior. Our findings show that local externalities clearly outweigh the global consequences related to the promotion of sustainable consumption behaviors that is, the ability to learn in small networks is critical for the promotion of trust and the exchange of ideas and practices.

JEL codes: Q58; D23; D11, D91; R21.

1. Introduction

Sustainable consumption is critical for reducing society's carbon footprint and complying with the Paris Agreement on Climate Change. Citizens are concerned increasingly about the environmental impact of their practices and the products they consume. Eurobarometer shows more specifically that French citizens are keen to engage in sustainable consumption, with 78% showing some awareness of the environmental impact of their daily consumption (European Commission 2011). Projection of their self-image when they buy sustainable products or engage in sustainable practices seems to be very positive across European consumers, with 80% agreeing that family and friends would achieve a positive image from their commitment to sustainability (European Commission 2013: 22).

Research on this topic has focused on daily practices across countries related to the supply of natural resources and the satisfaction of basic needs (Berkholz et al. 2010; Goldsmith and Goldsmith 2011), which are subject to social influences: 'individual and family behaviour is heavily influenced by socialization in the home and neighbourhood, learned by observation' (Goldsmith and Goldsmith 2011: 117). A large interdisciplinary literature, which includes sociology, behavioral economics, evolutionary economics, psychology and anthropology, provides insights into the impact of social influences on sustainable behavior (Axsen and Kurani 2012; Cordes and Schwesinger 2014; Jackson 2005; Henrich and Boyd 1998; Witt 2011; Babutsidze and Chai 2018; Chai et al. 2015). According to this literature, pro-environmental behavior is increased by conformity to the norm (Nolan et al. 2008; Cecere et al. 2014; Müller and van Wangenheim 2017; Baum and Gross 2017) and is influenced by the preferences of others (Bertrandias and Elgaaied-Gambier 2014; Gifford and Nilsson 2014; Johnstone and Hooper 2016; Seyfang 2009, Lucas et al. 2018).

In the context of environmental values, Buensdorf and Cordes (2008) demonstrate the extent to which hedonistic values vis-à-vis new 'green' goods need to evolve to make these goods attractive and to include indirect advantages to compensate for potential inconveniences. In other words, consumption habit

changes depend as much on the economic values of different consumers groups as on the capabilities of certain groups to convey new values and co-opt new consumers, suggesting the potential role of learning about sustainable consumption (Witt 2011). This process of change will be long and uneasy since there is a noticeable gap between concern for the environment and a propensity for positive action in this direction (Gifford et al. 2011; Chai et al. 2015).

In France, the scant empirical evidence on social influence and environmental values focuses on particular behaviors (e.g., recycling, see Kirakozian 2016; coffee machine purchases, see Bertrandias and Elgaaied-Gambier 2014, seafood products, see Lucas et al. 2018) and uses small samples (Sanches 2005). Articles on social influence, highlight the role of peer persuasion (see, among others, Babutsidze and Cowan 2014; Biswas and Roy 2015; Cordes and Schwesinger 2014; Salazar and Oerlemens 2016; Gershoff and Johar 2006). However, while there is some empirical evidence related to specific behaviours, such as green mobility and adoption of solar thermal systems (Axsen et al. 2013; Woersdorfer and Kaus 2011), we lack a broad view of sustainable consumption. For exceptions, see Salazar et al. (2013) and Baum and Gross (2017).

The present study tries to fill this gap by providing empirical findings on sustainable consumption related to a large range of daily practices, and identifying the main determinants of sustainable behavior in France. The study was financed by the French environmental agency (ADEME) with the aim of identifying different profiles among French green consumers and the main influencing factors. In 2012, we conducted an original survey of a representative sample of 3,005 French households to collect data on the main determinants of sustainable consumption and specific behaviors or choices concerning energy equipment and its maintenance, use of washing machines, food purchases, transport and waste recycling. One of the study's main contributions is a large-scale database that includes information on various consumption practices.

Based on the literature, we investigated social influence and environmental values as potential key explanatory variables. Following the recommendations in Caeiro et al. (2012) and Barcellos et al. (2011),

we use cluster analysis to describe a potential sustainable behavior profile, and test ordered logit models to evaluate the role of social influence and environmental values at three levels (low medium and high) of sustainable consumption behaviors. This cluster methodology identifies significant factors and groups of consumers without their a priori definition, and distinguishes three groups of consumers, characterized by diverse levels of concern about the environmental impact of their consumption.

The paper is structured as follows. Section 2 presents the conceptual framework and generates a set of testable hypotheses. Section 3 describes the methodology used to collect the data and build the sustainable consumption behavior clusters. Section 4 presents the econometric model and the estimation results. Section 5 concludes with some policy implications.

2. Theoretical framework and hypotheses

In this section, we review the main determinants of sustainable consumption identified in the literature, such as gender, education, age, income and environmental values and, also, peer effects and social norms. The use of socio-demographic variables to investigate sustainable consumption has been discussed in the literature. Some researchers find these variables questionable: 'given how much the effect varies by behavior it is difficult to provide sweeping conclusions about the effect of socio-demographic characteristics on environmental impact' (Baum and Gross 2017: 71); others highlight that they may overestimate some personal representations, such as worldviews and ideologies, leading researchers to be cautious about their application (Hornsey et al. 2016: 622). Among these surveys, only a few empirical results relate to France, which prompted our investigation. Diamantopoulos et al. (2003: 477) acknowledge that socio-demographic variables and their impacts are relatively complex, making it necessary to consider various aspects of environmental consciousness. Thus, our survey questionnaire asked about several behavioral dimensions. We also examined socio demographic determinants alongside social influences and environmental values in order to explain their potential weight in spurring

sustainable consumption behaviors**.** In the next sub-section, we discuss the main potential determinants and hypotheses that we test using our dataset.

2.1. Socio-demographic determinants

First, we consider the classical socio-demographic factors, such as gender, education, age and income, that effects which have been widely documented in the sustainable consumption empirical literature.

Gender effects

Numerous studies have investigated the effects of gender on sustainable consumption and several suggest that, in general, women are more willing than men to engage in sustainable consumption behaviors (Roberts 1993; Straughan and Roberts 1999). Women have been observed to be more socially oriented and less selfish than men and, also, more influenced by conformity and social pressure. Thus, individual personal status influences the social networks of households and needs to be considered. In the context of demand for eco-labelling on fish (Brécard et al. 2009), it has been shown that the most environmentally aware group and the 'typical green' fish consumer is a well-educated young woman, which shows that gender, age and education all matter. Empirical work suggests, also, that women tend to report stronger environmental attitudes than men, and this applies mostly across countries (Scannell and Gifford 2013), although in China, no gender difference was identified (Xiao and Hong 2010). This leads to the following hypothesis:

H1. Gender has a strong impact on sustainable behavior and being female has a positive impact on sustainable consumption behaviors.

Education

Knowledge and education are important drivers of sustainable behavior (Klineberg et al. 1998; Scannell and Gifford 2014). Greater knowledge about and awareness of environmental issues influence individual actions, and a higher level of education tends to favor sustainable consumption behaviors (see Brécard et

al. 2009: 115). Despite some contradictory links between education and environmental consciousness, it has been suggested that higher-educated individuals have a better understanding of the issues involved and, hence, are more concerned about sustainable consumption (Diamantopoulos et al. 2003; Gilg et al. 2005). This assumption is tested in our study through the following hypothesis:

H2. A higher level of education has a positive influence on sustainable consumption behaviors.

Age

The relationship between age and energy consumption has been discussed extensively in the literature with contrasting results. For instance, Chancel (2014) argues for a strong generational impact in France, showing that the baby-boomer generation tends to emit more carbon dioxide (CO2) than the younger generations. However, other studies report more pro-environmental behaviors among older compared to younger people (Swami et al. 2011; Pinto et al. 2011; Gifford and Nilsson 2014). In their profile of sustainable consumers, a group of British researchers found an older mean age among committed environmentalists (Gilg et al. 2005: 491). In generation Y, Hume (2010) notes significant interest in environmental issues not necessarily endorsed by concrete action and greener behaviors. Thus, evidence of a demographic bias in environmental awareness is mixed and there is no clear consensus on whether young, middle-aged or older consumers are more likely to express a higher level of environmental awareness. In a recent study, Morrison and Beer (2017 :81) suggest that 'the relationship of environmental awareness and age takes an inverse U shape: awareness rises with age, reaches a peak in early to late middle age and then declines with the oldest age groups'.

Based on these empirical findings, we hypothesize that:

H3. Age has a significant impact on sustainable consumption behaviors and being younger may have a negative effect on sustainable behavior.

Income

The results of investigations into the relationship between income and sustainable consumption are similarly not consensual. In essence, while wealthier consumers tend to exhibit a higher tendency to consume eco-friendly and healthy products, they also consume more overall, which tends to increase their carbon footprint. For example, while cost does not play a significant role in Switzerland (Tanner and Kast 2003), in a survey of Dutch households, the least sustainable consumption patterns applied to the high-income group and young couples (Gatersleben 2001). Several researchers suggest that both the specific relationship between income and sustainable consumption and the structural forces driving consumption can create damaging and confusing links between wants and needs (Sanne 2002; Witt 2011). For instance, Martinsson et al. (2011: 23) find 'that the cost of energy was less of a driving force in higher incomes households which have fewer economic incentives'. In addition, a desire to show a standard of living can promote unsustainable consumption (*à la Veblen*) or new ways of consuming that are 'greener' (Buensdorf and Cordes 2008; Viscusi et al. 2011).

To take account of income effects, we hypothesize that:

H4. Higher income may have a negative impact on sustainable consumption.

2.2 Social influences

Purchase decisions are not just individual economic decisions. Social influences play a part and consumers make decisions and act in specific social contexts (Granovetter 1985). The literature shows that consumer choices may be determined, in part, by the information carried by the people in their social environment, rather than being the result of purely autonomous and individual analysis of the available information. In fact, each consumer interacts with actors from different social groups (family, friends, co-workers, etc.), which implies that these social networks and their respective proximity have a simultaneous influence on consumer choices, but to varying degrees. Based, notably, on the concepts of bounded rationality and social conventions, some recent developments in cognitive science and related work in behavioral economics and neuro-economics (see, e.g., Camerer 2007) provide some additional insights in this

context. According to Simon (1982), rationality is bounded due to the inability of individuals, in uncertain contexts, to collect all the available data and render them consistent (Maréchal and Lazaric 2010). In this case, consumers use heuristics, that is, simplified models that capture the main features of the problem but not its complexity. These heuristics are important, but, as Simon (1982) points out, are just the first step in decision making. Other steps include identification with the group, which is one of the most interesting behavioural patterns that shape perceptions and appear to be a solution to individuals limited cognitive abilities. Identification with the group leads to the adoption of particular behavioral patterns that are considered consistent with the group's goals and values (Simon 1982). We can distinguish two different types of social influence: conformity bias and peer effects, both of which are discussed below.

Conformity bias

Conformity to others' behaviors via adherence to social norms is the subject of several studies examining the role of social influence on low carbon products and practices (e.g., Axsen and Kurani 2012; Salazar et al. 2013; Goldsmith and Goldsmith 2011). Conformity refers to interpersonal influence based on the individual's perception of what others are doing or expecting. Salazar et al. (2013) argue that, in most studies of sustainable consumption, the concept of social norms is defined and applied in too general a manner as scrutiny and influence of others, and does not point specifically to the influence of particular social groups (such as peers, family, friends, etc.). Social norms are 'shared perceptions of ideal forms of behavior to which individuals try to conform' (Abbott et al. 2013: 11) and individual awareness and acceptance of them are likely to modify individual behaviors. Along similar lines, Ruiz de Maya et al. (2011), in a study of eight European countries, show the important weight of cultural and social norms in organic food purchase, and the significance of network externalities on such purchasing practices, suggesting that 'if relevant referent groups adopt organic food, their behaviour may be imitated by others: the higher the number of consumers, the higher the social pressure to buy' (Ruiz de Maya et al. 2011: 1774).

As Salazar et al. (2013) emphasize, it is important to differentiate among the dimensions of social influence. In social sciences, a number of studies discuss different social effects such as social learning, imitative or herd behavior, conformity bias and peer effects. These concepts are all used interchangeably

at times, although they correspond to different social effects. Conformity bias refers mainly to imitative or herd behaviors. Xiong et al. (2016: 7) suggest that conformity bias and imitation are 'the individual's tendency to behave along with the trend that is created by the mass populous, regardless of their own beliefs'. Due to a kind of mimetic effect, which aligns behavior, herd behavior and conformity bias do not necessitate social exchanges. In such situations, individuals base their actions only on the observed actions of others and tend to imitate the overall trend.

To evaluate the extent to which conformity bias (imitation and herd behavior) influences sustainable consumption practices, we test the following assumption:

H5. Conformity bias is a significant determinant of sustainable consumption behavior.

Peer effects

Sustainable products or practices are not just alternatives analogous to the conventional product or practice; rather they exhibit different characteristics and provide different payoffs and externalities. Consequently, consumers may lack the information required to evaluate the various alternatives and, in this context, learning from others appears to be an important factor that needs to be considered when studying the choices of consumers in relation to sustainable products. When consumers imitate the behaviors of significant others in their social environment, they are influenced by information from different social groups, which might induce a change in the environmental impact of their consumption (Salazar et al. 2013).

Recent empirical findings show the difficulty experienced by consumers in putting into practice their initial intentions in relation to environmental issues. This 'value-action' gap is illustrative of the problems involved in implementing sustainable consumption (Gifford et al. 2011; Chai et al. 2015). In a context of bounded rationality, learning from small interactions is a first step, and recurrent interactions with peers may reduce the value-action gap (Babutsidze and Chai 2018: 292). Indeed, friends and others may appear to provide the most reliable and trusted information on the choices among different alternatives (Babutsidze and Cowan 2014: 152).

Social learning assumes that people learn from and are influenced by their social environment (observational learning) and psychological factors (cognitive learning) (Salazar et al. 2013). In other words, individuals base their decisions, at least partly, on the experience of their peers, which implies direct social interactions among individuals. Thus, individuals' actions are not based only on the well-known contagion model of technological adoption, as depicted in Rogers (2003), but on an exchange of local information about the 'telling', a behavior that appears to be distinct from 'showing' (Babutsidze and Cowan 2014). Also, this type of social learning is more difficult to measure in practice. While a large part of the literature agrees that, generally, consumers and citizens learn from their experience (learning by doing) or from observation of others or both (Hodgset and Barret 2010), measures of this peer effect are subject to so called 'projection bias': respondents may believe that their social network members tend to behave as they, themselves, do, and to project their own behaviour onto others (Gershoff and Johar 2006). The presence of this potential projection bias, which has been discussed in the literature (Manski 1993; Videras et al. 2012), means that our claims regarding causal effects should be cautious, and that we cannot make too many inferences about the sole weight of social influences since, much of the time, social effects and self-selection effects may be confounding (as shown, notably, by Fowler and Christakis 2008). To disentangle these influences, Videras et al. (2012) observe diverse types of social ties on economic pro-environmental behaviors, especially neighbors, co-workers and relatives, which are not substitutes and may be activated in different situations according to the local problem requiring resolution or the sustainable practices that need to be activated. In this context, peer effects are defined as 'the various influences on taking a specific action that an individual receives from other individuals in the same group' (Xiong et al. 2016: 2). These effects create local network externalities on consumption, generated by the increasing returns from information (Katz and Shapiro 1985): being surrounded by people who have adopted new consumption behaviors and new practices reinforces the willingness to adopt similar behaviors, through a local imitation effect. Consumers have social referents that include: (i) the individual's primary social networks (family, friends); and (ii) the individual's wider community to which

the consumer feels some commitment and belonging (without the need, necessarily, for direct interactions or relations with community members).

To evaluate the extent to which peer effects influence sustainable consumption practices, we test the following assumption:

H6. Peer effects linked to local social networks (family and friends) have a positive influence on sustainable consumption behavior.

This hypothesis focuses on local externalities, while H5 refers to global imitation and herd behavior effects.

2.3 Environmental values

Discussions about how to develop a more sustainable relationship with the environment frequently invoke values. This concept is related to the evolutionary theory and social sciences literature on altruism. The underlying assumptions in these works are that values influence our collective and individual decisions and that, if our values change, our decisions will be better for the environment (Dietz et al. 2005). In our framework, we relate variations in pro-environmental consumption behaviors to a set of individual level factors, including the role of environmental values. Values can be defined as the broad guiding principles, which orient one's life (Schwartz 1992) and are able to explain the likelihood that individuals engage in a range of environmentally relevant behaviors (Baum and Gross 2017). Most work on individual environmental values uses survey data, where values are measured by self-reported behaviors, behavioral intentions or other expressions of concern for the environment. The environmental section in the World Values Survey proposes several ways and measures to capture environmental values, based on the responses to a series of questions about beliefs and priorities in the context of environmental protection, membership of an environmental NGO and willingness to donate money for environmental protection. The responses to all these questions are used to assess people's concern for the environment.

In this paper, the presence of altruistic and/or biosphere values (see Stern and Dietz 1994) – that is, the weight attached to outcomes affecting other individuals and the broader environment – is approximated

by the individual's willingness to support environmental protection by making a monetary donation. This strategy is based on the framework developed by Stern (2000) and Stern et al. (1999), to capture environmentally significant individual behavior. They propose the notion of Value-Belief-Norm (VBN), a theory that attempts to generalize Schwartz's norm-activation theory of altruism (applied widely to pro-environmental behavior). VBN theory tries to explain individual environmental behaviors within the categories of environmental activism, policy support, private-sphere behaviors (including private consumption) and environmental citizenship. These behaviors are interdependent and mutually reinforcing and, generally, are predicted by different patterns of norms, beliefs and values. For example, environmental citizenship includes 'petitioning on environmental issues and contributing to environmental organizations' (Stern 2000: 409). VBN theory argues that these behaviors result from the activation of personal norms (N) – that is, a sense of moral obligation or feelings of personal obligation linked to one's self-expectations – which create a predisposition for pro-environmental actions. In turn, personal norms are activated by beliefs (B) about the threats to individual values (V) posed by environmental conditions and how the individual can act to reduce these threats. Those individuals who value other species (biosphere values) or the health and well-being of other individuals (altruistic values) will demonstrate more concern over environmental conditions that threaten those valued objects. It follows that the link between values and environmental citizenship in our framework (willingness to contribute financially to a scheme dedicated to the protection of the environment) is mediated by beliefs about environmental conditions and their impact on what the individual values and the activation of feelings of personal obligation to act. Note that VBN theory accounts for the fact that the role of this kind of general environmentalist predisposition can vary greatly according to contextual factors (e.g., social norms, regulations, etc.), personal capabilities (socio-demographic attributes) and the diversity of goods considered in our study.

For instance, the literature on social influence and sustainability in the household context (see, e.g., Goldsmith and Goldsmith 2011; Welsch and Kühling 2009) suggests the presence of an imitation process and distinctive behaviors according to diverse practices or goods (organic food, green electricity, investments in solar energy systems). Indeed, environmental attitude and social imitation depend largely

on the salience and visibility of these different goods (Babutsidze and Chai 2018). For example, adoption of solar energy systems may be motivated more by 'a desire to communicate to others individual pro-environmental choices, whereas green electricity adoption exhibits other kinds of behaviors' (Welsch and Kühling 2009: 168), suggesting that the relationship between sustainable behaviors and environmental values may be complex. Within this perspective, we can go further and identify a cluster of sustainable practices and their link to the environmental values endorsed by consumers.

Drawing on this literature, we include in our survey a proxy for environmental values (measured by the willingness to support protection of the environment by a monetary donation) and test the following assumption:

H7. Sustainable consumption behaviors are influenced positively by environmental values, that is, consumers' level of environmental concern.

3. Survey methodology, data description and clustering

3.1 Survey

Our empirical study is based on an original dataset, built on the responses to a large scale telephone survey. The size of the sample as well as the design of an extended set of questions to capture sustainable consumption practices and patterns are important contributions of our study. Quota sampling was used to identify a large population of French households representative of sex, age, geographical region, town area and socio professional category. See Appendix on quota sampling (Table 4) and sample description (Table 6). The project was funded by the French energy and environment agency (ADEME) and aimed at identifying and characterizing green consumers.

Our survey differs from previous investigations by including a large and representative sample of 3,005 French households[1] and focusing not on a specific product or technology, but on sustainable consumption and sustainable practices more broadly. As already argued, sustainable consumption behaviors refers to actions and practices, such as purchase of organic food and eco-friendly equipment, collecting and sorting waste and energy saving, among diverse consumers. According to Bartiaux (2008) and Halkier (2001), consumption practices are characterized by compartmentalization in relation to environmental aspects. Mental compartmentalization allows some consumers to keep 'green reflections out of certain practices' (Halkier 2001: 39) and to exhibit a kind of self-defense against not acknowledging the systematic outcomes of daily practices and decision making especially, if they contradict the norms of comfort and convenience in everyday living (Shove 2007; Lynas 2007). To achieve a broader view, we chose to address sustainable consumption behaviors linked to diverse practices such as food, washing machine purchase and use, waste sorting and recycling practices, energy saving practices and transportation.

To capture these dimensions, the survey asked respondents for their criteria[2] when purchasing dairy products and domestic equipment, such as a washing machines and detergent, in relation to their waste sorting and energy saving practices, and transportation (i.e., private car/public transport)[3] (see Appendix Table 5). We also asked about socio-economic and demographic aspects. The survey included 85 questions[4] and a huge set of variables characterizing consumers and their consumption behaviors.

Specifically, the survey includes three main sets of variables:

1 The phone survey was conducted by professional interviewers from CREDOC (French Research Centre for the Study and Observation of Living Conditions). The household sample was derived using the quota method and phone numbers were chosen randomly in 40% of cases, and taken from the phone book in the other 60%; 15% of the interviews were conducted on cell phones and 85% on landline phones.

2 Interviewees were asked to rank the degree of importance of each proposed purchase criterion on a 1 to 4 scale.

3 The choice of dairy products and washing machines was motivated by the suggestion in the literature on consumption that choice practices differ between current consumption goods and durables, the former being based more on habit and the latter involving a bigger investment and more thorough information search.

4 The survey was in the French language and is available upon request from the authors.

- **socio-economic and demographic variables:** gender, age, education, income;
- **sustainable consumption variables** related to purchase criteria for dairy products purchases and washing machine, as well as waste collecting and sorting habits, food consumption, use of washing machine and energy practices related to transport means;

- **environmental values** measured by a proxy variable based on the responses to a question about consumer willingness to contribute financially to a scheme aimed at protecting the environment. The originality of our approach lies in the fact that it is based on the consumer's vote for one of the three main programs of 'Fondation de France' (a well-known and reputable public foundation financing projects in various fields) via the following means:
  - at the end of the survey, respondents were asked about the possibility of making a donation, taken from our research budget, to the 'Fondation de France' program that received the most votes;
  - The three programs, concerning the environment, social aspects and health, were described briefly allowing the household to indicate its preference for one of them (they could choose none of them).

  These votes were used to proxy for their environmental concern and values. This is a declarative and relative proxy since the donation was not paid by the respondents and the choice was from among three programs. However, to a certain extent, this methodology avoids any possibility of income being either an influence or a constraint. It allows better identification of values and acts as a relevant signal of the prioritization of environmental concerns among others options;
- **social influence**: to capture peer effects and imitation, we included a question about behaviors in the respondent's social neighborhood: 'In your social neighborhood, do you have family, friends and colleagues whose

care for the environment is evident in their consumption behaviors? If yes, to what extent?'[5] Another question asked about conformity bias: 'Under what conditions would you be willing to change your consumption behavior to more eco-friendly behavior?' The response options were: if I am given more information; if it does not cost me more; if it does not reduce my quality of life; if everybody does it; or not willing. Respondents choosing the item 'if everybody does it' as the main trigger of their consumption behavior are considered to be driven mainly by imitation and conformity bias.

3.2 Clustering

According to Caeiro et al. (2012: 79), there is no standard metric or standardized data sets to distinguish sustainable consumption. This encouraged us to identify significant factors and groups of consumers without a priori defining them or arbitrarily weighting some variables. Given that consumption practices were surveyed using qualitative variables based on a series of questions asking consumers to evaluate (on a ranked discrete scale) some purchase or consumption criteria, we obtained a very large set of qualitative variables that were subjected to multiple correspondence analyses and clustering. This methodology identified three groups (clusters) of consumers characterized by more or less sustainable practices that were not defined a priori.

Since our variables are mainly qualitative, we use Multiple Correspondence Analysis (MCA) to identify a typology of individuals based on certain correspondence criteria such as two individuals being more similar because they have more responses in common. Analysis of the factor axes allows us to include the set of qualitative variables in a small number of numerical variables. We apply Ascending Hierarchical Classification (AHC) to the axes corresponding to the biggest part of the total information (total inertia corrected), which allows us to remove redundant information. On the basis of the quantitative results of the MCA, we used Euclidian distance to calculate the resemblance among individuals. For our aggregation criterion, we chose the Ward criterion, which minimizes inertia losses. Finally, we identified three clusters of

5 The possible responses to the second part of the question were: none; a minority; approximately 50% of my social neighborhood; the majority of my neighbors.

individuals corresponding to three different profiles of sustainable consumption behaviours (Figure 1 and Table 1). These clusters emerged entirely from the dataset and were not a priori defined. Thus, the path towards sustainable consumption is not linear, but is characterized by three exclusive clusters (binary coded and ordered as usual with this methodology). We use ordered logit models for their evaluation in terms of the factors that have a significant influence on the probability of belonging to the most sustainable cluster (i.e., the group encompassing the highest number of sustainable consumption practices).

Figure 1: The three clusters of Sustainable consumption

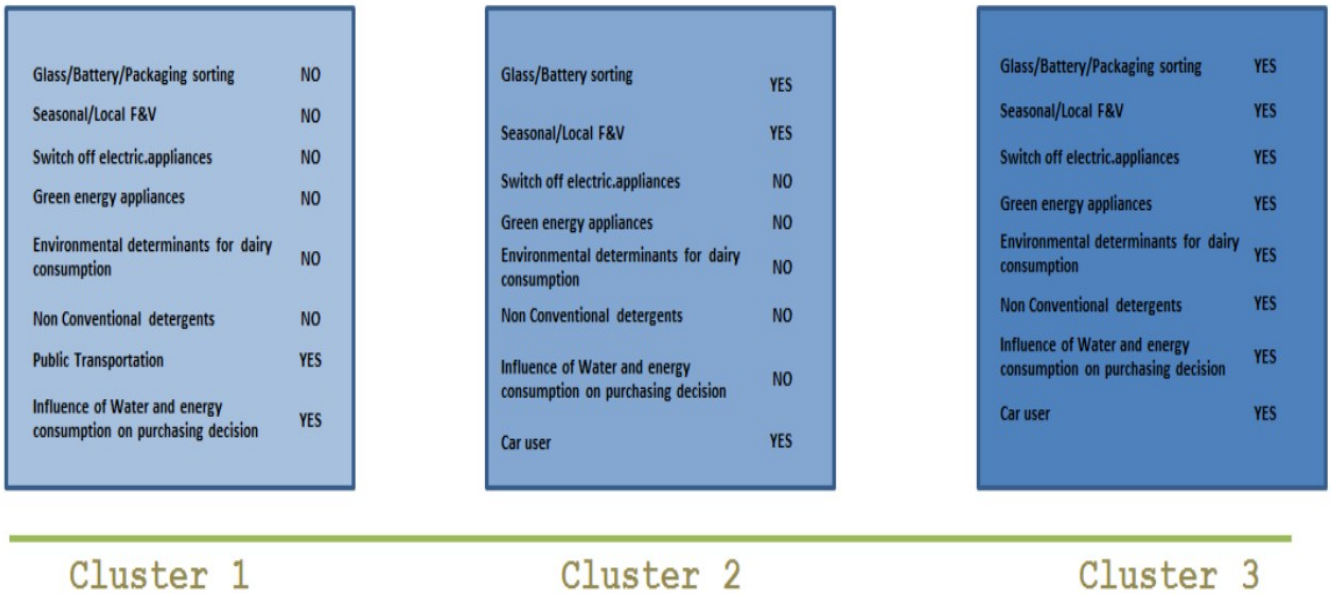


Table 1: Descriptive statistics of the three sustainable consumption behavior clusters

Clusters of Sustainable Consumption Behaviors	n	Freq
Cluster 1 - Low sustainable consumption practices	936	31,15%
Cluster 2 - Medium sustainable consumption practices	874	29.08 %
Cluster 3 - High sustainable consumption practices	1 195	39,77%

The first cluster gathers individuals who demonstrate mostly unsustainable practices (31% of the sample): they are unlikely to sort their waste or pay specific attention to purchasing seasonal or locally-grown fruit and vegetables. Labelling (organic or locally produced) on food and detergent has no impact on their

purchasing decisions. They show some concern over saving water and energy - both influence their purchasing decisions. However, they do not switch off electronic devices when not in use and do not have renewable energy appliances (solar thermal equipment, geothermic energy, etc.). The only sustainable behavior identified is collective transportation or cycling or walking to the shops.

The second cluster (29% of the sample) is more environmentally conscious and has some routine practices related to glass and battery recycling, and purchase of local and seasonal fruit and vegetables. However, energy saving is not a concern, and transportation is mainly by private car.

The third cluster, which includes nearly 40% of the sample, comprises individuals who indicated three out of four of our sustainable practices. Simple routinized behaviors are backed up by switching off electric devices at the socket, recycling batteries and use of alternative laundry products. They also regularly purchase local and seasonal fruits and vegetables, and their purchasing decisions are determined by organic and locally produced labelling. Organic labelling is an important motivation for their laundry detergent choices and they pay attention to energy and water consumption when choosing a new washing machine. This is consistent with their day to day energy saving efforts and investment in renewable energy devices. However, this virtuous behavior is undermined by use of a private car as their main transport means.

4. Econometric models and results

An econometrical analysis was conducted to identify the main determinants of sustainable consumption behaviors (i.e., cluster determinants). The three clusters were binary coded and are intrinsically ordered. Then, employing an ordered logit model, we evaluate the factors with a significant influence on the probability that sustainable consumption practices are greater than or equal to those in a given cluster (for each level of sustainable consumption). In other words, our ordered logit regression model tests our outcome variable, ordered from cluster 1 (least sustainable households) to cluster 3 (most sustainable

households). As predictors, we use socio-economic and demographic variables, environmental values and social influence variables.

The general specification of the econometric model is as follows (see Cameron and Trivedi 2005). For individual *i*:

$$Y^*_i = X'_i\beta + Z'_i\alpha + P'_i\delta + \varepsilon_i$$

where Y^*_i is an unobserved measure of the intensity of sustainable consumption practices; *X is* the vector of the socio-economic and demographic variables; Z is the vector of the environmental values variable; *P* is the vector of the social influence variables; β, α, and δ are the respective coefficient vectors; and ε_i, is the error term that is logistically distributed. Descriptive statistics for the covariates X, *Z*, and *P* are provided in Appendix Table 6.

For very low Y*, the level of sustainable consumption is poor ('Low sustainable consumption practices' and 'cluster 1' in Figure 1 and Table 1). For $Y^*>\alpha_1$, sustainable consumption improves to moderate levels ('Medium sustainable consumption practices' and 'cluster 2' in Figure 1 and Table 1). For Y*>α2, sustainable consumption becomes strong ('High sustainable consumption practices' and 'cluster 3' in Figure 1 and Table 1). α1, …, αm-1 are the m-1 threshold parameters.

Then, for j=1 to m (m=3) ordered alternatives (corresponding to clusters 1, 2 and 3) we define:

$$Y_i = j \text{ if } \alpha_{j-1} < Y^*_i \leq \alpha_j$$

Estimation of the ordered logit model aims to fit the coefficient vectors β, α, δ, and the threshold parameters α_1 and α_2 by maximizing the log likelihood function with Pr (Y_i = j).

Our main results are presented in Tables 2 and 3, which report the ordered logit regression and marginal effects for sustainable consumption practices. To check the robustness of our estimations, in Table 2 we fitted several versions of the ordered logit model from models (1) to model (3). Model (1) includes all the regressors; models 2 and 3, respectively, exclude the education and income variables. According to the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC), models 1 and 2 could be

used alternatively as the study model. However, we note that, in model (1), the variable for education and the income category 'More than €4,000' are non-significant while, in model (2), if the variable education is not regressed, the category 'More than €4,000' becomes significant , and, in model (3), the variable education, becomes significant if the income variable is not regressed. A potential explanation for this might be that higher education and high income are correlated. To check for this, Appendix Table 7 presents the tetrachoric correlations among the explanatory variables. It shows a tetrachoric correlation of 0.62 (the highest value in the table) between higher education and high income (more than €4,000 per month). Therefore, and because we know little about the potential impact of demographics on sustainable consumption practices, we estimate the education and income variables separately in models 2 and 3 (which improves the results since the level of statistical significance increases for these variables) and use models 2 and 3 as alternative study models in Table 3. Overall, this empirical strategy does not affect our conclusions, as shown by the P-values in Table 2.

Table 2: Ordered logit regression on sustainable consumption

Variables	Model 1	Model 2	Model 3
Demographic variables			
H1 – Gender (=1 if Female)	0.309***	0.309***	0.255***
	(4.32)	(4.32)	(3.61)
H2 – Education (=1 if BA and higher degree)	0.135		0.302***
	(1.59)		(3.90)
H3 – Age (Ref. Cat. <25 y.o.)			
25-34 y.o.	0.387***	0.384***	0.471***
	(2.63)	(2.61)	(3.23)
35-44 y.o.	0.999***	0.990***	1.095***
	(6.78)	(6.73)	(7.50)
45-54 y.o.	1.181***	1.164***	1.287***
	(7.92)	(7.83)	(8.71)
55-64 y.o.	1.273***	1.256***	1.372***
	(8.30)	(8.21)	(9.01)
>65 y.o.	1.270***	1.253***	1.296***
	(8.88)	(8.79)	(9.10)
H4 – Income (Ref. Cat. €2000 - €4000 and N.R.)			
Less than €1200 per month	-0.577***	-0.601***	
	(-4.84)	(-5.08)	
€1200 - €2000 per month	-0.431***	-0.450***	
	(-4.60)	(-4.83)	
More than €4000 per month	0.158	0.211**	
	(1.54)	(2.18)	
H5 – Conformity (=1 if conformity with norms)	0.101	0.091	0.095
	(1.41)	(1.28)	(1.33)
H6 – Peer effects (Ref. None of my neighborhood)			
A minority around my neighborhood	0.400***	0.409***	0.419***
	(4.55)	(4.67)	(4.79)
About half of my neighborhood	1.132***	1.145***	1.143***
	(10.75)	(10.90)	(10.90)
The majority of my neighborhood	1.330***	1.349***	1.314***
	(10.57)	(10.77)	(10.49)
H7 - Environmental values (=1 if env. friendly)	0.385***	0.388***	0.359***
	(3.54)	(3.56)	(3.32)
Threshold parameter α_1	0.780***	0.736***	1.004***
	(5.19)	(4.99)	(6.89)
Threshold parameter α_2	2.148***	2.103***	2.356***
	(13.87)	(13.82)	(15.59)
P-Value	0.000	0.000	0.000
Pseudo R2	0.070	0.070	0.063
Log likelihood	-3043.191	-3044.464	-3065.318
BIC (Bayesian Information Criterion)	6222.519	6217.056	6242.749
AIC (Akaike Information Criterion)	6120.382	6120.927	6158.637
Number of observations	3005	3005	3005

Note. P value: ***p < 0.01, **p < 0.05, *p < 0.1. Z test statistics reported in parentheses. The dependent variable is a measure of the intensity of sustainable consumption practices, which determines the probability to belong to a cluster, ordered from cluster 1 (least sustainable households) to cluster 3 (most sustainable households). The category "Age < 25 y.o." is the reference category for Age. Categories '€2000 - €4000' and 'Non-Response' are the reference categories for Income; 'None of my neighborhood' is the reference category
for Peer effects.

Table 3: Average marginal effects for sustainable consumption practices (based on models 2 and 3, Table 3)

	Based on Model 2			Based on Model 3		
Variables	**Cluster 1 Low sustainable consumption practices (1)**	**Cluster 2 Medium sustainable consumption practices (2)**	**Cluster 3 High sustainable consumption practices (3)**	**Cluster 1 Low sustainable consumption practices (4)**	**Cluster 2 Medium sustainable consumption practices (5)**	**Cluster 3 High sustainable consumption practices (6)**
	(	(	(	(	(	(
Demographic variables						
H1 – Gender (=1 if Female)	-0.059***	-0.006***	0.065***	-0.049***	-0.005***	0.054***
	(-4.36)	(-3.43)	(4.36)	(-3.63)	(-3.06)	(3.63)
H2 – Education (=1 if BA and higher degree)				-0.058***	-0.006***	0.065***
				(-3.91)	(-3.29)	(3.92)
H3 – Age (Ref. Cat. <25 y.o.)						
25-34 y.o.	-0.074***	-0.007**	0.081***	-0.091***	-0.009***	0.101***
	(-2.63)	(-2.29)	(2.62)	(-3.25)	(-2.71)	(3.23)
35-44 y.o.	-0.190***	-0.019***	0.209***	-0.212***	-0.022***	0.234***
	(-6.91)	(-4.08)	(6.81)	(-7.73)	(-4.33)	(7.62)
45-54 y.o.	-0.223***	-0.022***	0.246***	-0.249***	-0.026***	0.275***
	(-8.08)	(-4.38)	(7.98)	(-9.05)	(-4.60)	(8.93)
55-64 y.o.	-0.241***	-0.024***	0.265***	-0.266***	-0.028***	0.293***
	(-8.48)	(-4.49)	(8.40)	(-9.36)	(-4.70)	(9.27)
>65 y.o.	-0.240***	-0.024***	0.265***	-0.251***	-0.026***	0.277***
	(-9.13)	(-4.57)	(9.02)	(-9.48)	(-4.68)	(9.36)
H4 – Income (Ref. Cat. €2000 - €4000 and N.R.)						
Less than €1200 per month	0.115***	0.012***	-0.127***			
	(5.12)	(3.79)	(-5.13)			
€1200 - €2000 per month	0.086***	0.009***	-0.095***			
	(4.86)	(3.70)	(-4.87)			
More than €4000 per month	-0.040**	-0.004**	0.044**			
	(-2.18)	(-2.07)	(2.18)			
H5 – Conformity (=1 if conformity with norms)	-0.018	-0.002	0.019	-0.018	-0.002	0.020
	(-1.28)	(-1.25)	(1.28)	(-1.34)	(-1.30)	(1.34)
H6 – Peer effects (Ref. Cat. None of my neighborhood)						
A minority around my neighborhood	-0.079***	-0.008***	0.086***	-0.081***	-0.008***	0.090***
	(-4.71)	(-3.52)	(4.70)	(-4.84)	(-3.61)	(4.83)
About half of my neighborhood	-0.220***	-0.022***	0.242***	-0.221***	-0.023***	0.244***
	(-11.30)	(-5.21)	(11.54)	(-11.30)	(-5.29)	(11.55)
The majority of my Neighborhood	-0.259***	-0.026***	0.285***	-0.255***	-0.026***	0.281***
	(-11.10)	(-5.32)	(11.45)	(-10.77)	(-5.40)	(11.13)
H7 - Environmental values (=1 if env. friendly)	-0.074***	-0.007***	0.082***	-0.070***	-0.007***	0.077***
	(-3.58)	(-3.04)	(3.58)	(-3.33)	(-2.89)	(3.33)
Number of observations	3005	3005	3005	3005	3005	3005

Note. P value: ***p < 0.01, **p < 0.05, *p < 0.1. Z test statistics reported in parentheses. The coefficients represent the Average Marginal Effects (AME) of a given explanatory variable on the probability of each of the outcomes of the ordinal variable. The ordinal dependent variable considered is a measure of the intensity of sustainable consumption practices ordered from cluster 1 (least sustainable households) to cluster 3 (most sustainable households). AMEs are calculated across all individuals with their observed levels of covariates. The category "Age < 25 y.o." is the reference category for Age. Categories '€2000 - €4000' and 'Non-Response' are the reference categories for Income; 'None of my neighborhood' is the reference category for Peer effects.

Tables 2 and 3 are organized according to assumptions H1 to H7 formulated in Section 2. Some of the explanatory variables, such as gender, education, conformity and environmental values, are dichotomous, while age, income and peer effect are polytomous. For each of these variables, we set

the reference category in line with the literature. The dichotomic variable Gender takes the value 1 if the respondent is female (0 otherwise). Similarly, the variable Education take the value 1 if the respondent has a 'BA and higher degree' (0 otherwise). The reference category for the variable Age is 'Age < 25 y.o.' For the variable income, the categories €2000-€4000 (the average income in France is more than €2,000 per month) and 'Non-Response' are the reference categories since non-responses for income are NMAR (Not Missing At Random). The dichotomic variable Conformity takes the value 1 if the respondent is conforming to norms and 0 otherwise. 'None of my neighbourhood' is the reference category for peer effect and the variable Environmental values takes the value 1 if the respondent shares environmental values (0 otherwise).

Table 2 shows that, with the exception of the variable conformity (to norms), all other regressors tested in the ordered logit model have a significant influence on sustainable consumption practices. Therefore, the estimates in Table 2 are consistent with our hypothesis.

The Average Marginal Effects (AME) for models 2 and 3 in Table 2 are reported in Table 3. Marginal effects are first computed for each individual (with their observed covariate levels), then averaged across all individuals (which differs slightly from the Marginal Effects at the Mean (MEM) computation method). Note that we estimated both AMEs and MEMs, which showed very similar values. However, we retained the AMEs since the literature suggests that this value is superior (Wooldrige 2010).

The regression results in Table 3 highlight several interesting outcomes. We find support for the first four hypotheses of a significant impact of gender, education, age and income on sustainable consumption behavior. AMEs provide a tangible indication of the size and importance of these variables in terms of their impact on each category of the ordinal dependent variable, from low (Cluster 1) to medium (Cluster 2) to high (Cluster 3) sustainable consumption practices. Thus, holding all the other variables constant, marginal effects for the variable gender show that, on average, females are about 5.9 percentage points less likely than males to have low sustainable consumption practices (column 1), and about 6.5 percentage points more likely to have high

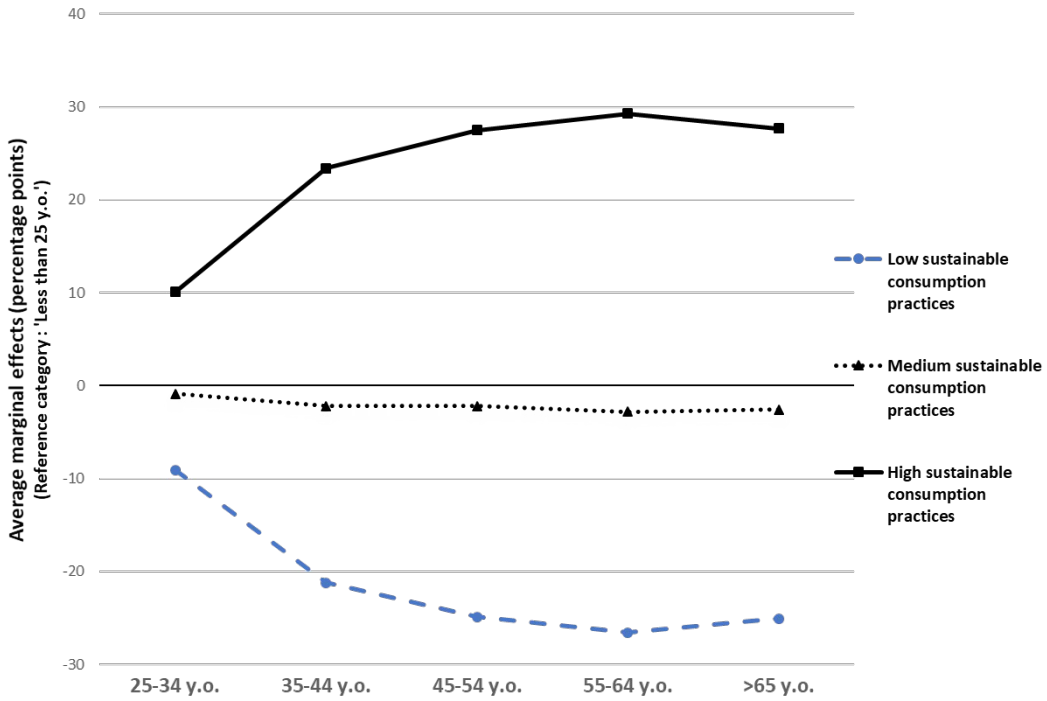
sustainable consumption practices (column 3). The gender effect is very significant and stable in the models tested (regardless of the inclusion of education or the exclusion of the variable income in econometric model 3, columns 4, 5 and 6). This confirms that being female has a positive impact on the probability of adopting sustainable consumption behavior. For example, in our sample, we observe that females tend to be more concerned than men by the environmental quality of their food. This result is in line with previous work, which shows that women report a stronger environmental attitude towards sustainable consumption.

Interestingly, we note that AMEs show almost perfect symmetry between the extreme clusters (i.e., cluster 1 *versus* cluster 3). For example, in absolute terms, the AME of the variable Gender is 5.9 percentage points versus 6.5 percentage points. This applies to all the AMEs in Table 3 which, in absolute terms, are consistently slightly lower for cluster 1 compared to cluster 3. This might indicate that the clusters are well defined and that cluster 2, with AME close to zero, plays a 'pivotal role' between low sustainable consumption practices and high sustainable consumption practices. Put another way, clusters 1 and 3 are discriminating, thus (except for the variable income because the reference category is set to the mean income), the signs of the AME in Table 3 will be negative for cluster 1 and positive for cluster 3. Similarly, education (bachelors or higher degree) has a positive impact on the probability to adopt high sustainable consumption behavior (6.5 percentage points, Table 3, column 6) but a negative impact on the probability to adopt low sustainable consumption behavior (5.8 percentage points, Table 3, column 4).

In our sample, the effect of age is significant and positive. Setting the reference category to under 25 years, all the coefficients are significant and the impact of age on the probability of adopting high sustainable consumption behavior is positive (Table 3, models 2 and 3, columns 3 and 6). The probability of adopting sustainable consumption behavior increases continuously with age up to the 55 to 64 years age group. More precisely, the AMEs in Table 3, model 3, columns 4 to 6 and the reported values in Figure 2, show an inverse U-shaped pattern between age and high sustainable

consumption practices (and, symmetrically, a U-shaped pattern between age and low sustainable consumption practices).

Figure 2: Average Marginal Effects by age of respondent and level of sustainable consumption practices



Thus, sustainable consumption practices may increase with age, reach a peak in late middle-age (55-64 y.o.) and decline among the oldest age groups. These findings are in line with the results in the literature showing a slightly higher mean age of green consumers (Gilg et al. 2005), and are in line with Morrison and Beer (2017) who suggest an inverse U-shaped relationship between environmental awareness and age.

When regressed without the variable education, income seems to be significant for all income categories, given the reference category of €2000-4000 per month, which corresponds to the average income in France. The results show that a households with income below the French average income (€2000-4000 Euros per month) tend to adopt low sustainable consumption practices (column 1, from 8.6 to 11.5 percentage points for income categories €1200-2000 and less

than €1200 Euros respectively), while households with higher than average income tend to adopt high sustainable consumption practices (column 3, 4.4 percentage points). However, extensive tests show that income effects become less significant if the reference category changes. For example, if the reference category is 'less than €1200 per month', the AMEs for the category €1200-2000 per month are no longer significant. This phenomenon may be due to missing responses for the variable income. The reference category for the variable income includes 'Don't know' or 'Refuse to reply' responses in about 7.7% of cases. It is generally difficult to infer why individuals may decide not to respond; it could be due to unemployment status or to belonging to the highest income category. Thus, our conclusions about the impact of income on sustainable consumption practices require some nuance.

In contrast, the results for social influence strongly confirm hypothesis H6 (variable peer effect), but do not validate hypothesis H5 (variable conformity). We should clarify that the results related to our proxy for conformity bias indicate that defining oneself as driven mainly by imitation and conformity bias has no impact on sustainable consumption behaviors. On the contrary, peer effect is positive, very significant and robust whatever the econometric model estimated (adding or removing regressors). More specifically, the regression results emphasize that the peer effect variables are among the most influential in the model. It seems that individuals whose close social network (family and friends) practices sustainable consumption related to food, energy saving, washing machine purchase and recycling, are more likely to adopt such behaviors and to belong to Cluster 3, this effect increasing with the size of the green neighborhood. More precisely, given the reference category 'none in (my) social neighborhood care for the environment', the change in the probability to adopt high sustainable consumption practices when a minority, about half and the majority of (my) neighborhood care for the environment, increases from 8.6 to 24.2, to 28.5 (column 3) percentage points, respectively. Symmetrically, while all other variables are held constant and given the reference category 'none in (my) social neighborhood care for the environment', the change in the probability to adopt low sustainable consumption practices decreases dramatically from 7.9, to

22 and 25.9 percentage points (column 1) if a minority, about half and the majority of (my) neighbourhood, respectively, care for the environment. Our conclusions are in line with the AMEs estimated in model 3 (columns 4, 5, 6). This result provides strong support for the importance of local network externalities and peer effects as sources of social learning, information exchange and diffusion of sustainable consumption practices. The greener the local neighborhood, the more likely the consumer will be influenced by and will imitate the behavior in this neighborhood.

Finally, in relation to consumers' environmental concerns (variable 'environmental values'), we observe a significant positive impact on the probability to adopt sustainable consumption behaviors (8.2 percentage points, column 3), validating hypothesis H7. Indeed, consumers who chose to donate to the 'Fondation de France' environmental programs are more likely to belong to Cluster 3. These results confirm the intuition that environmental concern triggers sustainable consumption.

5. Discussion and conclusion

Our empirical findings highlight the importance of age, gender, education and, to some extent, income, environmental concern and peer effects, as significant determinants of sustainable consumption. Based on a large and original French survey of sustainable consumption practices, we highlight new trends, notably the importance of age among socioeconomic variables, the role of environmental awareness and social influences, and the strong significance of peer pressure, which was the highest scoring influential variable tested in this study (Table 3, column 3)[6]. Thus, hypotheses H1, H2 and H3 are confirmed. The findings for H4 are less robust due to non-response bias, while H5 is not supported although H6 and H7 are. These results provide new insights for policy makers.

6 And the second highest scoring influential variable in Table 3, column 6.

First, we observe the significance of some socio demographics variables (especially age) for spurring sustainable consumption. While this is not a novel finding (Gilg et al. 2005), we demonstrate some potential limits to the effect of age and show that the effect may decline for ages over 65 years. Among the socio demographic variables, we observed positive effects on sustainable behavior of education and being female, which is in line with the literature (Brécard et al. 2009). More interesting, is the effect of income. Belonging to the low-income group has a negative effect on the chances of adopting sustainable behaviors, which suggests that policy makers should focus on increasing social equity among this group and should implement specific tools to reduce income inequality. Concern for the environment would seem to be a 'luxury', especially for low income groups that struggle to adjust their budgets to the economic constraints. In this context, sustainable consumption appears to be of secondary importance compared to other issues, although our conclusions are moderated to an extent by potential non-response bias.

For social influence, we found peer effects (H6) to be important for promoting sustainable consumption and changing consumption patterns in social groups (Vermeir and Verbeke 2008), but found no effect of conformity bias on sustainable consumption. This result extends the findings from a behavioral experiment that investigated the very significant weight of peer pressure and its limits as exemplifying social learning biases or 'small world' effects (Salazar et al. 2013: 178). Our findings also confirm some preliminary qualitative research (Bartiaux 2008; Axsen and Kurani 2012) and provide new robust results related to peer pressure, which complement prior findings. For instance, Bartiaux (2008) underlines the notion that sustainable consumption seems to remain within the acceptability limits of the individual's social environment and requires the social approval of the individual's close network such as family and friends. In this context, new consumption practices and preferences are more likely to be diffused via informal communication and learning in small local networks than by formal communications via policy, a finding that applies, also, to the diffusion of innovation (Rogers 2003).

In addition, we show that learning about sustainable consumption is a lengthy process involving many obstacles and many contradictions. This dynamic means that accumulation of new experiences and new representations is critical to overcome current difficulties. Experiencing and learning about sustainable consumption may be enabled, in part, by participation in small networks and discussions with peers (Rasmussen 2014); the 'telling' that occurs in face-to-face interactions can be more efficient than the 'showing' that promotes the spread of rumor within the network, but does not involve direct and face-to-face contact (Babutsidze and Cowan 2014). Our findings show that conformity bias (a type of 'showing') has no impact on the probability of belonging to the sustainable group (cluster 3), whereas discussions with peers and 'telling' have a positive effect because learning needs 'a richer view of social interaction [….] which allows for a passage of a richer informational content, including opinions not currently in use' (Babutsidze and Cowan 2014: 152). However this pattern may be affected by the societal socio demographic variables. For instance, in the context of waste practices in Southern France, peer pressure has been observed to have some negative effects in certain networks, and to undermine sorting practices (Kirakozian 2016). Communication and face-to-face interactions may result in some polarization due to the presence of several parallel informational cascades, and may become concentrated in certain options to the detriment of others, with either positive or negative influences (Babutsidze and Valente 2019). Thus, in some local contexts, this accumulated knowledge may not always produce the expected effect (Kirakozian 2016).

To summarize, our findings show that local externalities clearly outweigh global externalities related to promoting sustainable consumption behaviors, that is, the ability to learn in small networks is critical for a trustworthy climate for exchanging ideas and practices. As Witt (2011) shows, sustainable consumption practices have to be learnt and our findings provide some evidence and measures of this learning. In line with the discussion in Simon (1982), group belongingness matters; consumers and citizens are more able to identify with those most proximate to them, and this identification is more influential than information campaigns for promoting sustainable

consumption. Also, in the presence of a discrepancy in sustainable consumption between attitude and actual behavior, discussions with peers help to do the 'work of conscience' by reducing this gap (Rasmussen 2014), while considering various contradictions and difficulties related to changing behaviors in daily life (Chai et al. 2015). Citizens with more options and more time may be those more able to reduce this gap in the direction of more sustainable consumption (Chai et al. 2015), since a move in this direction is effortful due to the weight of current habits (Maréchal and Lazaric 2010). In addition, in their social interactions, citizens are very sensitive to the salience of sustainable goods or practices, and so, when they experience sustainable consumption, they may be more likely to promote visible actions and practices which will communicate their social values and actions to peers (Babutsidze and Chai 2018).

Finally, in the context of environmental values (H7), our results are in line with the literature and reinforce the influence of local networks for learning about sustainable consumption. Indeed, environmental values are derived from social influence and intertwined with complex causality links (Bertrandias and Elgaaied-Gambier 2014). Thus, if consumers are more inclined to discuss environmental issues with others, either to preserve social ties or to promote themselves, this proximity effect should be exploited to promote pro-environmental behaviors and to target certain groups of consumers. See Lucas et al. (2018), for a discussion of the role of peers in the context of seafood products. However, peer effects may complement changing environmental values and stimulate pro-environmental behavior.

Changing consumption patterns should be observed over the long term and policy makers should encourage local experience. Policy makers could create the conditions to support the emergence of local externalities and increasing returns from information about sustainable behaviors. 'Green nudges' could be one way to support individual efforts and provide additional motivation (Lucas et al. 2018). Public authorities could help to modify habits and practices through investment in infrastructure, which might instil new values within social groups (Axsen et al. 2012, 2013), and

should target inequality related to younger and potentially low-income households by helping these groups to practice more sustainable consumption.

Limitations and future research

Our empirical findings could be extended to investigate certain variables, such as age (which could be measured in discrete values rather than intervals), lifestyle and time constraints, in more depth, to allow a better understanding of how and in what context age matters when households try to adopt sustainable behavior (Seyfang 200; Shove 2007).

Our results highlighted the role of peer effects on sustainable consumption. Further research would enrich our understanding of peer effects for individual practices (food, mobility, transport), which have distinct features related to their potential salience and visibility. In the context of solar thermal systems, Welsh and Kühling (2009) show that green values are made more attractive if they can be shown to be green signals to others.

Given the urgent need to achieve rapid transformation of consumption, some extensions of our work should include investigation of additional variables for local and geographical conditions affecting peer effects. Are some localizations more likely to promote sustainable behavior, as has been shown for the case of Australia (Babutsidze and Chai 2018), and are these clustering effects dependent on and reinforced by the salience of the specific goods and practices?

Thus, future research could explore in more depth the weight of the regional context, for instance, why some places are more active at promoting sustainable practices and whether peer pressure, among other determinants, plays a role in these local externalities and differs according to the good or practice considered. For preliminary results on recycling, see Kirakozian (2016). For policy makers, a clearer understanding of the presence of sustainable practices could provide a better

appreciation of the local conditions related to their emergence and a better alignment between national and regional policy tools in this field.

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Appendix:

Table 4: Quota sampling

Variables	n	Freq (%)
Gender		
F	1 576	52,45%
M	1429	47,55%
Age		
[18-24]	285	9,48%
[25-34]	529	17,60%
[35-44]	542	18,04%
[45-54]	528	17,57%
[55-64]	437	14,54%
> 64	684	22,76%
French Regions		
Paris Basin	527	17,54%
East and Centre	360	11,98%
East	265	8,82%
Mediterranean Area	340	11,31%
North	204	6,79%
West	418	13,91%
Paris Region	540	17,97%
South West	351	11,68%
City size		
Rural municipalities	787	26,19%
< 20 000	519	17,27%

[20 000-100 000]	394	13,11%
[100 000-200 000]	171	5,69%
> 200 000	682	22,70%
Paris and suburbs	452	15,04%
Socio-professional groups		
Farmers	39	1,40%
Artisans, shopkeepers and senior executive	139	4,63%
Administrators and managers, higher grade professionals	363	12,08%
Intermediate-grade professionals	437	14,54%
Employees	420	13,98%
Workers	577	19,20%
Others, no activity	119	3,96%
Retired	908	30,22%

Table 5: Variables assessing sustainable consumption behaviours

Description	Categories	*Freq.*	*Percent*	*Cum.*
Environmental determinants (organic, local, recyclable packaging) for dairy product consumption	0: none	1 554	51.71	51.71
	1: one or two determinants	1 301	43.29	95.01
	2: three determinants	150	4.99	100
Are water and/or energy consumption important criteria when buying a washing- machine?	0: none	920	30.62	30.62
	1: one criterion	684	22.76	53.38
	2: two criteria	1 401	46.62	100
Use of non-conventional detergent(s)	0: no	2 093	69.65	69.65
	1: at least one	912	30.35	100
Buy local produced fruit and vegetables	0:no	876	29.15	29.15
	1: yes	2 129	70.85	100
Buy seasonal fruits and vegetables	0: no	385	12.81	12.81
	1: yes	2 620	87.19	100
Use of other laundry products (organic or conventional)	0: conventional products	2063	68.65	68.65
	1:solely organic products	406	13.51	82.16
	2:none	536	17.84	100
Dairy products over packaging recycling	0:no	445	16.18	16.18
	1:yes	2 306	83.82	100
Glass recycling	0: no	347	11.55	11.55
	1: yes	2 658	88.45	100
Battery recycling	0: no	628	20.90	20.9
	1: yes	2 377	79.10	100

Do you switch off electrical appliances?	0: no	897	29.85	29.85
	1: yes	2 108	70.15	100
Is your household equipped with renewable energy appliances?	0: no	2 436	81.06	81.06
	1: yes	569	18.94	100
Means of transportation for food shopping	0: car or motorbike	2 492	82.93	82.93
	1:Public transports/bicycle /home delivery	513	17.07	100
Was energy consumption a criterion for changing your washing machine?	0: no	2 815	96.74	96.74
	1: yes	95	3.26	100

Table 6: Descriptive statistics for the independent variables

Variable	Description	Freq (%)	Min	Max	Obs
H1 - Gender	(=1 if female)	52.4	0	1	3005
H2 - Education	(=1 if BA and higher degree)	30,1	0	1	3005
H3 - Age					
Age1 (Ref)	[18-24]	9,4	0	1	3005
Age2	[25-34]	17,6	0	1	3005
Age3	[35-44]	18	0	1	3005
Age4	[45-54]	17,5	0	1	3005
Age5	[55-64]	14,5	0	1	3005
Age6	> 64	22,7	0	1	3005
H4 - Income					
Income1	<1200 €/month	11.4	0	1	3005
Income2	[1200 – 2000[€/month	19.9	0	1	3005
Income3 (Ref)	[2000 – 4000[€/month	43.2	0	1	3005
Income4	≥4000 €/month	17.8	0	1	3005
Income5 (Ref)	Don't Know or Refuse to reply	7.7	0	1	3005
H5 - Conformity	(=1 if everybody does it)	0,402	0	1	3005
H6 - Peer effect					
None (Ref)	(=1 if none of my neighborhood is green)	26.5	0	1	3005
A minority	(=1 if a minority around my neighborhood is green)	40	0	1	3005

About half	(=1 if about half of my neighborhood is green)	20.7	0	1	3005
The majority	(=1 if the majority my neighborhood is green)	12.7	0	1	3005
H7 - Environmental values	(=1 if respondent is willing to make donations to environmental projects)	13	0	1	3005

Table 7: Tetrachoric correlations

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Gender (Female)	(1)	1																	
Education (BA and higher degree)	(2)	-0.12	1																
Age 18-24 y.o.	(3)	-0.02	0.03	1															
Age 25-34 y.o.	(4)	0.01	0.11	-1	1														
Age 35-44 y.o.	(5)	-0.17	0.10	-1	-1	1													
Age 45-54 y.o.	(6)	-0.03	0.00	-1	-1	-1	1												
Age 55-64 y.o.	(7)	-0.06	0.02	-1	-1	-1	-1	1											
Age >65 y.o.	(8)	0.22	-0.23	-1	-1	-1	-1	-1	1										
Income Less than €1200	(9)	0.18	-0.42	0.21	-0.14	-0.17	-0.16	-0.07	0.25	1									
Income €1200 - €2000	(10)	0.11	-0.36	0.04	-0.02	-0.04	-0.02	-0.08	0.10	-1	1								
Income €2000 - €4000	(11)	-0.07	-0.07	-0.05	0.18	0.08	0.02	0.00	-0.22	-1	-1	1							
Income More than €4000	(12)	-0.21	0.62	-0.22	-0.06	0.14	0.13	0.13	-0.21	-1	-1	-1	1						
Conformity	(13)	0.02	-0.17	0.01	0.02	-0.02	0.01	0.02	-0.03	0.06	0.02	0.01	-0.09	1					

Peer effect : None of my neighborhood	(14)	0.00	-0.27	-0.01	-0.05	-0.11	-0.10	-0.05	0.24	0.13	0.07	-0.05	-0.24	0.03	1				
Peer effect : A minority around my neighborhood	(15)	-0.03	0.08	0.15	0.19	0.11	0.00	-0.10	-0.29	-0.08	-0.04	0.09	0.08	-0.02	-1	1			
Peer effect : About half of my neighborhood	(16)	0.04	0.09	-0.07	-0.07	0.00	0.06	0.10	-0.04	-0.09	-0.02	0.02	0.08	-0.03	-1	-1	1		
Peer effect : The majority of my Neighborhood	(17)	0.01	0.12	-0.20	-0.23	-0.04	0.05	0.10	0.16	0.05	-0.02	-0.12	0.08	0.03	-1	-1	-1	1	
Environmental values	(18)	-0.14	0.08	0.08	0.09	0.15	0.02	-0.08	-0.25	-0.02	0.03	0.00	0.04	0.03	-0.21	0.04	0.10	0.09	1