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Determinants of the greening of households in Europe

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Contact: Katarina Jaksic
E-mail: Katarina.jaksic@ec.europa.eu

European Commission
B-1049 Brussels

Determinants of the greening of households in Europe

Jens Horbach
Corresponding author
University of Applied Sciences Augsburg
email: jens.horbach@hs-augsburg.de
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INTRODUCTION

The success of climate change measures depends heavily on changes of household behaviour, which is one of the most important sources of carbon dioxide emissions. In Germany in 2019, for example, the household share of final energy consumption amounted to 26.5% (Umweltbundesamt, 2021). Household heating, electricity consumption and private transport are important levers in reducing households' impacts on the environment. In order to realise their potential, however, environmental awareness and behaviour must work alongside the available technologies. The environmental behaviour of households is strongly related to factors such as personal characteristics of household members (e. g. gender, education level), their social and political environment, or their income and employment situation.

This paper[1] examines the determinants of greening households at European level. It comprises an extensive literature review, together with econometric analyses of European-wide household data. The analysis uses survey indicators for the description of household greening and sustainable behaviour. These indicators represent respondents' subjective perceptions of the importance of environmental problems, as well as their revealed preferences, such as green votes, the use of renewable energy for heating, green consumption behaviour, insulation of houses and flats, waste, recycling, and tourism. Among others, the determinants of green household behaviour comprise housing situation, type of region (town or countryside) and social milieu. Household characteristics such as age profile, number of household members, and working conditions are also considered.

The literature on individuals' and households' green (consumption) behaviour is extensive. However, there is a lack of comparative country analyses at European level, or joint analyses of different indicators of green household behaviour – this paper aims to close these gaps. Its main focus is an econometric analysis of the determinants of household greening at European level for different countries and indicators. The analysis uses two recent European data sources. The first is the European Social Survey (ESS) in 2019, which is a comprehensive data source for a large sample of European households, including variables on the greening of households, such as the self-perceived importance of caring for nature and the environment, or green voting behaviour. The ESS in 2017 included questions from which indicators of energy-saving behaviour and climate change attitudes can be derived. The database contains an extensive range of determinants and control variables, such as income, education level, establishment size, and working conditions of those interviewed. Factors such as the political orientation of a region are also included. The second data source is the recent Eurobarometer 92.4 of 2020, which captures European citizens' attitudes towards the environment. It allows a detailed and comparative analysis of green (consumption) behaviour by 14 different environmentally relevant household activities in 28 countries.

[1] The cut-off date for the analysis presented in this paper is 29 November 2021.

The econometric analysis of the determinants of green household behaviour sheds light on factors such as the role of income, education, working conditions and regional social environment. A broad range of control variables is also considered. A deeper understanding of these factors and determinants is necessary for the design and fine-tuning of household-oriented environmental and climate change measures. For example, the planning and shaping of subsidies for renewable energy in households might require knowledge of household characteristics, such as income or education level. The analysis also examines the relevance of measures to improve households' environmental awareness of sustainable or 'green' behaviour.

The paper is structured as follows: Section 2 describes the driving factors of green household behaviour from a theoretical perspective. Section 3 discusses empirical indicators and methods for the analysis of green household behaviour. It also contains an extensive literature review of econometric and experimental studies on green (consumption) behaviour. Section 4 presents the own econometric analyses of the determinants of perceived and revealed green behaviour. Finally, Section 5 draws some conclusions and discusses the implications for European policy measures.

DRIVING FACTORS OF GREEN HOUSEHOLD BEHAVIOUR

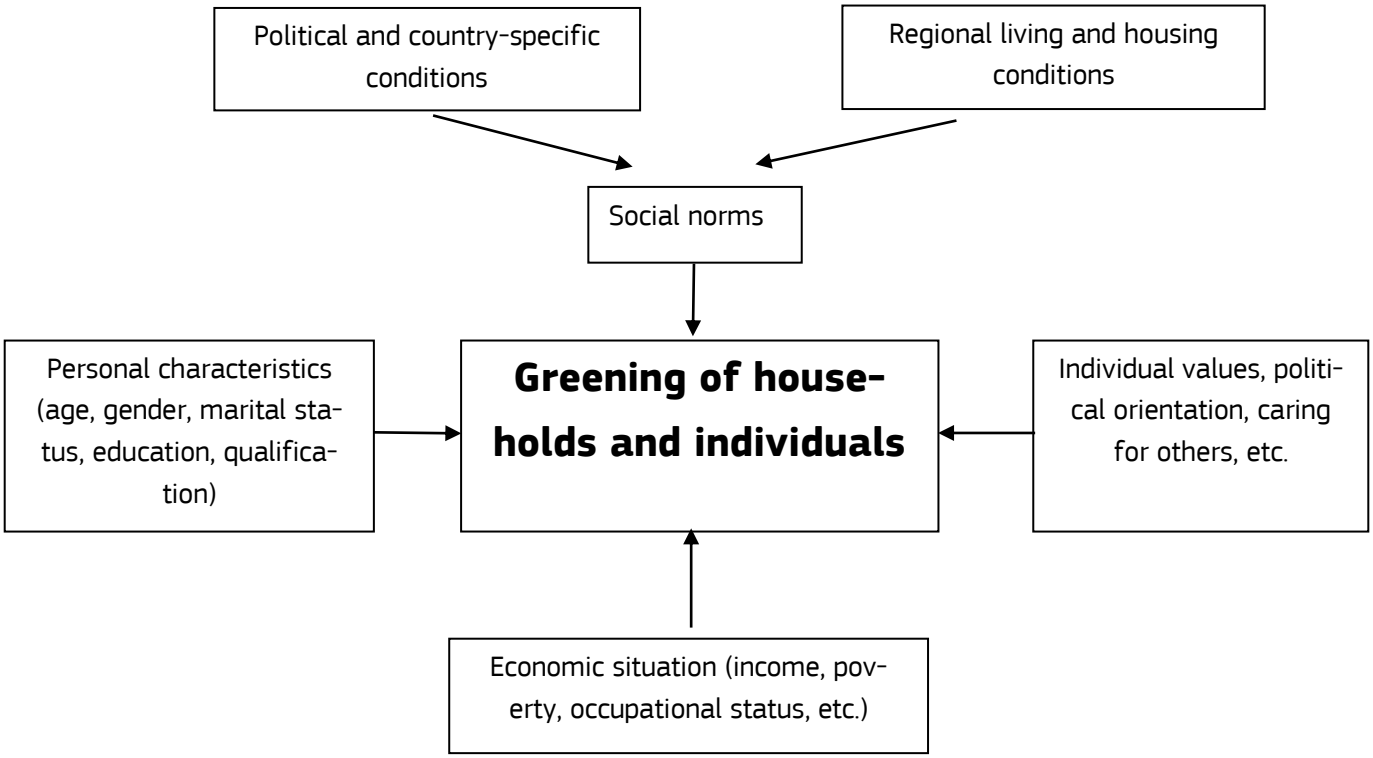
Green or pro-environmental behaviour describes a '... behaviour that consciously seeks to minimise the negative impact of one's actions on the natural and built world (e. g. minimise resource and energy consumption, use of non-toxic substances, reduce waste production)' (Kollmuss and Agyeman, 2002, p. 240). Green attitudes and environmental awareness among individuals do not necessarily result in real activities to reduce households' environmental impacts. Kollmuss and Agyeman (2002) explain the reasons underpinning this discrepancy between attitude and behaviour: Attitudes can change quickly but there are barriers to changing habits. Social norms such as family or cultural traditions shape individual behaviour, but these norms are often persistent and slow to change. External barriers and sunk costs may also act as a barrier. E.g., it is expensive to replace an existing heating system with one that consumes less energy or uses renewable energy. Furthermore, in most cases, individuals are typically not directly affected by environmental problems, thus the thresholds for behavioural change are higher than those where individuals are directly concerned. There are also temporal discrepancies. E.g., the German decision to phase-out nuclear energy came just after the Fukushima catastrophe, a few years later, it would have been difficult to realise this political decision.

Up to now, there is no overall theory explaining green behaviour but the extensive literature on green (consumption) behaviour contains many approaches that can be used to draw a comprehensive picture. Figure 1 summarises the main determinants of green behaviour that will be empirically tested in Section 4.

The theory of planned behaviour (Ajzen, 1991; Bamberg and Möser, 2007) assumes rational behaviour of individuals, i.e. that people always evaluate the consequences of their behaviour. This theory is closely related to the theory of social norms and customs (Akerlof, 1980; Videras et al., 2012; Keizer and Schultz, 2018; Vögele et al., 2021). Rational individuals comply with social norms because they fear punishment or social exclusion, feel guilty about disobedience, or, conversely, expect rewards for following social norms. Overall, individuals anticipate and assess positive and negative consequences of different behavioural options and decide their actions accordingly (Bamberg and Möser, 2007). Social norms and customs depend on regionally relevant political framework conditions, but also on the living and housing environment (see Figure 1).

The concept of value–attitude–behaviour does not rely on rational behaviour, but, rather, stresses the importance of functional, social, or emotional values to consumer behaviour (Zhang and Dong, 2020). In addition to a rational calculation of the social consequences of green behaviour, individual values such as political orientation, environmental consciousness, or willingness to care for others, might trigger environmentally advantageous consumer behaviour.
Many empirical studies on environmentally relevant behaviour suggest that other factors such as personal characteristics and economic situation should also be considered (e.g. Ziegler, 2020a; Vögele et al., 2021; Lange et al., 2017; Kahn, 2007).

Figure 1: Determinants of green household behaviour



Source: Own representation.

Several studies show that women have a higher environmental consciousness than men and are more likely to buy green products (e. g. Liobikiene et al., 2016). Economic situation and occupational status are also crucial determinants of environmental behaviour - poor and/or unemployed people may be less likely to pay a premium for green products. This raises the question of whether poverty similarly impacts 'costless' green activities, such as the separation of waste or voting for green parties. Professional activity might be positively or negatively correlated to green behaviour because individuals working in environmentally relevant professions might be more open to green products. The reverse may also be true - working in polluting or energy-intensive industries might lead to lower environmental awareness, as job opportunities could be negatively affected by green measures (e. g. workers in the lignite industry are perhaps less well-disposed towards climate protection measures such as the extension of renewable energy). Education and qualification level of individuals may also be an important factor, with higher qualified people perhaps more likely to be informed on the complex effects of climate change or other environmental problems, triggering green behaviour.

The empirical analysis in Section 4 will test the following hypotheses:

H1: Personal characteristics, such as gender, influence green behaviour.

H2: Determinants of green behaviour differ between costless and cost-intensive green activities, with economic situation relevant primarily for cost-intensive activities.

H3: Highly educated and (in most cases) better-informed people are more likely to engage in green activities.

H4: Occupational situations are relevant to green behaviour.

H5: The political climate in a country influences green behaviour.

EMPIRICAL ANALYSIS OF GREEN HOUSEHOLD BEHAVIOUR: METHODS AND RESULTS

GREEN HOUSEHOLD BEHAVIOUR – INDICATORS AND METHODS OF ANALYSIS

Indicators for the greening of households

The comprehensive term 'green household behaviour' contains different dimensions that cannot be summarised by a single indicator. The respective analyses in the literature and the own econometric estimations in Section 4 use four groups of indicators:

1) Self-perceived environmentally friendly attitudes and consciousness describe individuals' subjective views of the importance of environmental problems. The main problem of these indicators are

biased answers because of strategic response behaviour so that the effective utility for the environment might be zero.

2) Voting for green parties can be understood as a revealed behaviour indicator. One caveat is that there are no 'pure' green parties – even those with a primarily green agenda must still offer a full political programme, thus their voting share might reflect other policies. The relative strength and reputation of a green party can also play a role, or it might be characterised by country-specific attitudes.

3) Green consumption and purchasing behaviour (green food, use of renewable energy, reduction of energy consumption, use of public transport) are revealed preference indicators. The limit of this indicator group lies in the definition of green products, e.g. is an electric car truly green if the resulting battery waste or the coal-based production of electricity is considered? Another negative example are waste separation systems leading to a higher amount of plastic waste.

4) Environmentally relevant activities, such as the separation of waste, taking part in climate protection demonstrations, or recycling activities.

The analysis of the determinants of green behaviour distinguishes between cost-intensive (e. g. buying more expensive green products) and costless (e. g. separation of waste, reducing heating and energy use, voting for green parties) activities. Such distinction is useful because income-related variables might be more important for behaviours that incur additional cost.

Econometric and experimental methods

In most cases, regression analyses with binary or ordinal dependent variables are used to analyse green (consumption) behaviour. Some studies apply experimental methods. The literature review in Section 3.2 concentrates on recent studies using these types of methods and excludes mere correlation analyses and case studies.

REVIEW OF DIFFERENT STUDIES AND COUNTRIES IN THE LITERATURE

The following section examines the recent extensive literature on green behaviour of households. It includes different indicators of green behaviour, namely self-perceived greenness and revealed green activities. The indicators for revealed green behaviour comprise a broad range, such as green voting behaviour, various green consumption fields (energy, transport, housing, eco-labelled products, green food, etc.), separation of waste, reduction of energy and water use. The review captures results for different countries and methods. Given the substantial volume of literature sources, the review is not exhaustive but, rather, highlights important recent econometric and experimental studies. Case studies or mere correlation analyses are not considered. The aim of the review is to derive stylized fact on common and specific determinants of green behaviour for different green indicators, methods and even countries.

The review considers the following greening indicators:

1) Green products, green consumption in general.
2) Green food.
3) Energy efficiency, renewables, CO_2 reduction.
4) Green electricity, electricity consumption.
5) Waste, recycling.
6) Transportation, travel.
7) Perceived green behaviour.

Green products, green consumption in general

Lazaric et al. (2020) analyse the determinants of sustainable consumption in France using a combined indicator that captures food, purchase and use of washing machines, waste sorting, recycling, energy-saving practices and transportation. Their econometric analysis uses data from a survey of more than 3,000 French households in 2012. The results of ordered logit analyses show that age, female gender, education, perceived environmental concern and especially peer effects are positively correlated with sustainable consumption. Learning from peers seems to enforce pro-environmental behaviour. The role of reference groups and routine behaviour is also analysed by Welsch and Kühling (2009). The authors use the indicators "installation of solar energy equipment, subscription to green-electricity programs and buying organic food" to describe green consumption behaviour. The analysis is based on data from a survey conducted in the region of Hanover in Germany. A broad range of determinants including economic and cognitive factors (income, price premium, information on environmentally friendly goods), consumption patterns of reference persons and own consumption patterns in the past are considered. The econometric results show that the consumption patterns of reference persons are significantly correlated with all considered green consumption indicators, confirming the important role of social norms.

Several studies examine the role of social class and gender. Yan et al. (2020) show that belonging to the middle class increases the probability for green consumption activities compared to those in the lower and upper classes. Brough et al. (2016, p. 567) review seven studies that provide '… evidence that the concepts of greenness and femininity are cognitively linked and shows that, accordingly, consumers who engage in green behaviours are stereotyped by others as more feminine and even perceive themselves as more feminine."

Lades et al. (2021) analyse the role of economic preferences on green behaviour. They consider a variety of factors, such as risk-taking, patience, present bias, altruism, positive and negative reciprocity, but only altruism was found to significantly correlate with green behaviour. Their econometric results are based on Poisson and OLS regressions of responses from 350 consumers in Great Britain. The positive role of altruism for green consumption behaviour is confirmed by Lopez de Morais (2021), who use partial least squares structural equation modelling to analyse a survey of 170 Por-

tuguese and Brazilian citizens. Dhir et al. (2021) use cross-sectional data from 387 Japanese consumers collected in 2020 to analyse the drivers of green apparel buying behaviour. The authors apply a confirmatory factor analysis followed by a structural equation model. They find that '... green trust, environmental attitude, and labelling satisfaction are positively associated with green apparel-buying behaviour. Furthermore, green trust, environmental concern, and environmental attitude partially mediate the proposed associations, while age and gender moderate the association between environmental knowledge and environmental concern' (Dhir et al., 2021, p. 1).

Kahn (2007) analyses the relationship between environmental orientation, as measured by a community's share of green party voting in California and green consumption behaviour. Environmentally conscious people seem to be more likely to use public transport, purchase hybrid vehicles and consume less petrol than non-environmentalists.

Filippini and Wekhof (2021) examine the relationship between culture and revealed environmental preferences as measured by the registration of energy efficient vehicles in Switzerland, using municipal-level data from the internal French/German language border. The results of their spatial fuzzy regression show a significantly higher share of energy efficient vehicles in French-speaking municipalities compared with German-speaking counterparts. The authors argue that this might reflect a higher sense of collectivism and altruism among the French-speaking community.

Based on a sample of 900 middle-class households in Lima (Peru), Fuhrmann-Riebel et al. (2021) use energy saving, use of plastics and expenditures on electricity as indicators for pro-environmental behaviour. The authors find that '... social preferences matter mainly for saving-energy behaviour; time, risk and ambiguity preferences matter mainly for the consumption of plastics; and time and ambiguity preferences matter for expenditures on electricity' (Fuhrmann-Riebel et al., 2021, p. 1).

Migheli (2021) analyses the effects of parenthood and gender on green purchasing using data from the World Values Survey (WVS) across 61 countries. The results show that having children reduces the probability of buying green products, but the results are different between fathers and mothers. In rich countries the relationship between parenting and the number of children is not significant whereas the gender effect remains pointing to the fact that budget constraints are crucial for green consumption.

An OECD survey was conducted in 2011 and covers 12,000 households in 11 countries (OECD 2014). The results show the important role of environmental attitudes and norms for green consumption behaviour in the five different fields energy, food, transport, waste, and water. Financial incentives and the provision of services and infrastructure such as good public transportation systems, cycling paths or collection systems for recyclables are also crucial for green consumption (Serret and Brown 2014).

Green food

Based on the theory of planned behaviour using a sample of 456 young adults in Belgium, Vermeir and Verbeke (2008) analyse the role of attitudes, perceived behavioural control and social norms on the consumption of sustainable dairy products. Using multiple regression models the authors find that a '… combination of personal attitudes, perceived social influences, perceived consumer effectiveness and perceived availability' explains 50% of the variance in intention to consume these products (Vermeir and Verbeke, 2008, p. 542). Similarly, based on the theory of planned behaviour, Ricci et al. (2018) concentrate on green convenience food, specifically minimally processed vegetables labelled with integrated-pest-management standards. The authors use structural equation modelling to evaluate the data from face-to-face interviews in Milan and find a positive correlation between high consumer trust and consumer intention to buy such products.

Takahashi et al. (2018) analyse the purchasing behaviour for certified forest coffee, applying a randomised controlled trial that accounts for endogeneity. The authors use eye tracking techniques to observe consumption behaviour. Interestingly, purchases of certified forest coffee were not triggered by environmental concerns or information about certification programmes, but, rather, illustrations of forests on certified forest coffee labels. In a further study on eco-friendly coffee, based on Japanese data involving over 10,000 vending machines serving brewed coffee, Takahashi (2021) finds out that consumers in social spaces such as office buildings seem motivated to purchase eco-friendly coffee to establish a 'green' reputation among community members. This is not the case in non-social spaces, such as shopping malls.

Energy efficiency, renewables, CO_2 reduction

There is extensive literature on energy-related household behaviour. In a Swedish study of 4,000 respondents from 2004 to 2007, the results of ordered logistic regression models show that socio-economic characteristics such as age, housing type and income were positively correlated with savings on heating and hot water usage (Martinsson et al., 2011). The authors emphasise the important role of general environmental attitudes in energy-saving behaviour, but they do not discuss the possible endogeneity of this variable. Ramos et al. (2015) confirm that finding, using data of a national representative survey of Spanish households in 2008. The results of a discrete-choice model show that pro-environmental households are more likely to take energy efficiency measures. Households with older members seem less likely to invest in energy efficiency and show fewer eco-friendly habits. Contrary to these findings, for a sample of Italian households in the late 90s, Fiorillo and Sapio (2019) find that monetary drivers such as income and perceived energy costs are more crucial for energy-saving behaviour. Their results even show a negative correlation of environmental attitudes. For a sample of Irish households, Aravena et al. (2016) also find that energy efficiency measures are mainly driven by monetary factors, such as gains in energy savings and private cost reductions.

Schleich (2019) analyses the role of income in the adoption of energy efficient technologies for 15,000 households in eight European Union (EU) countries (France, Germany, Italy, Poland, Romania, Spain, Sweden, and the United Kingdom (UK)). The author differentiates between high-cost, medium-

cost, and low-cost energy efficient technologies. Poor homeowners show a lower probability of adopting high-cost energy efficient technologies. This is particularly true for Poland and Romania, which have relatively low average incomes but a high share of owner-occupiers. The effect of income on energy efficiency is also analysed by Pommeranz and Steininger (2021), using the German rental apartment dataset from 2007 to 2019. The results of hedonic regression models show that rents for energy-inefficient apartments are negatively correlated with high purchasing power and high green awareness. The rent-decreasing effect of purchasing power seems to be higher than that of green awareness, but the latter effect became more important from 2017 to 2019.

Welsch (2021) uses data from the European Social Surveys (see also Section 4.2). He shows that individual moral foundations such as care, fairness, or liberty are correlated to climate-friendly behavior.

Based on consumer expenditure data of 26 EU countries for 2010, linked with greenhouse gas (GHG) intensities, Ivanova and Wood (2020) demonstrate the unequal distribution of household carbon footprints. 'The top 10% of the population with the highest carbon footprints per capita account for 27% of the EU carbon footprint, a higher contribution to that of the bottom 50% of the population' (Ivanova and Wood, 2020, p. 1). Lévay et al. (2021) use consumption data for Belgian households, combined with an environmentally extended input-output model including GHG emissions. They find that income and household size seem to be the most important determinants of consumption-related emissions. Interestingly, the emission intensity of the consumption of poorer households is disproportionally high because they spend a higher share on emission-intensive products.

From a policy perspective, Andor et al. (2020) show that social comparison-based home energy reports are an effective measure to reduce the energy consumption of households, confirming previous US findings (Allcott and Rogers, 2014). For Germany, however, the effect sizes are considerably lower than those of the US.

Green electricity, electricity consumption

Frondel and Kussel (2019) analyse consumers' electricity tariff choices, using Germany's Residential Energy Consumption Survey. The results of their instrumental variable endogenous switching regression model show that information about electricity prices is a significant determinant of household behaviour. Households that are well informed about electricity prices are sensitive to price changes, whereas uninformed households do not change their behaviour. Their econometric model allows to correct for the possible endogeneity of household behaviour. A higher transparency of (green) electricity tariffs seems to have considerable impact on green household behaviour. Sommer (2018) uses the same database to show that richer and better educated individuals are more likely to adopt green electricity. His analysis relies on an endogenous dummy treatment effects model to control for self-selection into green tariffs. Ziegler (2020b) confirms the importance of transparency of electricity contracts for households' green behaviour. His analysis of a computer-based survey of more than 3,700 citizens in Germany shows that patience and trust are positively correlated with the choice of

green electricity contracts. Green policy orientation and household income play an important role in the use of green electricity. Based on the same database, Groh and Ziegler (2020) analyse the determinants of a reduction in electricity consumption. Whereas norms and environmental awareness only seem to play a minor role, the estimation results demonstrate the high importance of dwelling and socio-demographic characteristics.

Mezger et al. (2020) examine the switching behaviour of private consumers towards green electricity, using a sample of 787 German electricity consumers. The results of their structural equation model confirm those of Ziegler (2020b), that trust promotes the choice of green electricity. Reputation and perceived environmental impact were also relevant variables in this context. Based on a discrete choice experiment, Petrovich et al. (2021) analyses residential solar investment activities in Switzerland. Here, policy uncertainty seems to be a higher barrier to investing in solar electricity compared to inherent market risks. Colasante et al. (2021) stress the importance of economic incentives for the installation of photovoltaic systems, based on a sample of Italian households.

Waste, recycling

Concari et al. (2020) provide a systematic literature review of 699 papers published between 1975 and 2019 on private households' waste management. They conclude that pro-environmental consumer behaviour in the case of waste management can be promoted by a favourable context or a supportive institutional-legal framework.

Looking at the private recycling activities of a sample of households in the US, Viscusi et al. (2011) find that environmental awareness and economic incentives were important determinants, while social norms such as the recycling behaviour of other households have only small effects. For a sample of Italian households, Gilli et al. (2018, p. 294) find 'Overall, the results show that recycling behaviour does not correlate with individual motivations, while waste minimisation seems to be associated with intrinsic motivation only'. The authors use clusters of individual motivations and a simple regression framework. Using English local authority data, Abbott et al. (2013) find that social norms are relevant for recycling activities, although multifamily dwellings recycle less.

Czajkowski et al. (2017) use a sample of 8,000 randomly chosen Polish households in 2013 to analyse the determinants of alternative choices of recycling behaviour. Within the framework of a hybrid logit model, the authors consider economic factors affecting the net costs of recycling, as well as moral sentiments and social pressures. The main result '... is that the willingness to pay for (and desire to participate in) higher levels of household recycling is mostly linked to a moral or intrinsic motivation, associated with the belief that sorting at home is in fact more thorough than sorting at a central facility' (Czajkowski et al., 2017, p. 665). In a nationwide survey for Denmark, Nainggolan et al. (2019, p. 1) find '"... statistically significant relationships between the heterogeneity in household preferences for home waste sorting and households' sociodemographic characteristics, current self-reported time allocation for waste sorting and handling, use of recycling facilities as well as attitudinal factors on personal motivation and social influence'.

Agovino et al. (2019) analyse the effects of neighbour influence on separate waste collection, based on Italian municipal data for 2012. The results of their quantile regressions show that pro-environmental behaviour related to waste collection correlated with neighbour effects and cultural consumption. Contrary to these findings, Kirakozian (2016) examine the waste-sorting behaviour of 694 individuals in the French Provence–Alpes–Côte d'Azur region (which has the lowest recycling rate in France) and find that social norms can even negatively influence recycling activities.

Transportation, travel

Bamberg et al. (2007) model the choice between public transportation and private car, using data for two German urban agglomerations with different economic and sociocultural backgrounds. Their results show that personal norms, feelings of guilt and perceived social norms promote the use of public transport. Schwirplies et al. (2019) observes the willingness to pay for carbon offsetting by different modes of transportation (bus versus plane) and travel occasions, based on a sample of 1,000 individuals from Germany. The results of mixed logit and latent class logit models show that, unsurprisingly, individual willingness to pay is higher when carbon offsets are matched by the travel provider. Higher incomes, younger age, and stronger environmental awareness are positively correlated with willingness to pay for carbon offsets.

One significant aspect of travel reduction in a tourism context is analysed by Ghorban Nejad and Hansen (2021). Their experimental study of 429 participants (a Norwegian consumer panel, aged between 18 and 64) shows that herd influence and high self-monitoring has an impact on environmentally motivated travel reduction.

Perceived greening of households

A big part of the literature on the greening of households uses self-perceived awareness indicators. Ziegler (2015) analyses the determinants of climate change beliefs, support for publicly financed climate policy, and willingness to pay a price premium for climate-friendly products, based on a representative computer-based survey of more than 3,400 citizens in the US, Germany, and China. In Germany, climate change beliefs are not negatively affected by conservative and right-wing attitudes, but the willingness to pay for climate-friendly products and the support for climate-friendly political measures is lower. In the US, all indicators were negatively correlated with a right-wing political orientation.

Cicatiello et al. (2020) consider regional factors as determinants of individual perceptions of environmental protection. They use data from the European Values Study, linked with regional information for Italian regions at NUTS-2 level. The results show that a high regional incidence of polluting industries lowers willingness to pay for environmental protection. Faccioli et al. (2020) include regional variables in a study using data on peatland restoration in Scotland. The results of hybrid choice models show that environmentally aware respondents with a high attachment to peatlands and to Scotland has a higher willingness to pay for peatland restoration.

Based on a representative sample of 1,551 Greek citizens, Gkargkavouzi (2019) uses confirmatory factor analysis (CFA) and structural equation models to analyse psychological and structural variables as limiting factors of environmental behaviour. Those barriers are found to mediate the impact of environmental knowledge and motivation on pro-environmental behaviour. In Ecuador, using data from the National Institute of Statistics and Census (NISC) during 2010–2016 and panel data econometrics, Ponce et al. (2019) find that labour income and human capital support environmental behaviours of households. The authors also detect regional differences: cantons specialised in manufacturing seem to have poorer environmental performance than those dominated by the service sectors.

Ziegler (2019) highlight the importance of attitudinal factors in the acceptance of energy policy measures, based on a sample of German households. As a dependent variable in binary and ordered probit models, the study uses perceived support for several energy policy measures that seem to be highly correlated with environmental values and identifies the political orientation of the respondents as the main factor. Unsurprisingly, left-green policy identification is positively correlated with the support of energy policy measures, which is not the case for respondents showing a liberal-conservative policy orientation.

Institutional contexts and political values are relevant to attitudes towards emission-reducing policies. Aasen and Vatn (2018) conduct a survey of 1,500 car owners in Oslo and find a positive correlation between a higher social responsibility for avoiding climate change and support for an increase in petrol prices.

Melo et al. (2018) analyse the relevance of work-life-balance to pro-environmental behaviour, based on the UK Household Longitudinal Study. The authors use a combined self-perceived indicator of pro-environmental behaviour that encompassed 21 behaviours (home energy, personal transport, recycling, shopping). The results show that work-life imbalance is not relevant to pro-environmental behaviour, but factors such as individual's attitudes towards the environment, age, education, household income and the presence of young children are positively correlated with green behaviour. Welsch et al. (2021) also uses UK panel data to show that green self-image is positively correlated with life satisfaction.

Meta-studies and literature overviews

The vast literature on green household behaviour already contains meta-analyses and comprehensive literature overviews. Zhang and Dong (2020) analyse 97 papers on green purchasing behaviour published between 2015 to 2020. They consider individual factors, product attributes and marketing, and social factors. The evidence on individual factors is quite mixed and varies between green products. In most studies, women seem to be more likely to buy green products, although some papers find that gender does not play a significant role. Age and income are important factors for buying electric vehicles: middle aged and a middle-income level seem to promote demand for these cars,

although these factors are not significantly relevant for green food. The role of education level is similarly mixed. Looking at product attributes, eco-labels seem to be very important for consumers' purchase of green products. Social factors are crucial for green consumption behaviour. For example, for food products, a positive reputation enabled by mass communication and social media publicity triggers consumers' purchase intention for green food.

A comprehensive literature overview by Testa et al. (2021) considers 113 papers published between 2000 and 2018, using a survey-based quantitative approach to measure drivers of green consumption. The authors look at behavioural factors, socio-demographic variables, individual values and capabilities, products, producer, and context-related factors. The results show that ecological values, altruism, collectivism, and social justice are positively correlated with green consumption behaviour. Pro-environmental behaviours are also adopted because they are linked to positive self-image. Some of the studies find that collectivistic cultures favour green consumption. Path dependencies also seem to be relevant, with past green behaviour significantly driving green consumption in the future. Personal capabilities such as technological knowledge, income and education are also important drivers of green consumption, but the results are mixed for different products. For product and producer-related factors, a green brand image and trust promote green purchase decisions. The perceived economic future value of products - lower energy consumption or longer durability – is important. Contextual factors, including product access possibilities, social norms and marketing measures, also affect green consumption behaviour. If a green product requires effort to find, consumers may switch to non-environmental alternatives. Social norms such as the behaviour of peers, parents and general social pressure are also crucial for green consumption behaviour. Most of the studies consider gender, age, income, and education level as control variables. Females seem to be more receptive to green consumption, the results for the other socio-demographic variables are more mixed.

Heinz and Koessler (2021) summarise the results of experimental studies looking at the situation whereby actors care not only about their own benefits but also about the outcomes for others. Addressing other preferences seems to be positively correlated with green behaviour in most but not all cases. Andor and Fels (2018) provide a survey of 44 international studies on non-price interventions targeting energy conservation behaviour of private households. They only consider studies allowing for the analysis of causal effects. The four interventions - social comparison, commitment devices, goal-setting, and labelling - seem to have significant effects on reducing energy consumption of private households.

Table 1: Overview of the main recent studies on green (consumption) behaviour

Authors, publication year	**Methods, sample**	**Main results**
Green products, green food		
Lazaric et al. (2020)	Survey of 3,000 French households in 2012, ordered logit analysis,	Age, female gender, education, perceived environmental concern and (especially)

	combined indicator of different green products	peer effects positively correlated with sustainable consumption
Welsch and Kühling (2009)	Survey region Hanover (Germany), econometric analysis, combined indicator	Consumption patterns of reference persons relevant for all consumption indicators
Lades et al. (2021)	Survey of 350 British consumers, Poisson and OLS regressions, combined indicator	Important role of altruism in green consumption behaviour
Filippino and Wekhoff (2021)	Registration data for energy efficient vehicles in Switzerland, spatial fuzzy regression	Significant relationship between regional culture and environmental preferences
Migheli (2021)	World Values Survey from 61 countries, econometric analysis	Having children reduces probability of buying green products
OECD (2014)	Survey of 12,000 households in 11 countries, different fields	Important role of environmental attitudes and norms; financial incentives crucial for green consumption
Takahashi et al. (2018)	Japanese data on 10,000 coffee vending machines, randomised controlled trials	Illustrations of forests on coffee labels promotes purchase of 'green' coffee
Energy efficiency, renewables, CO_2 reduction		
Martinsson et al. (2011)	Swedish survey, 4,000 respondents from 2004-2007, ordered logistic regressions	Socioeconomic characteristics (age, housing type, income) positively correlated with savings on heating and hot water usage
Ramos et al. (2015)	Representative survey of Spanish households for 2008, discrete-choice model	Households with older members less likely to invest in energy efficiency
Schleich (2019)	Survey of 15,000 households in eight European countries, discrete-choice models	Poor homeowners show lower probability of adopting high-cost energy efficient technologies
Levay et al. (2021)	Belgian consumption combined with an input-output model, econometric methods	Income and household size are the most important determinants of consumption-related emissions
Green electricity, electricity consumption		
Frondel and Kussel (2019)	German Residential Energy Consumption Survey, instrumental variable, endogenous-switching, regression model	Households well informed about electricity prices are more sensitive to price changes, but uninformed households do not change behaviour; higher transparency of (green) electricity tariffs matters
Sommer (2018)	German Residential Energy Consumption Survey, endogenous dummy treatment effects model	Richer and better educated individuals are more likely to adopt green electricity

Ziegler (2020b)	Computer-based survey, 3,700 citizens in Germany	Patience and trust positively correlated with choice of green electricity contracts; green policy orientation and household income play important role in use of green electricity
Waste, recycling		
Concari et al. (2020)	Review of 699 papers published between 1975 and 2019	Pro-environmental waste management promoted by favourable context or supportive institutional framework
Viscusi et al. (2013)	Sample of US households, econometric models	Environmental awareness and economic incentives important determinants; social norms (e.g. recycling behaviour of other households) have only small effects
Czajkowski et al. (2017)	8,000 randomly chosen Polish households 2013, hybrid logit model	Willingness to pay for higher levels of household recycling mostly linked to moral/intrinsic motivation
Agovino et al. (2019)	Italian municipal data for 2012, quantile regressions	Pro-environmental behaviour related to waste collection correlated with neighbour effects and cultural consumption
Transportation, travel		
Schwirplies et al. (2019)	Survey of 1,000 German individuals, mixed logit and latent class logit models	Higher income, younger age, and stronger environmental awareness positively correlated with willingness to pay carbon offsets
Ghorban Nejad, Hansen (2021)	Norwegian consumer panel, 429 participants, experimental study	Herd influence and high self-monitoring influence environmentally motivated travel reduction
Perceived green behaviour		
Ziegler (2015)	Survey of 3,400 respondents in the US, Germany and China, discrete choice models	Germany: climate change beliefs not negatively affected by conservative and right-wing attitudes; lower willingness to pay for climate-friendly products and support for climate-friendly political measures US: all indicators negatively correlated with right-wing political orientation
Cicatiello et al. (2020)	European Values Study linked with regional information of Italian regions at NUTS-2 level, econometric models	High regional incidence of polluting industries lowers willingness to pay for environmental protection
Ponce et al. (2019)	Data from the National Institute of Statistics and Census (NISC) in Ecuador, 2010–2016, panel data econometrics	Labour income and human capital support self-perceived environmental behaviour of households

Aasen and Vatn (2018)	1,500 car owners in Oslo, econometric analysis	Higher social responsibility for avoiding climate change positively correlated with support for increase in petrol prices
Melo et al. (2018)	UK Household Longitudinal Study, econometric analysis of 21 different green self-perceived behaviours	Work-life imbalance not relevant for perceived pro-environmental behaviour; factors such as individual's attitudes towards the environment, age, education, household income and presence of young children are relevant
Meta analyses		
Zhang and Dong (2020)	97 papers on green purchase behaviour published between 2015 and 2020	Evidence on individual factors quite mixed and varies between different green products
Testa et al. (2021)	113 papers published between 2000 and 2018, survey-based quantitative approach	Ecological values, altruism, collectivism, social justice positively correlated with green consumption behaviour; past green behaviour drives green consumption in the future; personal capabilities (technological knowledge, income, education) all important drivers of green consumption but results mixed for different products; social norms (behaviour of peers, parents, general social pressure) are crucial
Andor and Fels (2018)	44 international studies	Four interventions - social comparison, commitment devices, goal-setting, and labelling – significantly reduce energy consumption of private households

Summary and stylised facts

The analysis of the extensive literature on green (consumption) behaviour shows that there are common determinants across different indicators and countries, but also indicator-related specificities. Personal factors such as female gender, education, and high income, are positively correlated with green (consumption) behaviour, although there are considerable differences between green products. For example, one study shows that middle age and middle income are important factors in buying electric vehicles, but they are not significantly relevant for green food. A perceived environmental concern is also connected with green behaviour: environmentally conscious people appear more likely to use public transport, purchase hybrid vehicles, and consume less petrol than to non-environmentalists. A caveat of this kind of analysis, however, is that environmentally active individuals are expected to show high values for self-perceived environmental awareness, although many of the studies reviewed do not discuss this endogeneity problem. The role of the number of children in a household seems to be mixed: a higher number of children reduces the probability of buying green products because of the negative income effect, while other 'costless' environmental activities (e. g. waste minimisation) may be positively correlated with the household size.

Social norms - especially peer effects and the consumption patterns of reference persons - are significantly correlated with green consumption indicators. Learning from peers seems to enforce pro-environmental behaviour. Social norms are particularly relevant for recycling activities and public transport.

Unsurprisingly, income is especially important for cost-intensive green activities, such as the installation of renewable energy or heating systems. Poor households show a lower probability of adopting high-cost energy efficient technology, such as the installation of photovoltaic systems. Economic incentives seem to be very important in triggering the use of these technologies.

Interestingly, some studies also find a significant negative relationship between the pollution intensity of the most prevalent economic sectors in a region and green household behaviour. Results show that high regional incidence of polluting industries may lower the willingness to pay for environmental protection, for example.

Some of the studies point to the important role of labelling and information. One interesting example is that illustrations of forests on labels might promote the purchase of certified forest coffee.

The political orientation of an individual plays an important role in green behaviour, with left-green policy identification positively correlated with support for energy policy measures. This is not the case for respondents showing a liberal-conservative policy orientation.

Despite the extensive literature on green household behaviour, research gaps persist. Most of the analyses are for a single country, whereas comparative quantitative country analyses are rare. This paper attempts to close some of those gaps and is exclusively based on European-wide databases. Comprehensive comparisons of different green (consumption) activities within a common econometric framework are similarly lacking, and Section 4.3 tries to close this gap using data from the recent Eurobarometer 92.4 (2020). The determinants of green voting behaviour are also analysed.

ECONOMETRIC ANALYSIS: A MULTI-SOURCE APPROACH

DATA SOURCES

The econometric analyses of the determinants of green household behaviour rely on two different European-wide data sources, the European Social Survey (ESS) (2017 and 2019) and the Eurobarometer 92.4 (2020). The ESS is a Europe-wide comparative general social survey in place since

2002. This analysis uses ESS round 8 (2017), containing 44,387 observations, and ESS round 9 (2019), with 49,519 observations. Looking at indicators for green household behaviour, ESS 2017 allows an analysis of self-perception of environmental problems and voting for green parties as a revealed preference indicator. It also contains a module on climate change and energy preferences (see detailed descriptions below). One major advantage of this data source is the broad country coverage. ESS 2017 contains the EU (excluding Bulgaria, Croatia, Cyprus, Denmark, Greece, Latvia, Malta, Luxembourg, Romania) and Israel, the Russian Federation, Iceland, Norway, and Switzerland. ESS 2019 also covers the EU (without Greece, Latvia, Malta, Luxembourg, Romania) and Iceland, Montenegro, Norway, Serbia and Switzerland. Data are collected by computer-assisted personal interviewing (ESS, 2017). The samples for the different countries must be representative of all people aged 15+, irrespective of nationality, citizenship, or language. Individuals are selected by random probability methods. All countries should attain a minimum sample size of 1,500, or 800 in countries with populations below two million.

The database of Eurobarometer 92.4 is very recent (December 2020) and allows the analysis of green consumption behaviour by various fields as revealed preference indicators. It covers all European countries, with 27,498 observations in the sample. The survey was carried out by Kantar Public Brussels, at the request of the European Commission in 2019. The whole population aged 15+ was considered for each country, with households selected by random probability methods. In each household, the respondent was drawn at random. If there was no answer, the interviewer revisited the same household up to three additional times. The interviews were conducted face-to-face in people's homes and in the appropriate national language (European Commission, 2019).

ESTIMATION RESULTS BASED ON THE ESS (2017 AND 2019)

Estimation strategy

Most of the dependent variables capturing green household behaviour are binary, thus probit models can be used for estimation. For example, for each green consumption field, a household has to decide whether to buy the green product (Y=1) or the non-green one (Y=0). Following the theoretical considerations, different factors such as gender, income, and education level, summarised by a vector x, may influence this decision. Therefore, an estimation of the probability $Prob\ (Y = 1|\ \boldsymbol{x}) = F\ (\boldsymbol{x}, \beta)$ is needed.

The β parameters reflect the impact of changes in x on this probability (Greene, 2008, p. 772). Average marginal effects for all covariates are calculated, allowing comparisons of the different consumption fields. A count variable is calculated for green (consumption) activities so that the estimation of a negative binomial regression is adequate (see Section 4.3). The analysis of different green consumption fields requires an estimation of a multivariate probit model instead of simple probit models, as the different outcomes are correlated. The multivariate probit model simultaneously estimates the determinants of four different green activities, including a common set of covariates (see Section 4.3).

ESS 2019 includes two indicators capturing green household behaviour (see Table 2): a self-perceived indicator capturing the importance of environmental problems for the respondent; and voting for green parties as a revealed preference indicator. The number of observations for green voting is lower compared with the self-perceived indicator because some countries do not have a green party. The combined indicator 'energyclimate' stems from ESS 2017. It is assigned a value of 1 when a respondent is highly likely to buy most energy-efficient home appliances and often does things to reduce energy use, or strongly feels personal responsibility to mitigate climate change and worries about climate change.

Table 2: Indicators for the greenness of households (dependent variables)

Greenness indicators	**In % of all respondents**	**Number of observations**
ESS 2019		
Green perception: important to care for nature and environment: Very much like me	35.1	48,634
Voting for a green party: Yes	6.9	27,172
ESS 2017		
Energyclimate: Yes	30.9	44,387

Source: ESS 2017, ESS 2019, ESS (2018), own calculations.

Table 3 summarises the indicators for the determinants of green household behaviour.

Table 3: Indicators for the determinants of green household behaviour

Determinants of green household behaviour	**ESS indicators**
Individual variables	
Personal characteristics and orientation	*Age* (in years), *female* (gender), *married* or *partner (ESS 2017), academic* education, *vocational* education, *eduyrs* (education in years), *relig* (very religious), *retired, unempdisabled* (unemployed or permanently sick or disabled), *selfemployed* (self employment), *responsibility* (responsible for supervising other employees), *publicemp* (employed in the public sector), *manuintens* (employed in environmentally intensive production sectors), employed in the *construction* sector, *healthsocial* (working in health or social oriented professions) *partdemonst* (participation in demonstrations) *minority* (belong to minority ethnic group in country) *creative* (important to think new ideas and being creative) *happydum* (high happiness), *helppeople* (important to help people and care for others well-beings), *imprichness* (important to be rich, have money and expensive things), *impsafeness* (important to live in secure and safe surroundings), *ruleconfident* (important to do what is told and follow rules), *polinterest* (interested in politics), *socialequal* (society fair when income and wealth is equally distributed)
Housing characteristics	*householdsize* (household size)
Income/poverty	*highincome* (8th to 10th decile of the income distribution), *poverty* (first decile of household's total net income)
Contextual variables	
Regional living conditions, social milieu	*smallcity* (small city), *victim* (respondent or household member victim of burglary/assault last 5 years), *country* (farm or home in countryside)
Political conditions	*fairchance* (political system in country gives everyone fair chance to participate in politics), *satisfygov* (satisfaction with government)

Results of ESS 2019

The results of the probit models for the determinants of green behaviour indicated by the perceived importance of care for nature and the environment, and green voting are summarised for all countries and country groups (see Tables 4 and 5).

Confirming other studies in the literature (see Section 3.2), the results show that women disproportionally vote for green parties and have higher perceived environmental awareness, supporting the

study hypothesis H1. For the Northern countries (Denmark, Finland, Iceland, Norway, Sweden), the marginal effects for *female* (6.7% green perception, 4.9% green votes) are much higher than those for all countries (1.5% and 2.6%, respectively). For the *age* of the respondents, results are mixed. For nearly all countries, age is positively correlated with perceived green orientation, but is not significant for green votes, except a significantly negative sign in Northern countries. For green perception, *married* status shows a significantly negative correlation, but only for the core EU (AT, BE, CH, DE, ES, FR, GB, IE, IT, NL, PT) and the sample of all countries. This result also holds for the green votes model. High qualification and education seem to be crucial for both green indicators, documented by the significant marginal effects of *academic*, *vocational* and *eduyrs* (supporting H3). Only for the Baltic and Balkan countries is this relationship not significant. In all countries, higher *religi*ousness is negatively correlated with the green voting indicator, but is not significant for green perception, except in the Baltic countries.

Interestingly, for the perceived green indicator, a poor economic situation is not a barrier to green attitudes, as the marginal effects for unemployment (*unempdisabled*) and *poverty* have significantly positive signs. Similar indicators show negative signs for cost-intensive green consumption behaviour, but green attitudes seem independent from economic restrictions (see Section 4.3). Respondents' occupation is also correlated with green attitudes. Employees in the public sector (*publicemp*) disproportionally vote for green parties and have a high green perception. The Northern countries show the highest marginal effects for this variable (4% green perception, 3% green votes). On the other hand, working in environmentally intensive branches (*manuintens*) significantly reduces the probability of voting green (supporting H4). This result also holds for respondents working in the *construction* sector and, surprisingly, in the *health* and *social* sectors.

In nearly all countries, a high degree of happiness (*happydum*), creativity (*creative*) and willingness to participate in demonstrations (*partdemonst*) positively correlate with the green perception indicator, but the results for green votes show a slightly different picture. In the core EU countries, high happiness is significantly positively correlated with green votes, but shows a negative sign for the Northern countries.

Different results for the two indicators are observed for the importance of living in secure and safe surroundings (*impsafeness*), importance of following rules (*ruleconfident*), and a high interest in politics (*polinterest*) (H5). These indicators are negatively (or not, as in the case of *polinterest*) correlated with green voting behaviour, showing that the green voters seem disproportionally progressive and 'game changers', while these variables are positively significant for the green perception indicators across all countries. Indicators of interest in helping people and caring for others (*helppeople*) and a high preference for social equality (*socialequal*) are positively correlated with green perception indicators for nearly all countries. Again, the green voting indicators differs, with *helppeople* not significant for all countries.

The political system and living conditions as contextual variables are also relevant for green behaviour. If respondents believe that the political system in a country ensures a fair chance for everyone (*fairchance*) to participate in politics, the probability of more green attitudes increases. This result holds for all countries except the Baltic and the Balkan countries, whose democracies are relatively new. Living in a *small city* or in the *country*side is not significantly correlated with green attitudes.

Table 4: Green perception model (ESS 2019)

Correlates	All countries	Core EU and CH	Eastern countries	Baltic countries	Balkan countries, CY	Northern countries
age	0.018**	0.020**	0.005	0.027**	0.014+	0.016**
	(0.002)	(0.004)	(0.006)	(0.007)	(0.007)	(0.006)
female	0.015**	0.004	0.011	0.005	-0.011	0.067**
	(0.005)	(0.008)	(0.013)	(0.017)	(0.015)	(0.013)
married	-0.015*	-0.023*	-0.026	-0.031	0.019	0.008
	(0.007)	(0.010)	(0.019)	(0.021)	(0.019)	(0.017)
academic	0.059**	0.079**	0.088*	-0.021	0.057	0.013
	(0.011)	(0.015)	(0.037)	(0.037)	(0.045)	(0.023)
vocational	0.016+	0.035**	0.022	-0.022	-0.006	-0.015
	(0.008)	(0.012)	(0.022)	(0.028)	(0.028)	(0.020)
eduyrs	0.004**	0.002+	0.005	0.009**	0.001	0.003*
	(0.001)	(0.001)	(0.003)	(0.003)	(0.004)	(0.002)
relig	0.002	0.004	0.004	0.037*	-0.001	-0.015
	(0.006)	(0.009)	(0.014)	(0.018)	(0.015)	(0.014)
retired	0.006	0.003	0.028	-0.000	0.047*	-0.024
	(0.007)	(0.011)	(0.018)	(0.021)	(0.023)	(0.018)
unempdisabled	0.025*	0.006	0.012	0.021	0.062*	0.082**
	(0.011)	(0.017)	(0.031)	(0.032)	(0.029)	(0.030)
selfemployed	0.020*	0.014	0.027	0.050+	0.035	0.011
	(0.008)	(0.012)	(0.021)	(0.028)	(0.025)	(0.019)
responsibility	-0.016**	-0.019*	-0.007	-0.014	-0.023	-0.015
	(0.006)	(0.008)	(0.017)	(0.017)	(0.017)	(0.013)
publicemp	0.021**	0.006	0.004	0.019	0.038*	0.039**
	(0.006)	(0.010)	(0.014)	(0.018)	(0.017)	(0.014)
manuintens	-0.018+	-0.003	-0.041*	-0.008	-0.018	-0.042
	(0.010)	(0.016)	(0.019)	(0.030)	(0.023)	(0.029)
construction	-0.027*	-0.048**	-0.046*	0.003	0.017	-0.011
	(0.011)	(0.017)	(0.022)	(0.030)	(0.030)	(0.024)
healthsocial	-0.030**	-0.026*	-0.009	-0.033	-0.023	-0.045**
	(0.008)	(0.012)	(0.024)	(0.029)	(0.036)	(0.017)
partdemonst	0.071**	0.069**	-0.004	-0.002	0.042	0.118**
	(0.010)	(0.014)	(0.026)	(0.043)	(0.031)	(0.021)
minority	-0.039**	-0.053**	-0.101**	0.015	-0.025	-0.016
	(0.011)	(0.018)	(0.028)	(0.025)	(0.026)	(0.032)
creative	0.116**	0.115**	0.124**	0.106**	0.105**	0.118**
	(0.007)	(0.011)	(0.022)	(0.028)	(0.021)	(0.016)
happydum	0.030**	0.025**	0.030*	0.053**	0.041**	0.004
	(0.006)	(0.008)	(0.013)	(0.016)	(0.015)	(0.015)
helppeople	0.216**	0.219**	0.242**	0.244**	0.256**	0.170**
	(0.007)	(0.010)	(0.024)	(0.026)	(0.019)	(0.014)
imprichness	-0.038+	-0.059+	-0.041	0.023	-0.057	-0.068
	(0.020)	(0.032)	(0.033)	(0.057)	(0.049)	(0.069)
impsafeness	0.166**	0.118**	0.221**	0.301**	0.219**	0.065**
	(0.007)	(0.010)	(0.016)	(0.021)	(0.019)	(0.017)
ruleconfident	0.106**	0.092**	0.141**	0.173**	0.058*	0.108**
	(0.010)	(0.016)	(0.025)	(0.040)	(0.025)	(0.022)
polinterest	0.056**	0.051**	0.039	0.055+	0.017	0.082**

	(0.008)	(0.011)	(0.030)	(0.032)	(0.030)	(0.017)
socialequal	0.070**	0.085**	-0.018	-0.039	0.128**	0.069**
	(0.008)	(0.011)	(0.019)	(0.032)	(0.021)	(0.025)
householdsize	-0.005*	-0.008*	-0.011+	0.003	-0.001	0.001
	(0.002)	(0.004)	(0.006)	(0.007)	(0.006)	(0.006)
highincome	-0.007	-0.004	-0.014	-0.027	0.031	-0.019
	(0.006)	(0.010)	(0.016)	(0.020)	(0.019)	(0.014)
poverty	0.027**	0.021	0.016	0.037	0.020	0.040
	(0.010)	(0.016)	(0.022)	(0.025)	(0.029)	(0.028)
smallcity	-0.004	0.004	0.001	-0.050**	-0.001	0.007
	(0.006)	(0.010)	(0.015)	(0.018)	(0.019)	(0.014)
country	0.005	0.014	-0.004	-0.008	0.013	-0.004
	(0.006)	(0.010)	(0.015)	(0.019)	(0.018)	(0.015)
victim	0.030**	0.036**	0.001	0.043+	0.062*	0.018
	(0.007)	(0.011)	(0.024)	(0.024)	(0.025)	(0.015)
fairchance	0.025**	0.019+	0.048*	0.020	-0.014	0.048**
	(0.006)	(0.010)	(0.020)	(0.019)	(0.023)	(0.012)
satisfygov	0.020**	0.030**	0.011	0.012	0.001	0.033
	(0.007)	(0.011)	(0.015)	(0.021)	(0.017)	(0.020)
Observations	30,799	13,695	4,419	3,326	3,533	5,826
Wald Chi	4603** (61)	1831** (43)	793** (37)	587** (35)	822** (37)	667** (37)
Pseudo R^2	0.13	0.11	0.19	0.16	0.20	0.10
Overfit in % (SE)	1.19 (0.08)	2.26 (0.20)	3.84 (0.41)	5.47 (0.53)	3.78 (0.38)	5.34 (0.44)

Probit models. Average marginal effects are reported. Robust standard errors in parentheses, ** p<0.01, * p<0.05, + p<0.1. Calculation of shrinkage statistics based on Bilger and Manning (2015).

Source: ESS (2019), own estimations.

Table 5: Green vote model (ESS 2019)

Correlates	All countries	Core EU and CH	Baltic countries	Northern countries
age	-0.002	-0.004	0.003	-0.011*
	(0.002)	(0.003)	(0.007)	(0.004)
female	0.026**	0.034**	0.014	0.049**
	(0.004)	(0.007)	(0.016)	(0.009)
married	-0.018**	-0.022*	0.010	-0.014
	(0.005)	(0.009)	(0.023)	(0.012)
academic	0.019*	0.031*	0.004	0.022
	(0.008)	(0.014)	(0.033)	(0.019)
vocational	0.002	-0.002	0.025	-0.008
	(0.007)	(0.012)	(0.026)	(0.017)
eduyrs	0.002**	0.002*	-0.002	0.004**
	(0.001)	(0.001)	(0.003)	(0.001)
relig	-0.022**	-0.026**	-0.031*	-0.021*
	(0.004)	(0.006)	(0.015)	(0.010)
retired	-0.009+	-0.003	-0.000	-0.023+
	(0.005)	(0.009)	(0.019)	(0.012)
unempdisabled	-0.003	0.013	0.008	-0.042**
	(0.008)	(0.016)	(0.030)	(0.016)
selfemployed	0.009	0.022*	0.040	0.013
	(0.006)	(0.010)	(0.030)	(0.015)
responsibility	-0.008*	-0.006	-0.011	-0.013
	(0.004)	(0.007)	(0.016)	(0.009)
publicemp	0.016**	0.014+	0.009	0.030**
	(0.004)	(0.007)	(0.016)	(0.011)
manuintens	-0.020**	-0.036**	0.027	-0.003
	(0.007)	(0.011)	(0.031)	(0.024)
construction	-0.017*	-0.042**	0.008	-0.008
	(0.008)	(0.012)	(0.032)	(0.019)
healthsocial	0.001	0.002	-0.032	-0.002

	(0.005)	(0.009)	(0.024)	(0.012)
partdemonst	0.049**	0.067**	0.039	0.065**
	(0.007)	(0.013)	(0.043)	(0.016)
minority	0.001	0.018	-0.041+	0.001
	(0.009)	(0.018)	(0.023)	(0.024)
creative	0.021**	0.027**	0.035	0.031**
	(0.005)	(0.009)	(0.026)	(0.011)
happydum	-0.002	0.015*	-0.010	-0.026*
	(0.004)	(0.007)	(0.014)	(0.012)
helppeople	-0.004	-0.009	-0.013	-0.008
	(0.004)	(0.007)	(0.020)	(0.009)
imprichness	-0.033*	-0.018	-0.027	-0.082**
	(0.013)	(0.036)	(0.041)	(0.022)
impsafeness	-0.014**	-0.022**	0.017	-0.013
	(0.004)	(0.008)	(0.016)	(0.012)
ruleconfident	-0.022**	-0.025*	0.022	-0.038**
	(0.006)	(0.012)	(0.033)	(0.013)
polinterest	0.009+	0.011	-0.035	0.003
	(0.005)	(0.008)	(0.025)	(0.011)
socialequal	0.017**	0.028*	-0.040+	0.059**
	(0.006)	(0.011)	(0.024)	(0.020)
householdsize	-0.001	-0.001	-0.006	-0.004
	(0.002)	(0.003)	(0.009)	(0.004)
highincome	-0.006	0.002	-0.032	-0.021*
	(0.004)	(0.007)	(0.020)	(0.010)
poverty	0.025**	0.003	0.055*	-0.021
	(0.008)	(0.015)	(0.022)	(0.018)
smallcity	-0.004	0.002	0.022	-0.023*
	(0.004)	(0.008)	(0.019)	(0.009)
country	-0.006	-0.011	0.052**	-0.035**
	(0.004)	(0.008)	(0.019)	(0.010)
victim	0.001	-0.012	0.040	-0.003
	(0.005)	(0.008)	(0.027)	(0.010)
fairchance	0.007+	0.001	-0.006	0.011
	(0.004)	(0.007)	(0.019)	(0.009)
satisfygov	0.020**	0.029**	-0.003	0.047**
	(0.006)	(0.011)	(0.019)	(0.016)
Observations	21,055	8,274	2,055	4,845
Wald Chi	1744** (52)	554** (41)	332** (35)	441** (37)
Pseudo R^2	0.19	0.14	0.25	0.15
Overfit in % (SE)	3.38 (0.32)	6.59 (0.68)	13.8 (1.52)	9.37 (0.98)

Probit models. Average marginal effects are reported. Robust standard errors in parentheses, ** p<0.01, * p<0.05, + p<0.1. Calculation of shrinkage statistics based on Bilger and Manning (2015). Analysis of the Eastern European countries and Balkan countries was not undertaken due to very low numbers of green votes.

Source: ESS (2019), own estimations.

Results of ESS 2017

The ESS survey of 2017 allows including further indicators of energy-saving behaviour and climate change attitudes. The combined indicator *energyclimate* is assigned a value of 1 where a respondent is highly likely to buy most energy-efficient home appliances and often does things to reduce energy use **or** feels strong personal responsibility to mitigate climate change and worries about climate change. The models are also estimated for each indicator, but as the results are quite similar, only the models with the combined indicator are reported.

Overall, the results for the energy/climate indicator confirm the findings of perceived environmental consciousness and green voting observed in ESS 2019 (see Table 6). *Age* is positively correlated with energy and climate behaviour (except in Northern countries). Women are significantly more in favour of energy and climate measures, with the highest marginal effect (6.6%) for the Northern countries.

Table 6: Energy and climate change (ESS 2017)

Correlates	All countries	Core EU and CH	Eastern European, Baltic	Northern countries
age	0.016**	0.018**	0.019**	0.005
	(0.002)	(0.003)	(0.004)	(0.005)
female	0.044**	0.046**	0.022*	0.066**
	(0.006)	(0.008)	(0.010)	(0.014)
partner	0.033**	0.050**	0.025*	-0.004
	(0.006)	(0.009)	(0.011)	(0.016)
academic	0.031**	0.050**	0.023	-0.030
	(0.012)	(0.016)	(0.027)	(0.026)
vocational	0.015+	0.024*	0.028	-0.054*
	(0.009)	(0.012)	(0.018)	(0.021)
eduyrs	0.007**	0.007**	0.007**	0.009**
	(0.001)	(0.001)	(0.002)	(0.002)
relig	0.019**	0.018*	0.031**	0.019
	(0.006)	(0.009)	(0.011)	(0.016)
retired	-0.026**	-0.028*	-0.025+	-0.008
	(0.008)	(0.011)	(0.013)	(0.020)
unempdisabled	0.029*	0.048**	0.021	0.008
	(0.011)	(0.016)	(0.023)	(0.026)
selfemployed	-0.015+	-0.013	-0.024	-0.008
	(0.008)	(0.011)	(0.016)	(0.020)
responsibility	0.012+	0.014+	0.009	0.006
	(0.006)	(0.009)	(0.012)	(0.014)
publicemp	0.014*	0.010	0.023*	0.015
	(0.006)	(0.010)	(0.011)	(0.015)
manuintens	-0.008	-0.001	-0.001	-0.062*
	(0.011)	(0.016)	(0.016)	(0.031)
construction	-0.013	-0.003	-0.037*	-0.022
	(0.011)	(0.016)	(0.017)	(0.026)
healthsocial	-0.000	0.023+	-0.023	-0.026
	(0.009)	(0.012)	(0.019)	(0.017)
partdemonst	0.072**	0.070**	0.055*	0.105**
	(0.011)	(0.014)	(0.026)	(0.023)
minority	0.000	-0.018	-0.008	0.080*
	(0.012)	(0.019)	(0.018)	(0.038)
creative	0.078**	0.078**	0.060**	0.097**
	(0.007)	(0.010)	(0.015)	(0.016)
happydum	0.066**	0.071**	0.070**	0.058**
	(0.006)	(0.008)	(0.010)	(0.015)
helppeople	0.075**	0.085**	0.049**	0.068**
	(0.007)	(0.009)	(0.014)	(0.015)
imprichness	-0.030+	-0.067*	0.035	-0.027
	(0.016)	(0.029)	(0.024)	(0.058)
impsafeness	0.036**	0.028**	0.034**	0.027
	(0.007)	(0.010)	(0.011)	(0.019)
ruleconfident	0.009	0.004	0.012	0.024
	(0.010)	(0.015)	(0.017)	(0.022)

polinterest	0.073**	0.080**	0.067**	0.053**
	(0.008)	(0.011)	(0.021)	(0.019)
householdsize	-0.004+	-0.003	-0.006	-0.001
	(0.003)	(0.004)	(0.005)	(0.006)
highincome	-0.020**	-0.031**	-0.005	-0.010
	(0.007)	(0.010)	(0.012)	(0.015)
poverty	0.027**	0.026+	0.016	0.011
	(0.011)	(0.016)	(0.018)	(0.027)
smallcity	-0.009	-0.013	0.017	-0.015
	(0.007)	(0.010)	(0.011)	(0.015)
country	-0.008	-0.001	-0.007	-0.022
	(0.007)	(0.010)	(0.012)	(0.016)
victim	0.026**	0.031**	0.026+	0.020
	(0.007)	(0.011)	(0.015)	(0.016)
satisfygov	0.031**	0.027*	0.017	0.052*
	(0.008)	(0.011)	(0.012)	(0.020)
Observations	29,432	14,874	8,264	4,989
Wald Chi	2514** (53)	1217** (41)	537** (37)	321** (34)
Pseudo R^2	0.07	0.06	0.06	0.06
Overfit in % (SE)	2.11 (0.15)	3.55 (0.27)	7.30 (0.62)	11.3 (1.15)

Probit models. Average marginal effects are reported. Robust standard errors in parentheses, ** p<0.01, * p<0.05, + p<0.1. Calculation of shrinkage statistics based on Bilger and Manning (2015).

Source: ESS (2017), own estimations.

In all countries, higher education – as documented by the indicators *academic*, *vocational* and *eduyrs* - is positively correlated with energy saving and climate orientation. This also holds for *religi*ous orientation, except in Eastern European and Northern countries. *Retired* people are less likely to support energy saving and climate change measures. Interestingly, unemployed, disabled (*unempdisabled*) or poor respondents (*poverty*) are more likely to support energy and climate change measures, while a *high income* is negatively correlated with *energyclimate*. This might be due to the self-perceived character of the energy/climate indicator, whereby a person can worry about climate change without bearing the costs. Revealed preference indicators, including cost-intensive activities, show opposite signs of poverty indicators (see Section 4.3). Politically interested (*polinterest*) and active (*partdemonst*) respondents are also more likely to support energy and climate measures. Characteristics such as happiness (*happydum*), creativity (creative) and a preference for helping other people (*helppeople*) are positively correlated with *energyclimate*. These three variables are significant for all country groups. In the core EU, and especially in the Northern countries, low satisfaction with the government is related to a green orientation, but this is not the case for newer Member States. Overall, however, respondents from the old Member States appear satisfied with the energy and climate policy of their governments.

ESTIMATION RESULTS BASED ON EUROBAROMETER 92.4 (2020): EUROPEAN CITIZENS' ATTITUDES TOWARDS THE ENVIRONMENT

Eurobarometer 92.4 (2020) allows an analysis of different green (consumption) activities for 28 European countries (see Table 7).

Table 7: Different green (consumption) activities

Green activities during the past six months	In %
1. Chosen a more environmentally-friendly way of travelling (walk, bicycle, public transport, electric car),	27.8
2. Avoided buying over-packaged products,	28.4
3. Avoided single-use plastic goods other than plastic bags (e. g. plastic cutlery, cups, plates, etc.) or bought reusable plastic products,	43.8
4. Separated most of your waste for recycling,	65.5
5. Cut down your water consumption,	27.2
6. Cut down your energy consumption (e. g. by turning down air conditioning or heating, not leaving appliances on stand-by, buying energy-efficient appliances),	36.1
7. Bought products marked with an environmental label,	22.2
8. Bought local products,	43.6
9. Used your car less by avoiding unnecessary trips, working from home (teleworking), etc.,	18.8
10. Joined an environmentally-related demonstration, attended a workshop, taken part in an activity (e.g. a collective beach or park cleanup),	5.8
11. Changed your diet to more sustainable food,	17.9
12. Spoken to others about environmental issues,	30.3
13. Bought second-hand products (e. g. clothes or electronics) instead of new ones,	20.7
14. Repaired a product instead of replacing it.	30.9

Source: Eurobarometer 92.4 Bilingual Master Questionnaire (2020: 8/9), own calculations.

In a first step, the different green (consumption) activities are condensed into a single dependent variable *greenactivities* (see Table 8). This variable denotes the number of revealed green (consumption) activities, ranging from 0 to 14. This non-negative count variable can be analysed using a negative binomial regression model. The tested and significant existence of overdispersion in all model variants (denoting that the variance is bigger than the mean of the Poisson process ($Var(y|\mathbf{x}) > E(y|\mathbf{x})$)) does not allow the use of a mere Poisson model (see also Cameron and Trivedi (2009) for a detailed description of the model).

The econometric results for the model capturing all countries (see Table 8) show that women are more likely to engage in green (consumption) activities, confirming the findings of the literature review, H1, and the econometric models in Section 4.2. Interestingly, this result does not hold for Croatia, Cyprus, Greece and Malta. The highest marginal effect can be observed for the Northern countries. Living in a *partnership* also promotes green consumption activities, while respondent age is negatively correlated with GCA. That result for *partnership* is especially relevant for the Baltic countries and Croatia, Cyprus, Greece and Malta, but is not significant for the core EU or Northern countries. A high qualification (*highqual*) is positively correlated with green consumption activity, as is high satisfaction (*highsatisfaction*), except in Northern countries and Eastern European countries.

As the combined green indicator contains cost-intensive activities, the employment situation, poverty, and wealth are relevant for the self-perceived importance of green issues. This runs contrary to the findings in Section 4.3. For all countries, *unemployed*, *retired* persons and those only taking care of

the household (*housemanwife*) are less likely to engage in green consumption activities. This also holds for lower incomes, as indicated by belonging to *workclass,* and poverty, as indicated by problems paying bills (*diffbills*) in the last 12 months. Interestingly, these results are not valid for the Northern countries: employment status does not play a role, nor is poverty (indicated by *diffbills* and *workclass*) significant. This result is likely due to the highly developed social security systems in these countries.

Living conditions characterised by a high level of pollution play a role for all countries. Those feeling a direct daily negative life effect of environmental problems (*envaffected*) show more green consumption activity. Interestingly, for the model of all countries, living in big towns (*bigtown*) increases the probability of green consumption activity, while living in the *countryside* has no significant effect. The different country models reveal that living in big towns is especially relevant for the Baltic countries, as well as Croatia, Cyprus, Greece and Malta.

Table 8: Results for all green consumption activities (green activities score)

Correlates	All countries	EU core	Eastern European countries	Baltic countries	HR, CY, GR, MT	DK, FI, SE
woman	0.391**	0.477**	0.158**	0.493**	0.072	1.024**
	(0.030)	(0.049)	(0.056)	(0.090)	(0.076)	(0.103)
partner	0.165**	0.100+	0.113+	0.284**	0.290**	0.118
	(0.037)	(0.060)	(0.067)	(0.101)	(0.090)	(0.149)
lnhouseholdsize	0.076*	0.149*	0.108+	-0.085	0.043	0.120
	(0.037)	(0.060)	(0.065)	(0.100)	(0.086)	(0.149)
age	-0.004**	-0.002	0.003	-0.005	-0.006+	-0.016**
	(0.001)	(0.002)	(0.003)	(0.004)	(0.003)	(0.005)
highqual	0.624**	0.761**	0.493**	0.562**	0.533**	0.613**
	(0.037)	(0.059)	(0.077)	(0.096)	(0.096)	(0.117)
housemanwife	-0.177*	-0.241*	-0.060	-0.097	0.090	0.484
	(0.075)	(0.109)	(0.166)	(0.242)	(0.170)	(1.047)
employed	0.146**	0.220**	0.159*	0.033	0.055	-0.067
	(0.042)	(0.069)	(0.072)	(0.126)	(0.101)	(0.157)
unemployed	-0.211**	-0.118	-0.399**	-0.351+	0.051	-0.348
	(0.074)	(0.118)	(0.149)	(0.192)	(0.172)	(0.304)
retired	-0.169**	-0.072	-0.341**	-0.457**	0.148	-0.187
	(0.054)	(0.089)	(0.092)	(0.153)	(0.142)	(0.196)
diffbills	-0.228**	-0.006	-0.174**	-0.489**	-0.565**	-0.006
	(0.038)	(0.061)	(0.064)	(0.100)	(0.082)	(0.220)
envaffected	0.997**	1.139**	0.668**	0.690**	1.096**	1.173**
	(0.033)	(0.053)	(0.061)	(0.092)	(0.073)	(0.128)
envcostbear	0.507**	0.780**	0.277**	0.481**	0.090	0.576**
	(0.036)	(0.058)	(0.074)	(0.136)	(0.082)	(0.105)
countryside	0.058	0.122*	0.047	-0.037	-0.011	0.083
	(0.037)	(0.059)	(0.069)	(0.104)	(0.091)	(0.138)
bigtown	0.180**	0.064	0.031	0.272*	0.644**	0.071
	(0.037)	(0.061)	(0.067)	(0.108)	(0.105)	(0.117)
workclass	-0.296**	-0.362**	-0.340**	-0.276**	-0.136	-0.043
	(0.038)	(0.062)	(0.068)	(0.099)	(0.092)	(0.159)
upphighclass	-0.022	0.229	-0.043	-0.870+	-1.550**	0.823+
	(0.154)	(0.231)	(0.287)	(0.492)	(0.471)	(0.474)
highsatisfaction	0.182**	0.180**	0.071	0.272*	0.360**	0.168
	(0.036)	(0.055)	(0.079)	(0.121)	(0.095)	(0.109)

left	0.608**	0.770**	0.253**	0.100	0.518**	1.141**
	(0.044)	(0.075)	(0.081)	(0.138)	(0.108)	(0.155)
middle	0.291**	0.442**	0.056	0.242**	0.288**	0.426**
	(0.037)	(0.067)	(0.064)	(0.091)	(0.085)	(0.146)
politunsatisfied	0.111**	0.092+	0.190**	0.044	0.044	0.179+
	(0.031)	(0.051)	(0.055)	(0.087)	(0.075)	(0.104)
Observations	27,397	11,173	6,151	2,991	4,039	3,043
Wald Chi^2	8387** (48)	3333** (31)	639** (25)	414** (22)	774** (24)	750** (22)
Pseudo R^2	0.05	0.05	0.02	0.03	0.04	0.04
Overfit in % (SE)	0.71 (0.06)	1.19 (0.14)	4.66 (0.54)	6.50 (0.71)	4.12 (0.45)	3.90 (0.48)

Negative binomial models. Average marginal effects are reported. Robust standard errors in parentheses, ** p<0.01, * p<0.05, + p<0.1. Calculation of shrinkage statistics based on Bilger and Manning (2015).

Source: Eurobarometer 92.4 (2020), own estimations.

The results for political orientation show that politically *left* and *middle* oriented people are more likely to engage in green consumption, as are those who are dissatisfied with politics in their country. This might be because the majority of the parties with government responsibilities do not sufficiently represent the preferences of green respondents (H5). This result is especially relevant for core EU and Eastern European countries, but is not the case in the Baltic and Northern countries, or in Croatia, Cyprus, Greece and Malta, where green consumers seem to support their governments.

Differences between green consumption fields

The analysis of different green consumption fields and other green-related activities uses a multivariate probit model (Roodman, 2011) instead of simple probit models (see Table 9), as the different green activities could be correlated. As the error terms of the single models are significantly correlated, this choice of model is appropriate. Nevertheless, there are only marginal differences in the results compared to the simple probit models (see Table A4 in the Appendix).

Gender (*female* is relevant only for environmental activities (*envactivities*) (e.g. avoiding plastic, reducing water consumption, avoiding unnecessary packaging, separating waste, or participating in environmental actions) and environmental products (*envproducts*). By contrast, recycling activities such as repairing rather than replacing a product show no gender difference. The *age* of the respondent is negatively correlated with environmentally friendly mobility activities and recycling, but positively correlated with environmental activities. This is not surprising, as older people are less able to move about on foot or bicycle. Interestingly, the occupational status *employed* is only significant for cost-intensive environmental products, suggesting that income matters for this category (supporting H2). Consequently, *unemployed* and people struggling to pay their bills (*diffbills*) show a lower probability of buying environmental products or engaging in environmental activities, although the marginal effects of these variables for mobility and recycling are insignificant or even positive (recycling). This argument is reinforced by the significantly negative variable *workclass* (i.e. being working class) for the probability of environmentally friendly activities and consumption behaviour. These findings do not imply that high income households are more environmentally friendly in their overall ecological footprint *per se*. Compared to low-income households, they might have higher total consumption, polluting more despite their higher willingness to consume green products. Unfortunately, the database does not allow an empirical assessment of this argument.

The relationship of household size (*householdsize*) and green behaviour varies by different fields. Bigger households are more likely to engage in cost-reducing environmental measures, such as energy and water saving (*envactivities*) and *recycling,* while the marginal effects of this variable for environmental products and mobility are not significant.

Table 9: Results for different green (consumption) fields (Eurobarometer 92.4, 2020)

Correlates	Mobility	Envactivities	Envproducts	Recycling
woman	0.010+	0.033**	0.064**	-0.005
	(0.006)	(0.004)	(0.006)	(0.006)
partner	-0.007	0.006	0.032**	0.036**
	(0.007)	(0.004)	(0.007)	(0.007)
inhouseholdsize	0.006	0.013**	-0.002	0.017*
	(0.007)	(0.004)	(0.007)	(0.007)
age	-0.001**	0.000**	0.000+	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
highqual	0.060**	0.025**	0.067**	0.052**
	(0.007)	(0.004)	(0.007)	(0.007)
housemanwife	-0.023	-0.009	-0.018	-0.026+
	(0.015)	(0.009)	(0.015)	(0.015)
employed	0.005	0.003	0.023**	0.008
	(0.008)	(0.005)	(0.008)	(0.008)
unemployed	0.025+	-0.040**	-0.054**	0.004
	(0.014)	(0.009)	(0.014)	(0.014)
retired	0.023*	-0.015*	-0.028**	-0.026*
	(0.010)	(0.006)	(0.010)	(0.011)
diffbills	-0.009	-0.033**	-0.030**	0.025**
	(0.007)	(0.004)	(0.007)	(0.007)
envaffected	0.077**	0.058**	0.096**	0.060**
	(0.006)	(0.003)	(0.006)	(0.006)
envcostbear	0.044**	0.020**	0.051**	0.056**
	(0.007)	(0.004)	(0.007)	(0.007)
countryside	-0.034**	0.003	0.008	0.028**
	(0.007)	(0.004)	(0.007)	(0.007)
bigtown	0.057**	0.010*	-0.001	0.008
	(0.007)	(0.004)	(0.007)	(0.007)
workclass	-0.039**	-0.027**	-0.032**	-0.001
	(0.007)	(0.004)	(0.007)	(0.007)
upphighclass	-0.023	-0.068*	0.025	-0.024
	(0.032)	(0.028)	(0.034)	(0.033)
highsatisfaction	0.027**	0.006	0.025**	0.004
	(0.007)	(0.005)	(0.007)	(0.007)
left	0.065**	0.022**	0.072**	0.054**
	(0.008)	(0.004)	(0.008)	(0.008)
middle	0.035**	0.015**	0.049**	0.019*
	(0.007)	(0.004)	(0.007)	(0.007)
politunsatisfied	-0.003	-0.005	0.002	0.031**
	(0.006)	(0.004)	(0.006)	(0.006)

Multivariate probit model. Average marginal effects are reported. Robust standard errors in parentheses. LR Chi^2 (192) = 6778**. Number of observations = 27,397. p<0.01, * p<0.05, + p<0.1. Shrinkage statistics calculated for simple probit models (see Table A4).

Source: Eurobarometer 92.4 (2020), own estimations.

Table 10: Country differences: mobility and energy consumption (Eurobarometer 92.4, 2020)

Correlates	Mobility		Energy consumption	
	Northern countries	Southern countries	Northern countries	Southern countries
woman	0.046**	-0.020+	-0.011	0.008
	(0.018)	(0.011)	(0.018)	(0.011)
partner	-0.045+	-0.014	0.060*	0.037**
	(0.026)	(0.013)	(0.026)	(0.014)
lnhouseholdsize	-0.003	0.009	-0.028	0.016
	(0.027)	(0.013)	(0.027)	(0.013)
age	-0.003**	-0.002**	-0.001	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)
highqual	0.075**	0.047**	0.056**	0.065**
	(0.020)	(0.014)	(0.020)	(0.015)
housemanwife	0.061	0.016	-0.123	0.071**
	(0.133)	(0.025)	(0.127)	(0.026)
employed	-0.014	0.013	0.009	0.049**
	(0.027)	(0.015)	(0.028)	(0.015)
unemployed	0.038	0.093**	0.032	0.004
	(0.054)	(0.025)	(0.057)	(0.025)
retired	0.043	0.074**	-0.009	0.006
	(0.032)	(0.020)	(0.033)	(0.021)
diffbills	-0.039	-0.013	-0.002	-0.039**
	(0.036)	(0.012)	(0.037)	(0.012)
envaffected	0.092**	0.075**	0.112**	0.129**
	(0.022)	(0.011)	(0.023)	(0.011)
envcostbear	0.048**	-0.014	0.011	0.023
	(0.018)	(0.013)	(0.019)	(0.014)
countryside	-0.068**	-0.028*	0.054*	0.008
	(0.023)	(0.013)	(0.023)	(0.014)
bigtown	0.094**	0.104**	-0.026	0.042**
	(0.021)	(0.014)	(0.022)	(0.015)
workclass	0.017	-0.044**	-0.029	-0.035**
	(0.025)	(0.012)	(0.026)	(0.013)
upphighclass	0.092	-0.090	0.020	-0.172**
	(0.083)	(0.067)	(0.090)	(0.061)
highsatisfaction	0.030	0.047**	0.011	0.035*
	(0.019)	(0.014)	(0.019)	(0.015)
left	0.091**	0.073**	0.007	0.038*
	(0.025)	(0.015)	(0.025)	(0.015)
middle	0.026	0.054**	-0.007	0.021
	(0.023)	(0.013)	(0.024)	(0.013)
politunsatisfied	-0.001	-0.030**	0.039*	0.004
	(0.018)	(0.011)	(0.018)	(0.012)
Observations	3,043	7,073	3,043	7,073
Wald Chi^2	260** (22)	474** (27)	65** (22)	479**(27)
Pseudo R^2	0.07	0.06	0.02	0.05
Overfit in % (SE)	8.90 (0.95)	2.16 (0.23)	37.1 (3.75)	2.93 (0.28)

Probit models. Average marginal effects are reported. Robust standard errors in parentheses, **p<0.01, * p<0.05, + p<0.1. Calculation of shrinkage statistics based on Bilger and Manning (2015).

Source: Eurobarometer 92.4 (2020), own estimations.

As expected, people living in the *countryside* show lower environmental mobility behaviour because the supply of public transport is less developed. A politically *left* or *middle* orientation is positively correlated with all green (consumption) activities.

A comparison between Northern countries and Southern countries in respect of mobility behaviour and energy consumption shows significant differences (see Table 10). Women in the Northern countries prefer more environmentally friendly ways of travelling, unlike in the Southern countries. Members of the working class (*workclass*) in the Southern countries prefer travelling by car, whereas *unemployed* and *retired* people prefer public transport, likely because they do not have their own car. In the Northern countries, people with a high willingness to bear environmental costs (*envcostbear*) are more likely to use environmentally friendly transport. The poorer economic situation in Southern countries is also reflected in energy consumption: households unable to pay their bills (*diffbills*) and members of the working class (*workclass*) buy significantly fewer energy-efficient appliances. These variables do not play a significant role in the Northern countries. The results for the Northern countries in relation to the energy consumption variable should be interpreted with caution, as the overfitting value is quite high.

LIMITATIONS OF THE ECONOMETRIC ANALYSIS

The econometric models in Section 4 explaining pro-environmental behaviour of households might show endogeneity problems because variables such as participation at demonstrations, choice of occupation, degree of happiness, or willingness to help people might be dependent on the greenness of households. Even a time lag structure does not remedy the issue, as many of the personal characteristics or choice of occupation do not change over time (or change only in the longer term). Nor are instrumental variable estimations useful here, due to the lack of appropriate instruments not correlated to the greenness of households. The results of the econometric analysis should therefore be interpreted as correlations rather than causal effects.

An additional issue is the social desirability of pro-environmental behaviour, potentially creating a bias in self-perceived survey indicators. The importance of green social norms may differ between countries, and this bias might partially explain country-specific results. Despite the inclusion of country dummies, unobserved heterogeneity in country differences may remain.

The high complexity of the econometric models may result in overfitting (i.e. where a model is excessively complex relative to the amount of data available). 'When models greatly over-explain the data at hand, this casts doubt on both the statistical significance and magnitude of the estimates' (Bilger and Manning, 2015, p. 75). The overfitting measure of Bilger and Manning (2015) is reported in the tables. The values show that, generally, overfitting is not a problem within the different models, with the exception of some estimations for country groups with relatively small sample sizes. Small sample sizes in country groups may lead to low representativeness of the results, which should thus be interpreted with caution.

A final limitation of the analysis is the fact that, typically, one household member responds to the questionnaire and the answers might be not representative of the whole household. For example, a

female respondent might give more optimistic answers about green behaviour, resulting in overestimation of the greenness of the household.

SUMMARY AND EUROPEAN POLICY IMPLICATIONS

This paper analyses the determinants of green (consumption) behaviour based on a literature review and econometric estimations of European survey data. Those data facilitate the use of a variety of indicators to describe green behaviour: green perception (importance of caring for nature and the environment), green voting, energy, and climate change behaviour, and 14 different consumption fields. The results show common determinants for different indicators and countries, as well as indicator and country-related specificities.

In general, personal factors such as female gender, education and a high income are positively correlated with green (consumption) behaviour. Women disproportionally vote for green parties and have higher perceived environmental awareness. The gender-specific result also holds for environmental activities such as avoiding plastics, reducing water consumption, avoiding unnecessary packaging, separating waste, participating in environmental actions, and buying environmental products. By contrast, recycling activities such as repairing instead of replacing a product do not show gender differences. In all countries, higher education is positively correlated with all green behaviour indicators considered. Respondents' occupation is also correlated with green attitudes, with employees in the public sector disproportionally voting for green parties and having a higher green perception. Conversely, working in environmentally intensive branches significantly reduces the probability of voting for green parties.

In all countries, living conditions characterised by high exposure to environmental pollution play a role. People feeling a direct daily negative life effect of environmental problems engage in more green activities. Looking at political orientation, left and middle-oriented people are more likely to engage in green consumption. Interestingly, those who are dissatisfied with politics in their country are also more likely to engage in green consumption activities.

Income, poverty and joblessness are very relevant for green behaviour, but considerable differences are evident between cost-intensive and 'costless' green activities. The econometric results show that income is positively correlated with cost-intensive green behaviour, such as buying relatively expensive products marked with an environmental label. Consequently, unemployed people and those struggling to pay their bills have a lower probability of buying green products. By contrast, the marginal effects of these variables are insignificant for mobility and are even positively significant for

recycling. In fact, a poor economic situation is not a barrier to green attitudes, as the unemployment and poverty variables have significantly positive signs for the perceived green indicator.

Looking at country differences, the Northern countries show some specificities. The positive marginal effects of female gender and employees in the public sector who disproportionally vote for green parties and have a high green perception are much higher here compared to all countries. Interestingly, employment status and poverty do not play a role for green consumption behaviour in the Northern countries, possibly reflecting the highly developed social security systems in these countries.

A comparison of the mobility behaviour and energy consumption in Northern and Southern countries shows significant differences. Women in the Northern countries prefer more environmentally friendly ways of travelling, which is not the case in the Southern countries. Members of the working class in the Southern countries prefer to travel by car, while unemployed and retired people prefer public transport, likely because they do not have their own car. In the Northern countries, people with a high willingness to bear environmental costs are more likely to use environmentally friendly transport. The poorer economic situation in the Southern countries is also reflected in energy consumption. Members of the working class and those unable to pay their bills are not able to buy energy-efficient appliances to reduce their energy consumption, variables that do not play a significant role in the Northern countries.

From a political perspective, the fight against poverty and unemployment increases green consumption, with the results showing that poor households are not less green *per se,* but only in respect of cost-intensive green activities. Information policy that helps to create green social norms matters, as the discussion on climate change triggers self-perceived green attitudes and prompts green behaviour. The results of the literature review and the econometric analysis imply that financial incentives and subsidies are highly relevant for cost-intensive green consumption activities, especially for low-income households

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APPENDIX

Table A1: Descriptive statistics - ESS 2019

Variable	Description of variables (all personal variables are related to the respondent)	Mean	Std. Dev.
greenperc	Important to care for nature and environment: 1: Very much like me, 0: Otherwise	.35	.477
greenvotes	Voted for green party in last national election: 1: Yes, 0: No	.069	.253
age	Age in years/10	5.107	1.865
female	Gender: 1: Female, 0: Male	.535	.499
married	Family status married: 1 Yes, 0: No	.684	.465
academic	Academic education: 1: Yes, 0: No	.302	.459
vocational	Vocational education: 1: Yes, 0: No	.48	.5
eduyrs	Years of education	12.96	4.164
relig	Highly religious: 1: Yes, 0: No	.309	.462
retired	Retired, community or military service, housework, looking after children: 1: Yes, 0: No	.342	.474
unempdisabled	Unemployed, looking (or not) for job, permanently sick or disabled: 1: Yes, 0: No	.074	.263
selfemployed	Self-employed: 1: Yes, 0: No	.13	.336
responsibility	Responsible for supervising other employees: 1: Yes, 0: No	.297	.457
publicemp	Working in the public sector: 1: Yes, 0: No	.331	.471
manuintens	Working in an environmentally intensive sector: 1: Yes, 0: No	.068	.251
construction	Working in the construction sector: 1: Yes, 0: No	.059	.235
healthsocial	Working in the health sector/social institutions: 1: Yes, 0: No	.093	.29
partdemonst	Taken part public demonstration last 12 months: 1: Yes, 0: No	.075	.264
minority	Belong to minority ethnic group in country: 1: Yes, 0: No	.063	.242
creative	Highly important to think new ideas: 1: Yes, 0: No	.172	.378
happydum	How happy are you: 1: Very happy, 0: Otherwise	.578	.494
helppeople	Very important to help people: 1: Yes, 0: No	.266	.442
imprichness	Important to be rich: 1: Yes, 0: No	.022	.147
impsafeness	Important to live in safe surroundings: 1: Yes, 0: no	.266	.442
ruleconfident	Important to follow rules: 1: Yes, 0: No	.089	.284
polinterest	Very interested in politics: 1: Yes, 0: No	.11	.313
socialequal	Society fair when wealth is equally distributed: 1: Agree strongly, 0: Otherwise	.141	.348
householdsize	Number of persons living in the household	2.56	1.355
highincome	8^{th} to 10^{th} decile of household's total net income	.256	.436
poverty	First decile of household's total net income	.1	.3
smallcity	Living in a small city: 1: Yes, 0: No	.311	.463
country	Living at the countryside: 1: Yes, 0: No	.374	.484
victim	Household victim of burglary last 5 years: 1: Yes, 0: No	.134	.341
fairchance	Political system in country ensures fair chance to be politically active: 1: Yes, 0: No	.231	.421
satisfygov	Low satisfaction with the national government: 1: Yes, 0: No	.159	.365
at	Austria	.05	.219
be	Belgium	.036	.186
bg	Bulgaria	.044	.206
ch	Switzerland	.031	.174
cy	Cyprus	.016	.125
cz	Czechia	.048	.215
de	Germany	.048	.213
ee	Estonia	.038	.192
es	Spain	.034	.18
fi	Finland	.035	.185

fr	France	.041	.197
gb	Great Britain	.045	.206
hr	Croatia	.037	.188
hu	Hungary	.034	.18
ie	Ireland	.045	.207
is	Iceland	.017	.131
it	Italy	.055	.229
lt	Lithuania	.037	.189
lv	Latvia	.019	.135
me	Montenegro	.024	.154
nl	Netherlands	.034	.181
no	Norway	.028	.166
pl	Poland	.03	.171
pt	Portugal	.021	.144
rs	Serbia	.041	.199
se	Sweden	.031	.174
si	Slovenia	.027	.161
dk	Denmark	.032	.175
sk	Slovakia	.022	.146

Table A2: Descriptive statistics - ESS 2017

Variables	Description of variables (all personal variables are related to the respondent)	Mean	Std. Dev.
energclimate	Very likely to buy most energy efficient home appliance or doing things to reduce energy use **or** high perceived personal responsibility to reduce climate change or highly worried about climate change: 1: Yes, 0: No	.309	.462
age	Age in years/10	4.91	1.86
female	Gender: 1: Female, 0: Male	.526	.499
partner	Family status: 1: Partner, 0: Otherwise	.586	.493
academic	Academic education: 1: Yes, 0: No	.323	.468
vocational	Vocational education: 1: Yes, 0: No	.45	.497
eduyrs	Years of education	13.03	3.85
relig	Highly religious: 1: Yes, 0: No	.309	.462
retired	Retired, community or military service, housework, looking after children: 1: Yes, 0: No	.311	.463
unempdisabled	Unemployed, looking (or not) for job, permanently sick or disabled: 1: Yes, 0: No	.077	.266
selfemployed	Self-employed: 1: Yes, 0: No	.137	.344
responsibility	Responsible for supervising other employees: 1: Yes, 0: No	.289	.454
publicemp	Working in the public sector: 1: Yes, 0: No	.312	.463
manuintens	Working in an environmentally intensive sector: 1: Yes, 0: No	.063	.242
construction	Working in the construction sector: 1: Yes, 0: No	.065	.246
healthsocial	Working in the health sector/social institutions: 1: Yes, 0: No	.097	.295
partdemonst	Taken part public demonstration last 12 months: 1: Yes, 0: No	.077	.267
minority	Belong to minority ethnic group in country: 1: Yes, 0: No	.065	.246
creative	Highly important to think new ideas: 1: Yes, 0: No	.204	.403
happydum	How happy are you: 1: Very happy, 0: Otherwise	.577	.494
helppeople	Very important to help people: 1: Yes, 0: No	.26	.439
imprichness	Important to be rich: 1: Yes, 0: No	.036	.187
impsafeness	Important to live in safe surroundings: 1: Yes, 0: No	.266	.442
ruleconfident	Important to follow rules: 1: Yes, 0: No	.094	.292
polinterest	Very interested in politics: 1: Yes, 0: No	.122	.328
householdsize	Number of persons living in the household	2.622	1.38
highincome	8^{th} to 10^{th} decile of household's total net income	.243	.429
poverty	First decile of household's total net income	.101	.301
smallcity	Living in a small city: 1: Yes, 0: No	.314	.464
country	Living at the countryside: 1: Yes, 0: No	.361	.48
victim	Household victim of burglary last 5 years: 1: Yes, 0: No	.148	.355

satisfygov	Low satisfaction with the national government: 1: Yes, 0: No	.151	.358
at	Austria	.045	.208
be	Belgium	.04	.195
ch	Switzerland	.034	.182
cz	Czechia	.051	.22
de	Germany	.064	.245
ee	Estonia	.045	.208
es	Spain	.044	.205
fi	Finland	.043	.204
fr	France	.047	.211
gb	Great Britain	.044	.205
hu	Hungary	.036	.187
ie	Ireland	.062	.241
il	Italy	.058	.233
is	Iceland	.02	.139
it	Italy	.059	.236
lt	Lithuania	.048	.213
nl	Netherlands	.038	.191
no	Norway	.035	.183
pl	Poland	.038	.192
pt	Portugal	.029	.167
ru	Russia	.055	.227
se	Sweden	.035	.184
si	Slovenia	.029	.169

Table A3: Descriptive statistics - Eurobarometer 92.4 (2020)

Variables	Description of variables (all personal variables are related to the respondent)	Mean	Std. Dev.
envconsscore	Sum of all green activities during the past six months (see Table 7)	4.19	2.731
mobility	Green activities 1 and 9: 1: Yes, 0: No	.368	.482
envactivities	Green activities 2, 3, 4, 5, 6, 10, or 12: 1: Yes, 0: No	.899	.301
envproducts	Green activities 7, 8, or 11: 1: Yes, 0: No	.571	.495
recycling	Green activities 13 or 14: 1: Yes, 0: No	.412	.492
woman	Gender: 1: Female, 0: Male	.541	.498
partner	Family status: 1: Partner, 0: Otherwise	.644	.479
lnhouseholdsize	Number of household members (ln)	.795	.537
age	Age in years	51.83	18.20
highqual	At least 21 years old when stopping full-time education: 1: Yes, 0: No	.297	.457
housemanwife	Only working at home: 1: Yes, 0: No	.048	.214
employed	Employed: 1: Yes, 0: No	.31	.463
unemployed	Unemployed: 1: Yes, 0: No	.052	.222
retired	Retired, unable to work: 1: Yes, 0: No	.334	.472
diffbills	Difficulties paying bills last year: 1: Yes, 0: No	.319	.466
envaffected	Direct daily life effect of environmental problems: 1: Yes, 0: No	.356	.479
envcostbear	Willingness to bear environmental costs: 1: Yes, 0: No	.242	.428
countryside	Living at the countryside: 1: Yes, 0: No	.329	.47
bigtown	Living in a big town: 1: Yes, 0: No	.286	.452
workclass	Belonging to the working class of society: 1: Yes, 0: No	.263	.44
upphighclass	Belonging to the middle/higher class: 1: Yes, 0: No	.007	.085
highsatisfaction	Very high life satisfaction: 1: Yes, 0: No	.266	.442
left	Left political orientation: 1: Yes, 0: No	.253	.435
middle	Middle political orientation: 1: Yes, 0: No	.44	.496
politunsatisfied	Unsatisfied with national or EU policy: 1: Yes, 0: No	.561	.496
at	Austria	.037	.189
be	Belgium	.037	.188
bg	Bulgaria	.037	.19

cy	Cyprus	.018	.134
cz	Czechia	.036	.187
dew	West-Germany	.037	.189
dee	East-Germany	.018	.134
dk	Denmark	.037	.19
ee	Estonia	.036	.187
es	Spain	.037	.188
fi	Finland	.037	.188
fr	France	.037	.19
gb	Great Britain	.037	.189
gr	Greece	.037	.188
hr	Croatia	.037	.19
hu	Hungary	.037	.19
ie	Ireland	.037	.189
it	Italy	.037	.189
lt	Lithuania	.036	.187
lu	Luxembourg	.019	.135
lv	Latvia	.036	.187
mt	Malta	.018	.134
nl	Netherlands	.038	.19
pl	Poland	.038	.19
pt	Portugal	.036	.187
ro	Romania	.039	.194
se	Sweden	.037	.188
si	Slovenia	.037	.188
sk	Slovakia	.038	.191

Table A4: Results for green consumption fields (Eurobarometer 92.4, 2020) – probit models

Correlates	Mobility	Envactivities	Envproducts	Recycling
woman	0.010+	0.033**	0.064**	-0.005
	(0.006)	(0.004)	(0.006)	(0.006)
partner	-0.007	0.006	0.032**	0.036**
	(0.007)	(0.004)	(0.007)	(0.007)
householdsize	0.006	0.013**	-0.002	0.017*
	(0.007)	(0.004)	(0.007)	(0.007)
age	-0.001**	0.000**	0.000+	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
highqual	0.061**	0.024**	0.066**	0.052**
	(0.007)	(0.004)	(0.007)	(0.007)
housemanwife	-0.022	-0.011	-0.018	-0.025+
	(0.015)	(0.009)	(0.015)	(0.015)
employed	0.005	0.003	0.023**	0.008
	(0.008)	(0.005)	(0.008)	(0.008)
unemployed	0.025+	-0.040**	-0.054**	0.004
	(0.014)	(0.009)	(0.014)	(0.014)
retired	0.023*	-0.017*	-0.028**	-0.026*
	(0.010)	(0.006)	(0.010)	(0.011)
diffbills	-0.008	-0.034**	-0.030**	0.025**
	(0.007)	(0.004)	(0.007)	(0.007)
envaffected	0.077**	0.058**	0.096**	0.060**
	(0.006)	(0.003)	(0.006)	(0.006)
envcostbear	0.045**	0.019**	0.051**	0.056**
	(0.007)	(0.004)	(0.007)	(0.007)
countryside	-0.034**	0.002	0.008	0.028**
	(0.007)	(0.004)	(0.007)	(0.007)
bigtown	0.057**	0.010*	-0.001	0.008

	(0.007)	(0.004)	(0.007)	(0.007)
workclass	-0.039**	-0.027**	-0.032**	-0.001
	(0.007)	(0.004)	(0.007)	(0.007)
upphighclass	-0.022	-0.073**	0.025	-0.024
	(0.032)	(0.028)	(0.034)	(0.033)
highsatisfaction	0.028**	0.005	0.025**	0.004
	(0.007)	(0.005)	(0.007)	(0.007)
left	0.065**	0.021**	0.072**	0.053**
	(0.008)	(0.004)	(0.008)	(0.008)
middle	0.034**	0.016**	0.049**	0.018*
	(0.007)	(0.004)	(0.007)	(0.007)
politunsatisfied	-0.003	-0.005	0.002	0.031**
	(0.006)	(0.004)	(0.006)	(0.006)
Observations	27,397	27,397	27,397	27,397
Wald Chi	2017** (48)	1542** (48)	2211** (48)	1810** (48)
Pseudo R^2	0.06	0.10	0.06	0.05
Overfit in % (SE)	2.61 (0.20)	2.89 (0.27)	2.26 (0.19)	2.79 (0.23)

Probit models. Average marginal effects are reported. Robust standard errors in parentheses, ** p<0.01, * p<0.05, + p<0.1. Calculation of shrinkage statistics based on Bilger and Manning (2015).