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"Patterns in sustainable food choices and policy support: Novel evidence from nine countries"

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Patterns in sustainable food choices and policy support: Novel evidence from nine countries

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Abstract:

This analysis uses OECD survey data from over 8,000 households in nine countries. The paper analyses household profiles via latent class analysis on the basis of both diet composition, as well as purchasing habits for products that are generally perceived to be environmentally sustainable. Results reveal four main household profiles that are distinguished by different broad patterns in these two behaviours. Household profiles are found to differ in terms of their socio-demographic characteristics and attitudes towards the environment, as well as with respect to their level of support for various food policies. Interestingly, results regarding the relationship between environmental attitudes and red meat consumption may suggest the existence of another “meat paradox” in the sense that one group of respondents reports high levels of environmental concern but also a high frequency of meat consumption.

Keywords: food choices; meat consumption; environment-friendly products; public policies; cognitive dissonance; latent-class analysis

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Patterns in sustainable food choices and policy support:
Novel evidence from nine countries

1. Introduction

The objective of the current analysis is to inform the design of policy interventions seeking to incentivize consumers to increase their purchase of environmentally sustainable food products. The analysis uses recent OECD survey data from over 8,000 households in nine countries. The originality of the current paper is to identify household profiles focusing on both diet composition (frequency of consuming red and white meat) and purchasing habits regarding products generally perceived to be environmentally sustainable (locally-produced food, products with minimal packaging and in-season products). Using latent class analysis, we identify four consumer profiles that are characterised by different behaviours in terms of meat consumption and purchasing habits, and express different levels of support for food-related policies. The OECD household survey we rely on was run in nine countries, which provides a unique opportunity to control for differences in cultural food habits.

Globally, one-third of greenhouse gas emissions are linked to food systems (Crippa et al., 2021). Beyond greenhouse gases, food systems are also responsible for other important environmental impacts, including land use change, water use, and biodiversity loss (OECD, 2025; Poore and Nemecek, 2018; IPCC, 2019). Animal products use 83% of agricultural land and contribute to 56-58% of emissions from food while providing only 37% of protein and 18% of calories produced globally (Poore and Nemecek, 2018).

The environmental footprint of any given food item depends on a constellation of context-specific factors, such as the use of land, water, chemicals and energy, as well as seasonality and production location (OECD, 2023; Deconinck and Toyama, 2022). Differences in environmental footprints can also exist across different producers of the same product (OECD, 2025). Even when considering the lowest-impact producers, however, emissions from animal products still exceed the average emissions from plant-based proteins, regardless of production method (Poore and Nemecek, 2018). Plant-based alternatives and lab-grown meat can be produced in less resource-intensive ways with a considerably smaller carbon footprint than conventionally-raised meat (Frezal et al., 2022; Treich, 2021).

According to the OECD-FAO Agricultural Outlook (OECD/FAO, 2024), global per capita meat consumption is expected to continue to rise in the coming years, reaching 28.6 kg/year/person on an edible retail weight equivalent basis, by 2033 compared to 28.13 kg/year/person on average from 2021-2023 and 26.74 kg/year/person from 2011-2013. Growth is expected to be

slower in developed countries compared to developing countries, as consumers' preferences shift away from red meat and towards poultry, fish and plant-based proteins because of health, ethical and environmental concerns. In light of a projected increase in meat consumption, the climate mitigation potential of a widespread shift to plant-based diets has been estimated at 0.7–8 billion tonnes of carbon dioxide equivalent (CO2eq) per year by 2050 and up to 44% reduction in emissions from the sector (8 GtCO2eq) by 2050 (IPCC, 2019). Other evidence estimates an emission reduction potential of 5.5-7.4 billion tonnes of CO2eq, with an additional 8 billion tonnes per year from carbon sequestration in soils and natural vegetation (Poore and Nemecek, 2018). Decreasing meat consumption (Hoek et al., 2004), and consuming plant- and insect-based foods (Lea et al., 2005; Caparros Megido et al., 2016) as well as seasonal products (Macdiarmid, 2013) have been identified as environmentally sustainable forms of consumption.

More environmentally sustainable diets can also deliver significant co-benefits in terms of public health and food security (Searchinger et al., 2019; IPCC, 2019), with some evidence suggesting that a shift to diets with fewer animal- sourced foods could reduce global mortality by 6-10% (Springmann et al., 2016). Despite this potential, however, encouraging dietary shifts is complex, as households' consumption habits often carry cultural and personal significance, and factors such as the affordability and taste of food products tend to be more important to households than their environmental impacts (OECD, 2023; Katt and Meixner, 2020). For example, socioeconomic characteristics (e.g. income, gender, age, and education), attitudes (e.g. regarding environmental, health and ethical concerns), as well as prices and availability have been shown to explain willingness to pay for organic food (Katt and Meixner, 2020; Rana and Paul, 2017). Gender, age, education and income have also been shown to drive intentions to purchase other types of ethically produced food products such as fair-trade and animal welfare certified products (Alonso et al., 2020; Gorton et al., 2023).

With respect to meat consumption, evidence suggests that price, taste and convenience tend to be of greater importance than animal welfare (Alonso et al., 2020). Insofar as environmentally sustainable products can also offer other benefits, e.g. related to health, affordability, taste, animal welfare or supporting the local economy, consumers may purchase them for a variety of reasons (Muller et al., 2017; Hughner et al., 2007; Banovic et al., 2019). Indeed, evidence suggests that few consumers buy environmentally sustainable products primarily for environmental reasons (Vermeir et al., 2020; Muller et al., 2017).

Existing research also highlights the heterogeneity of consumers' preferences for sustainable food products (Gerini et al., 2016; Gorton et al., 2023) finding that consumers can often be categorised into different groups based on their food consumption habits. At a minimum, data

suggests that households can often be divided into two groups, namely those whose purchasing patterns are primarily driven by ethical concerns (e.g. for the environment or the welfare of farmers, local communities, or animals) and who tend to eat less red meat, versus those who consider affordability as the most important factor (e.g. Gorton et al., 2023) and who tend to eat more red meat. Seconda et al. (2018) found that approximately one quarter of a sample of almost 30,000 consumers in France reported having diets generally characterised by relatively low amounts of animal-based products. In line with these findings, Vieux et al. (2020) found that about one fifth of sampled households in five European countries (Finland, France, Italy, Sweden and the UK) reported eating diets characterised by lower levels of greenhouse gas emissions, higher nutritional quality, less meat and more plant-based products.

With respect to meat consumption, individual barriers to consuming more plant-based foods relate to habits and other psychological barriers, social and cultural norms, as well as limited availability, knowledge of and experience with plant-based alternatives (Rickerby and Green, 2024). Evidence points in particular to the (perceived) high price of plant-based products, a lack of information about such products, as well as a lack of interest in changing one's habits as among the most important barriers to reducing meat consumption (Perez-Cuelo et al., 2022; Kuosmanen et al., 2023). As a current component of many household diets, meat is consumed for a combination of cultural, social, hedonic and perceived nutritional reasons (Graça et al., 2015; Kemper, 2020; Laffan, 2024). In a global empirical assessment of the determinants of meat consumption across 137 countries, Milford et al. (2019) found that, in addition to socioeconomic characteristics, culture, religion, and economic and social globalisation were important factors in determining meat consumption. The authors observe that the difficulty of targeting these factors via policy interventions points to the potential need of acting on consumer preferences and habits through the use of information, education policy and increasing the availability of plant-based proteins. Social norms have also been shown to influence consumer decisions surrounding meat consumption (Dannenberg et al., 2024).

Empirical evidence has also notably demonstrated a gap between favourable attitudes toward environmental sustainability and the actual purchase of sustainable food products (Vermeir and Verbeke, 2006; van Dam and van Trijp, 2013; Aschemann-Witzel and Zielke, 2015), suggesting that individuals may not be aware of the environmental implications of meat consumption, and/or that they experience cognitive dissonance, i.e. a misalignment between what they believe and how they behave. Evidence from other domains indeed suggests that some consumers actively avoid certain types of information in order to avoid uncomfortable feelings (Onwezen and van der Weele, 2016; Thunström et al., 2016; Reisch et al., 2021; Edenbrandt et al., 2021). Evidence of barriers such as these point to a role for a variety of

information-based public policies in reducing the consumption of red meat in favour of plant-based foods (Rickerby and Green, 2024).

In light of the complexity of food systems, Giner and Brooks (2019) have proposed a four-track policy approach to encourage healthier food choices. The approach includes demand side public interventions (e.g. information campaigns and counselling), collaboration with the food industry at the supply-demand interface (e.g. product reformulation and testing of new labelling schemes), use of stricter regulations (e.g. rules regarding advertising confectionery to children) and fiscal measures (e.g. consumption taxes). Such a four-track approach would help to encourage healthier food choices in a way that is consistent with wider objectives for the food and agriculture sector including objectives related to environmental sustainability and to the livelihoods of agents along the food chain. This article analyses support for a number of different types of policies within the four-track policy approach in relation to household's socioeconomic characteristics, environmental attitudes and food purchasing habits.

Consumers have a central role to play in the transition towards more sustainable food production systems. Consumer demand drives the quantity and type of products supplied in the market. While supply-side interventions can to some extent regulate how this supply is met, outright bans on specific products or production methods are rarely used in policies aiming to increase the environmental sustainability of food systems, unlike in other sectors such as transport. Instead, effective environmental policy approaches with respect to food systems should aim to incentivise more sustainable food choices such that they align with consumer preferences. In particular, ensuring that the most sustainable food products are also the most desirable overall options for consumers will require a combination of demand-side and supply-side policies. Given that public policies in this area generally do not seek to restrict consumer choices on the basis of environmental impacts, policies that effectively achieve shifts in consumption will be those that provide consumers with environmentally sustainable options that respond to their needs. Developing such policies will require a well-developed understanding of consumer priorities regarding food purchases, as well as their policy preferences.

Taxes are understood to be an efficient disincentive to discourage behaviours that reduce social welfare (Banerjee, 2025; Bonnet et al., 2020) and have been found to be effective in reducing sugar intake (Rogers et al., 2023) and body mass index (Young et al., 2024). Past research suggests that "beliefs about effectiveness and cost-effectiveness, appropriateness, economic and socioeconomic benefit, policy adoption and implementation, and public mistrust of the industry, government and public health experts" can all have important implications for the acceptability of a sugar-sweetened beverage tax (Eykelenboom et al., 2024). While

precedent for taxes on food consumption remains low, carbon taxes are for example now been considered and have the ability to compensate inequitable impacts (Klenert et al., 2023). Design choices have been shown to have the capacity to improve public acceptability (Ejelöv et al., 2025; Klenert et al., 2018; Fesenfeld et al., 2020; Dechezleprêtre et al., 2022; Siegerink et al., 2024; Yang et al., 2024; Bendz et al., 2023). For example, a carbon tax covering the agricultural sector that was recently adopted in Denmark earmarks revenues to make agriculture more efficient and restore one fifth of the country's farmland to forests and wetlands.

In Section 2, we describe the survey and present descriptive statistics on the main variables of interest. The identification of household profiles using latent-class analysis is the purpose of Section 3. In Section 4, we investigate support for various food policies among the four household classes. Finally, we discuss the policy implications of our main findings and conclude.

2. Description of the survey data and descriptive statistics

The empirical analysis uses data from the third round of the OECD Survey on Environmental Policies and Individual Behaviour Change (EPIC). The survey was run in mid-2022 and covers representative household samples from nine countries: Belgium (BEL), Canada (CAN), France (FRA), Israel (ISR), the Netherlands (NLD), Sweden (SWE), Switzerland (CHE), the United Kingdom (GBR) and the United States (USA). Among the 17,216 households who participated in the survey, more than 8,000 were randomly selected to respond to questions about food consumption (four domains were covered in total: energy, food, transport, and waste). For a complete description of the sampling design, see OECD (2023).

In the section concerning food consumption habits, households were asked to report the frequency with which they consume various types of food products, including red meat, white meat, seafood, dairy products, and eggs. They were also asked to report how often they purchase locally-processed food, fair-trade certified products, products with minimal packaging, in-season products, and organic food. While we make the assumption that survey respondents answered as honestly as possible, we cannot exclude the possibility of social desirability bias in the reporting for these survey items. Given the large environmental footprint of meat production, the subsequent analysis focuses primarily on the determinants of consumption of red and white meat. In addition, dairy products and eggs are frequently consumed in all nine countries and seafood may not be always easily available to all respondents.

Survey responses also include information about the socio-demographic characteristics of the respondents (sex, age, education) and their households (size, location, country-specific income quintile), as well as respondents' environmental attitudes. Environmental concern is measured using responses to the question: "How important are climate change or other environmental issues to you personally?" Respondents indicating that these concerns are either "important" or "very important" are considered to exhibit a *high* level of environmental concern, and those indicating "not at all important", "not important", or "indifferent" are not considered to be environmentally concerned.

Figures 1 and 2 show the stated frequency of purchase of red meat and white meat, respectively. Respondents from the USA and Canada purchase red meat more frequently than respondents from other countries, with 76% of respondents in the United States and 73% of respondents in Canada consuming red meat at least once a week. Respondents in the Netherlands and Switzerland consume red meat less frequently: 18% of respondents in the Netherlands and 19% of respondents in Switzerland consume red meat more than once a week, compared to 33% in the United States. Respondents from the United States and Canada also consume white meat more frequently than respondents in other countries. The reported frequency of meat consumption across countries appears to be in line with per capita meat consumption values as reported in the OECD-FAO Agricultural Outlook (OECD/FAO, 2024). Average per capita meat consumption on an edible retail weight equivalent in the European Union in 2021-23 is about 40% of that in the United States and 50% of that in Canada for beef and veal, respectively (and 45% and 65%, respectively, for poultry meat).

[Figure 1 here] Fig. 1: Consumption frequency of red meat, by country

[Figure 2 here] Fig. 2: Consumption frequency of white meat, by country

Given the environmental impacts of red meat production, we would expect respondents showing a high level of concern to consume red meat less frequently. Figure 3 shows the frequency of red meat consumption by level of environmental concern, for the entire sample. While environmentally concerned respondents consume red meat less frequently than those that are not environmentally concerned, the difference is small. 12% of environmentally concerned respondents never consume red meat, compared to 9% of those that are not environmentally concerned. A similarly small difference across these groups is observed with respect to frequent meat consumption: 22% of environmentally concerned respondents report

consuming meat more than once a week, compared with 28% of those who are not environmentally concerned.

[Figure 3 here] Fig. 3: Consumption frequency of red meat, by level of environmental concern

Affordability and price appear to be among the primary factors driving food purchases.[1] A comparison of the frequency of red meat consumption across income quintiles (IQ) in Figure 4 shows that respondents living in wealthier households consume red meat more frequently: 29% of respondents belonging to the highest income quintile consume red meat more than once a week versus 21% of those in the lowest income quintile. Similarly, 8% of respondents in the highest income quintile report never consuming red meat, compared to 14% in the lowest income quintile.

[Figure 4 here] Fig. 4: Frequency of consuming red meat, by income quintile

In addition to diet composition as assessed through the frequency of purchase of red and white meat, we are interested in the consumption of food products perceived to be "more sustainable". While recognizing that characteristics such as organic, locally-produced and in season do not necessarily imply greater sustainability (Seufert and Ramankutty, 2017; Muller et al., 2017; Meemken and Qaim, 2018; Clark and Tilman, 2017; Poore and Nemecek, 2018), it is assumed in this paper that insofar as these characteristics are widely perceived to be environmentally sustainable, households that prioritise them can be understood to be environmentally-minded. Figure 5 compares the frequency of purchase of organic products, food products with minimum packaging, in-season, and locally-grown products across respondents with low and high environmental concern.

We observe a larger difference in purchase behaviour of product types (than in the consumption of red and white meat) across the two groups of respondents: 26% of environmentally concerned respondents report often or always purchasing organic products, compared to 12% of respondents that are not environmentally concerned. These proportions are respectively 41% vs. 19% for food products with minimum packaging, and 59% vs. 44%

[1] In the survey, respondents were asked to select a maximum of 5 out of 14 items that describe the characteristic(s) of the food which are the most important for them at the time of purchase. Number 1 was affordability, followed by taste and freshness. Environmental characteristics of the products were at the bottom of the list.

for in-season products. The share of respondents consuming local products several times a week is 27% among those who express high environmental concern, compared to 19% among respondents with low environmental concern.

While the frequency of purchase of food products with sustainable characteristics also varies across income quintiles, these differences are relatively small (fewer than a 10-percentage point difference between the lowest and the highest income quintile). This pattern is consistent with earlier findings (Katt and Meixner, 2020; Gerini et al., 2016; Gorton et al., 2023): respondents belonging to higher quintiles tend to purchase food products perceived to be more environmentally sustainable more often than those in lower income quintiles.

[Figure 5 here] Fig. 5: Purchase frequency of organic food, products with minimal packaging, in-season, and locally-grown products, by level of environmental concern

In what follows, we use latent class analysis to identify household profiles based on both their diet composition (the frequency of consumption of red and white meat) and their purchasing habits (frequency of purchasing locally-produced products, in-season products, and products with minimum packaging). These products are referred to as “environmentally responsible” given that they are likely to be perceived by households as having lower environmental impacts than their alternatives.

3. Identification of household profiles using latent-class analysis

Latent class analysis (LCA) is a statistical procedure used to identify different subgroups (or latent classes) within a population based on patterns of responses to observed variables. Latent class analysis assumes that observed behaviours, in this case self-reported food consumption choices, are driven by membership in unobserved household profiles.

No definite statistical criterion to select the “best” number of latent classes exists. An important theoretical criterion for determining the number of latent classes is the identification of distinct and interpretable household profiles. Other commonly-used indicators of statistical fit include the Bayesian Information Criterion (BIC), the Akaike information criterion (AIC) and likelihood-ratio tests. Once the number of latent classes is specified, LCA uses maximum likelihood estimation to determine the proportion of observations that fall into each latent class. Further information on this method can be found in the Appendix A1.

3.1. The selection of indicator variables and covariates

Latent class analysis consists of two stages. In a first stage, indicator variables are used to define (unobserved) latent classes. In a second stage, membership in each of these classes can be modelled as a function of specified covariates. As discussed above, the indicator variables include: i) the frequency with which respondents eat red meat and white meat and ii) the frequency with which respondents purchase locally-grown food products, seasonal products and products with minimum packaging. Organic products were excluded from the analysis given that they may not be easily accessible to all respondents in the sample.

The indicator variables related to diet composition (red and white meat) are measured using the following four-item scale indicating frequency of consumption: “never”, “once a month”, “once a week”, and “several times a week”. Better statistical performance of the latent class analysis is obtained when collapsing the four response options into two categories. With this modification, the response options “never” and “once a month” become “never or rarely” and the response options “once a week” and “several times a week” become “often or quite often”. As for product attributes, the same two categories (“never or rarely” and “often or quite often”) were constructed for the locally-grown attribute. The original response options for the purchase of minimally packaged products and in-season products were “never”, “rarely”, “sometimes”, “often”, or “always”. These categories were also collapsed into two categories for the purpose of the LCA, specifically: “never”, “rarely” or “sometimes” became ”never to a few times” and “often” or “always” became ”often or quite often”. In addition to improving statistical performance, reducing the number of response categories to two also facilitates a clearer interpretation of the classes resulting from the LCA.

Several models featuring different numbers of unobserved (latent) classes were tested and compared considering both statistical performance as well as the interpretability of the resulting classes. The four-class model was found to outperform the two- and three-class models in terms of the Akaike’s Information Criterion. Once the number of latent classes has been selected, covariates can be included to explain how the probability of class membership varies with various factors.

In addition to the binary variable reflecting respondents’ level of environmental concern, we control for the following respondent and household characteristics: sex, age category (18-34, 35-54, and 55+), household size, living area (rural vs. urban or sub-urban), income (five classes from the lowest to the highest income group), and education (a dummy variable taking the value 1 if the respondent has completed higher education). We also consider a variable that represents the sense of personal responsibility, and which was constructed from expressed agreement/disagreement on the following five statements:

(i) I am willing to make compromises in my current lifestyle for the benefit of the environment.

(ii) Environmental issues should be dealt with primarily by future generations.

(iii) Environmental issues should be resolved mainly through public policies.

(iv) Environmental policies introduced by the government should not cost me extra money.

(v) Environmental issues will be resolved mainly through individuals voluntarily changing their behaviour.

For each item, respondents were asked to choose one of the following: (1) Strongly disagree, (2) Disagree, (3) Neither agree or disagree, (4) Agree, (5) Strongly agree, (6) Prefer not to say. Those who preferred not to respond were excluded. For items (i) and (v), the score for each of the five possible responses varied from 1 (strongly disagree) to 5 (strongly agree). For items (ii), (iii), and (iv) and in order to ensure consistency, the scores were reversed, varying from 5 (strongly disagree) to 1 (strongly agree). The index for personal responsibility is the mean of the five scores. A higher index indicates a higher sense of personal responsibility with respect to addressing environmental problems. Several specifications for the regression were tested and results from only the best models are reported and discussed in the following section.

3.2. Latent class analysis results

The latent class analysis was performed on a total of 8,261 observations from the nine countries. Table A2 in Appendix reports the estimated coefficients and marginal effects of various covariates on the probability of class membership.[2] Four classes or household profiles were identified. Table 1 shows the estimated probability of consuming or purchasing various food products by class.

[2] Marginal effects measure the impact of a given variable on the probability that a household will fall into a given class relative to the reference class, controlling for the impact of other variables included in the analysis. For a binary indicator, the marginal effect measures the change in probability when the binary indicator changes from 0 to 1. For a continuous variable, the marginal effect measures the change in probability for a very small change in the continuous variable.

Table 1. Estimated probability of consuming/purchasing each food product type “often or quite often” in each latent class

Probability of “often or quite often” consuming:	Class 1 (41%)	Class 2 (21%)	Class 3 (26%)	Class 4 (12%)
White meat	0.96	0.50	0.93	0.52
Red meat	0.88	0.26	0.90	0.06
Locally-produced food	0.49	0.25	0.86	0.74
In-season products	0.32	0.24	0.93	0.90
Products with min packaging	0.12	0.12	0.67	0.69

The latent class model predicts that 41% of respondents fall in Class 1. This class is characterised by a very high frequency of white and red meat consumption (the model estimates that 96% of respondents in this class consume white meat often or quite often, and 88% consume red meat often or quite often) and occasional purchases of products perceived as environmentally responsible (i.e. locally-produced products, in season products, and products with minimal packaging). Between 12% and 49% of the respondents in this class purchase such products often or quite often, with more frequent purchase of locally-produced food. Class 2 comprises 21% of the sample and is characterised by a relatively low frequency of red meat consumption (26% of respondents in Class 2 consume red meat often or quite often), more frequent purchase of white meat (50% of respondents in Class 2 consume white meat often or quite often), and occasional purchase of products perceived as environmentally responsible (although the purchase of such products is less frequent than in Class 1). Class 3 (26% of the sample) and Class 4 (12% of the sample) are characterised by a high frequency of purchasing products perceived as environmentally responsible. More than two-thirds of respondents in Class 3 and 4 purchase such products often or quite often (with more than 90% of the respondents in these two classes buying in-season products often or quite often). However, Class 3 and Class 4 differ drastically in terms of meat consumption. Whereas Class 3 members are very frequent consumers of red meat (with more than 90% of the respondents in this class consuming it often or quite often), only 6% of respondents in Class 4 members report consuming red meat often or quite often.

Average statistics within each class, on a number of variables including socio-demographic characteristics, attitudes, and respondents’ behaviour and consumption choices are shown in Table 2.

Table 2. Mean statistics by class

	Class 1 (41%)	Class 2 (21%)	Class 3 (26%)	Class 4 (12%)
Red meat consumption frequency	High	Moderate	High	Low
Environmentally-responsible products frequency of purchase	Moderate	Moderate	High	High
Respondent is male[b]	0.53	0.39	0.56	0.21
Age class: 18 – 34[b]	0.29	0.36	0.24	0.19
Age class: 35 – 54[b]	0.33	0.33	0.27	0.30
Age class: 55+[b]	0.38	0.31	0.48	0.51
Higher education[b]	0.55	0.56	0.67	0.57
Income (from 1 to 5)	3.30	2.82	3.67	3.15
Household size	2.68	2.44	2.77	2.12
Rural area[b]	0.37	0.36	0.41	0.50
High environmental concern[b]	0.52	0.59	0.84	0.87
Sense of personal responsibility	2.98	2.98	3.14	3.30
Frequency of organic food purchase	2.34	2.34	3.12	3.05

Note: all variables marked with a [b] are binary indicators. Income varies from 1 (first quintile) to 5 (fifth quintile). The variable measuring respondent's sense of personal responsibility varies from 1 to 5, with 5 indicating greatest sense of responsibility in relation to environmental problems and solutions. Frequency of purchase of organic food varies from 1 to 5, with 5 being the highest frequency.

The values in Table 2 enable for a characterisation of the consumer profiles across classes: male respondents are more likely to be found in Class 1 and Class 3, which are characterised by a high frequency of meat consumption. Class 3 and Class 4 differ from the other two classes insofar as a larger proportion of respondents report having a high level of environmental concern (84% in Class 3 and 89% in Class 4, versus 52% in Class 1 and 59% in Class 2) and a higher sense of personal responsibility, on average. Respondents in Class 3 and Class 4 also more likely to be aged 55+ than the other two classes. Wealthier respondents and those with higher education are more likely to be in Class 3. Environmental attitudes, higher income and education are commonly found to explain the purchase of products supposed to be more environmentally-responsible. These findings are confirmed on our study since Class 3 and Class 4 stand out by the high frequency of purchase of in-season and local food, and products with minimum packaging (cf. Table 1). Respondents in Class 3 and Class 4 also purchase organic food more frequently than Class 1 and Class 2 members. Younger (aged 18-34) and less wealthy respondents are more likely to be in Class 2 where meat consumption and purchase of responsible products are only occasional.

In the survey, respondents could select up to 5 out of 14 items that describe the characteristic(s) of the food which are the most important at the time of purchase. We report in Table 3 the four items that were the most often chosen by the respondents in each class.

Affordability appears to be the most important priority for consumers in Class 1 and Class 2 (item selected by 72% and 70% of class members, respectively). Affordability was selected by 51% of the members of Class 3 (the wealthiest group, on average) and by 55% of members in Class 4). Healthiness ranks first for members of Class 4, who are characterised by the highest environmental concern and sense of personal responsibility, who regularly purchase products seen as environmentally-responsible, and consume red meat very rarely. Healthiness ranks second for members of Class 3, while it ranks fourth for members of Class 1 and Class 2. A good taste and food freshness matter to all groups. Members of Class 1 and Class 2 put a high weight on taste, which ranks second after affordability.

Table 3. Most important food characteristics at the time of purchase (share of class members)

Class 1		Class 2		Class 3		Class 4	
Affordable	0.72	Affordable	0.70	Fresh	0.64	Healthy	0.59
Tastes good	0.71	Tastes good	0.62	Healthy	0.59	Fresh	0.58
Fresh	0.64	Fresh	0.54	Tastes good	0.53	Affordable	0.55
Healthy	0.53	Healthy	0.53	Affordable	0.51	Tastes good	0.45

Taken together, respondent characteristics across classes (Table 2), as well as their reported priorities when making food purchases (Table 3), shed some light on the motivational drivers of the observed differences in behaviours across classes (Table 1). Meat consumption patterns appear to be primarily driven by affordability concerns in Class 2 (who report the lowest household income on average) and by health and environmental concerns in Class 4 (whose priorities are health and freshness. Class 2 members are also comprised of relatively more respondents aged 18-34, who may have a weaker attachment to or habits surrounding meat consumption. Additionally, our findings could notably illustrate another type of “meat paradox” by which Class 3 consumers consume red meat on a regular basis despite expressing a high level of environmental concern and sense of personal responsibility. In general our findings on “ethical” purchases align with the literature on the willingness to pay for “ethical” products, which has identified two main groups of consumers, i.e. “price sensitive” and “concerned” consumers (Gorton et al., 2023) or “light” versus “regular” consumers (USDA, 2023). In the current analysis, “concerned” consumers can be considered to fall in Class 3 and Class 4, and “price sensitive” consumers in Class 1 and Class 2.

Figure 6 shows the predicted probabilities of belonging to each class within each country, computed from the estimated coefficients shown in Table A2. Significant differences exist

across countries, likely reflecting differences in typical diets and availability of food products, culturally-related food habits and level of environmental concern. Switzerland and France are characterised by a large proportion of respondents regularly purchasing products perceived as environmentally-responsible: 80% of Swiss respondents and 67% of French respondents belong to either Class 3 or Class 4. In Switzerland, 32% of the respondents belong to Class 4, which can be considered the most environmentally responsible group (combining both regular purchase of products perceived as environmentally-responsible and rare red meat consumption). In France, 17% of respondents fall in Class 4 and 47% in Class 3. The latter likely reflects culturally-related food habits and the regular use of meat in French cuisine. In five countries out of nine (Canada, the United Kingdom, Israel, Sweden, and the United States), more than 50% of respondents fall in Class 1 (frequent meat eaters and those who make occasional to regular purchases of ethical products). In the United States, only 3% of respondents fall in Class 4.

[Figure 6 here] Figure 6. Probability of class membership by country

Taken together, these results illustrate significant heterogeneity in food purchasing behaviour in the sample and may call for targeted policies. In the next sub-section, we explore the extent to which respondents' support for a set of hypothetical food policies differs across classes.

4. Support for various food policies

In the survey, respondents were asked to state their agreement / disagreement with nine hypothetical food policies using the following scale: i) strongly disagree, ii) disagree, iii) neither agree nor disagree, iv) agree, v) strongly agree, and vi) don't know. We classify policies as shown in Table 4, distinguishing between demand- and supply-side policies and, within each category, between soft policies (e.g. educational programs) and stronger policies (e.g. regulations and price-based instruments).

Table 4. Classification of proposed food policies

Demand-side policies	Awareness and education programmes (soft)	Educate school children about sustainable diets
	Public/private collaboration (soft)	Improve the design and use of sustainability labels
	Regulations (strong)	Limit advertising for food products with large environmental impacts
	Price-based instruments (strong)	Put a tax on meat and/or seafood
Supply-side policies	Soft instruments	Provide incentives for restaurants to use sustainable products
		Provide incentives to farmers to convert to more environmentally-friendly agricultural practices
	Regulations (strong)	Place stricter regulations on the use of pesticides, industrial farming and aquaculture operations
		Make food companies pay for or take back their packaging for proper disposal

Table 5 shows the proportion of respondents in each class agreeing or strongly agreeing with the proposed policy type. We also report this information separately for the tax on meat and seafood, since this is a main policy of interest for targeting red meat consumption.

Table 5. Share of respondents in each class agreeing or strongly agreeing to each policy type

	Class 1	Class 2	Class 3	Class 4
Demand-side & soft	0.64	0.64	0.83	0.85
Demand-side & strong	0.31	0.40	0.48	0.56
Supply-side & soft	0.65	0.65	0.82	0.84
Supply-side & strong	0.62	0.63	0.80	0.85
Tax on meat or seafood	0.16	0.25	0.26	0.36
All eight policies	0.56	0.58	0.73	0.77

In line with expectations, respondents from Class 3 and Class 4 (which comprise the respondents with higher environmental concern, on average) always express the strongest support. Class 3 and Class 4 express similar support to all policies except for demand-side strong policies which include the tax on meat and seafood. As expected, Class 3 members, who express high environmental concern but are frequent red meat eaters, are less supportive

of taxing meat than members of Class 4. Similarly, Class 1 and Class 2 express similar levels of support for all types of policies except for the tax on meat and seafood, which receives lower support from Class 1 members (and who consume meat relatively more frequently than those in Class 2).

Table A3 in Appendix reports the estimated marginal effects of Probit models for each policy type. Dependent binary variables take the value 1 if the respondent agrees or strongly agrees with the policy. The columns labelled *demand* [resp. *supply*] indicate the average level of support across the demand-side [resp. supply-side] policies, of the soft and strong types. The last column examines the probability of supporting a tax on meat and seafood. Income quintiles were used as control variables in all models but since only one income coefficient was significant across all models, estimates are not shown.

Estimation results confirm the earlier observation that high environmental concern is a major determinant of policy support. The estimated marginal effects vary between 12 and 22 percentage points, depending on the policy type. Higher education increases the probability of supporting most policies (with marginal effects ranging from 3 to 4 percentage points across policies). Respondents aged 55+ express disagreement on a tax on meat or seafood. Belonging to this age group reduces the probability of supporting a tax policy by 21 percentage points.

Our results demonstrate the presence of significant consumer heterogeneity and the usefulness of characterising different consumer classes as a way to understand different household profiles. Notably, the latent classes in this analysis are not only characterised by different behaviours in terms of diet and purchasing habits, they also express different levels of support for food-related policies. Those in Class 3 and Class 4 are more supportive of all policies than those in Class 1 and Class 2. Additionally, Class 3 and Class 4 differ regarding their support towards the tax on meat. Being a Class 4 member (i.e. rarely consuming red meat) increases the probability of supporting a tax on meat by 24 percentage points, which is statistically different from the marginal effect of being in Class 3 on support (+ 9 percentage points).

Finally, our findings also illustrate that policy support varies across countries more broadly. For example, the United Kingdom, the Netherlands and Sweden express significantly higher support for a tax on meat.

5. Discussion and policy implications

Several policy implications can be drawn from these results. First, heterogeneity in consumer behaviours and priorities suggests the need for a mix of policies that address the

diversity of household situations and preferences. In particular, certain household groups can be expected to be more or less responsive to different types of interventions. For example, households that are more price sensitive could be expected to be more responsive to price-based policy measures than households that are less price sensitive. Similarly, with respect to information provision and awareness campaigns, the results point to the usefulness of a varied set of messaging, suggesting for example, that messaging emphasising different co-benefits of reducing red meat consumption (e.g. lower costs vs. health benefits) will resonate more with some classes of consumers than others.

Second, insofar as affordability is reported as a top concern for the majority of respondents, price-based measures can be expected to be an effective policy tool overall for influencing consumption decisions. However, the analysis also shows low support for tax-based instruments, indicating that implementing such measures will require careful policy design and communication surrounding the aims of a tax and use of tax revenues.

A final main policy insight is that, as seen in Class 3, having a high level of environmental concern may be a necessary, but ultimately insufficient condition for reducing meat consumption, which appears to also depend highly on culture, habits and preferences, even among those who are environmentally concerned. Overall, the analysis indicates that, for the majority of households (88% on average), preferences and habits are more important than concern for environmental impacts. The behavioural inertia embodied in this constellation of factors can therefore be considered as a widespread barrier to making more sustainable food choices. This suggests that, along with carefully designed price-based measures, the messaging strategies employed in awareness campaigns should generally seek to align sustainable food choices with households' reported priorities. In particular, this could involve emphasizing the affordability and health benefits of sustainable choices (e.g. unprocessed sources of vegetable protein such as legumes).[3]

This analysis shares the limitations of any stated preference study, namely the possibility for various types of sampling and measurement error, due to recruitment procedures and reporting biases (e.g. social desirability bias, hypothetical bias, etc.).[4] As such, future work based on observed food purchasing habits could complement these findings in important ways.

[3] In contexts where culturally-related food habits appear important, e.g. in France, messaging could also seek to raise the visibility of sustainable food choices in line with cultural food heritage (e.g. lentils du Puy or haricots coco de Paimpol).
[4] A discussion of these with respect to the OECD EPIC Survey is provided in OECD (2023).

6. Conclusion

Given the highly sensitive nature of food policies, public support for such policies is a priority. In this sense, the results regarding policy support could be a highly informative element of the analysis insofar as it indicates which policy directions are likely to be feasible and acceptable. While efficient, taxes are likely to face many headwinds. Further research on the elements of tax-based policies in the food sector that foster greater acceptance would therefore be of high value.

In general, this work also points to the importance of exploring the specific policy mixes and design elements therein that would be most effective in encouraging sustainable behaviours over the long term in different classes. Class 3, for example, demonstrates evidence of cognitive dissonance, i.e. an incongruity between their beliefs (i.e. a high level of environmental concern) and their behaviours (i.e. frequent consumption of red meat). Research on overcoming barriers related to cognitive dissonance indicate, for example, that individuals who experience climate-related cognitive dissonance and/or feelings of responsibility change behaviour more following the provision of climate information. These findings point to the potential effectiveness of information provision approaches that simultaneously make salient feelings of personal responsibility and activate pro-environmental social norms, particularly among those that may be likely to experience cognitive dissonance (Edenbrandt et al., 2021). For respondents in Class 1, who prioritise affordability, price-based measures in combination with targeted compensatory support for the purchase of sustainable food products could be expected to be effective in reducing red meat consumption.

The important role of gender in determining food consumption habits also suggests that more work could be done to explore the possible ways in which differentiated messaging that targets men and women may be effective in increasing the adoption of sustainable choices. Finally, another extension of this work would be to undertake the latent class analysis at the country level in order to explore the possible existence of different types of households in different countries.

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Appendix

A1. Latent class analysis

Latent class analysis is a statistical procedure used to identify different subgroups (or latent classes) of households based on patterns in their behaviour (Lazarsfeld, 1950; Goodman, 1974; Eliason & Hagenaars, 1990). LCA assumes that observed behaviours, in this case self-reported food consumption choices, are driven by membership in unobserved household profiles. The latent variable is considered to be an unordered categorical variable.

There is no definite statistical criterion to select the "best" number of latent classes. An important theoretical criterion to choose the number of latent classes is the identification of distinct and interpretable household profiles. Once the number of latent classes is specified, LCA uses maximum likelihood estimation to determine the proportion of observations that fall into each latent class. For each latent class, it also estimates the likelihood of observing each response option. Specifically, it maximises the statistical independence of the observed variables of a household conditional on its latent class. This process assigns households with similar characteristics to the same latent class (or group).

In a well-performing LCA model, each observation is estimated to have a high likelihood of belonging to one class and a low likelihood of belonging to the other classes. Common indicators of the statistical fit of latent class models include the Bayesian Information Criterion (BIC), the Akaike information criterion (AIC) and likelihood-ratio tests (LRT).

LCA has a number of advantages over simpler algorithm-based approaches. It can account for class size during the allocation process and accommodate different types of data (e.g. categorical and numerical). LCA is model based insofar as it derives clusters using a probabilistic model that describes the distribution of the data. Because LCA models the latent structure of data rather than simply identifying similarities, it also allows for tests of goodness-of-fit and significance and thus can measure the degree of uncertainty in the resulting classifications.

Formally, the probability of obtaining response pattern $\boldsymbol{y}$, $P(\boldsymbol{Y} = \boldsymbol{y})$, is a weighted average of the C class-specific probabilities $P(\boldsymbol{Y} = \boldsymbol{y}|X = x)$:

$$P(\boldsymbol{Y} = \boldsymbol{y}) = \sum_{x=1}^{C} P(X = x)\, P(\boldsymbol{Y} = \boldsymbol{y}|X = x)$$

Table A2. Estimated coefficients and marginal effects of covariates on the probability of class membership (8,261 observations)

	Class 1	Class 2		Class 3		Class 4	
	Marginal effect	Marginal effect	*Coef.*	Marginal effect	*Coef.*	Marginal effect	*Coef.*
Respondent is male[b]	0.083	-0.049	*-0.512* ***	0.078	*0.070*	-0.113	*-1.410* ***
Age class: 18 – 34[b]	-	-	-	-	-	-	-
Age class: 35 – 54[b]	0.015	-0.028	*-0.169*	-0.015	*-0.081*	0.028	*0.246*
Age class: 55+[b]	-0.043	-0.086	*-0.312*	0.072	*0.539* ***	0.056	*0.774* ***
Higher education[b]	-0.093	0.010	*0.294* ***	0.059	*0.562* ***	0.025	*0.577* ***
Income quintile 1[b]	-	-	-	-	-	-	-
Income quintile 2[b]	0.016	-0.074	*-0.339* **	0.081	*0.442* *	-0.024	*-0.204*
Income quintile 3[b]	0.041	-0.090	*-0.483* ***	0.092	*0.414* *	-0.044	*-0.487* **
Income quintile 4[b]	0.010	-0.137	*-0.660* ***	0.178	*0.877* ***	-0.050	*-0.398* *
Income quintile 5[b]	0.079	-0.185	*-1.165* ***	0.164	*0.640* ***	-0.058	*-0.693* ***
Household size	-0.001	-0.008	*-0.043*	0.017	*0.079* ***	-0.008	*-0.078*
Rural area[b]	-0.181	-0.070	*0.128*	0.171	*1.413* ***	0.080	*1.497* ***
High environmental concern[b]	-0.042	-0.037	*-0.057*	0.012	*0.237* **	0.068	*0.856* ***
Sense of personal responsibility	0.026	-0.039	*-0.258* **	0.000	*-0.053*	0.013	*0.059*
Belgium (base)[b]	-	-	-	-	-	-	-
US[b]	0.237	-0.079	*-1.070* ***	-0.010	*-0.805* ***	-0.149	*-2.304* ***
UK[b]	0.185	-0.035	*-0.661* ***	-0.108	*-1.062* ***	-0.041	*-1.059* ***
France[b]	-0.069	-0.035	*-0.001*	0.091	*0.654* ***	0.012	*0.393*
Netherlands[b]	0.075	0.090	*0.265*	-0.142	*-0.939* ***	-0.023	*-0.558* *
Sweden[b]	0.218	0.084	*-0.134*	-0.256	*-1.908* ***	-0.045	*-1.293* ***
Switzerland[b]	-0.164	-0.100	*-0.059*	0.157	*1.327* ***	0.107	*1.733* ***
Israel[b]	0.166	-0.006	*-0.435* *	-0.186	*-1.341* ***	0.026	*-0.328*
Canada[b]	0.231	-0.121	*-1.245* ***	-0.018	*-0.770* ***	-0.091	*-1.677* ***
Log-pseudolikelihood		-23,479					
Akaike Info Criterion		47125					
Number of observations		8,261					

Note: ***, **, * indicate statistical significance at the 1, 5 and 10% level. Estimated coefficients are not computed for Class 1 since this is the base outcome. Standard errors could be computed only for coefficients. All variables marked with a [b] are binary indicators. Income varies from 1 (first quintile) to 5 (fifth quintile). The variable measuring respondent's sense of personal responsibility varies from 1 to 5, with 5 indicating greatest sense of responsibility in relation to environmental problems and solutions.

Table A3. Estimation of the probability of support towards food policies (marginal effects after Probit models)

	Support demand soft		Support demand strong		Support supply soft		Support supply strong		Support tax on meat	
Respondent is male	-0.006		0.004		-0.019	**	-0.004		0.058	***
Age: 18 – 34 (base)	-		-		-		-		-	
Age: 35 – 54	-0.013		-0.056	***	-0.024	**	0.002		-0.094	***
Age: 55+	0.013		-0.103	***	-0.007		0.024	**	-0.209	***
Higher education	0.028	***	0.036	***	0.035	***	0.027	***	0.042	***
Household size	-0.001		0.014	***	-0.003		-0.005	**	0.014	***
Rural area	-0.004		-0.039	***	-0.003		-0.001		-0.077	***
High envir. concern	0.150	***	0.216	***	0.161	***	0.154	***	0.117	***
Sense of personal responsibility	0.074	***	0.060	***	0.070	***	0.050	***	0.006	
Class 1 (base)	-		-		-		-		-	
Class 2	-0.027	**	0.053	***	-0.014		-0.004		0.079	***
Class 3	0.064	***	0.151	***	0.069	***	0.069	***	0.088	***
Class 4	0.073	***	0.212	***	0.085	***	0.100	***	0.242	***
Belgium (base)	-		-		-		-		-	
US	-0.045	***	-0.132	***	0.004		-0.034		0.035	*
UK	0.015		0.008		0.041	**	0.046	**	0.065	***
France	-0.026		-0.003		-0.017		0.018		-0.021	
Netherlands	0.010		0.034		0.029		0.002		0.088	***
Sweden	-0.031	*	-0.028		0.005		0.004		0.049	**
Switzerland	-0.011		-0.120	***	0.013		0.004		0.010	
Israel	-0.006		-0.036		0.069	***	0.046	**	-0.027	
Canada	-0.047	***	-0.102	***	0.011		-0.005		-0.033	
# of observations	8,261		8,261		8,261		8,261		8,261	
Pseudo R2	0.133		0.112		0.117		0.104		0.127	

Note: ***, **, * indicate statistical significance at the 1, 5 and 10% level.

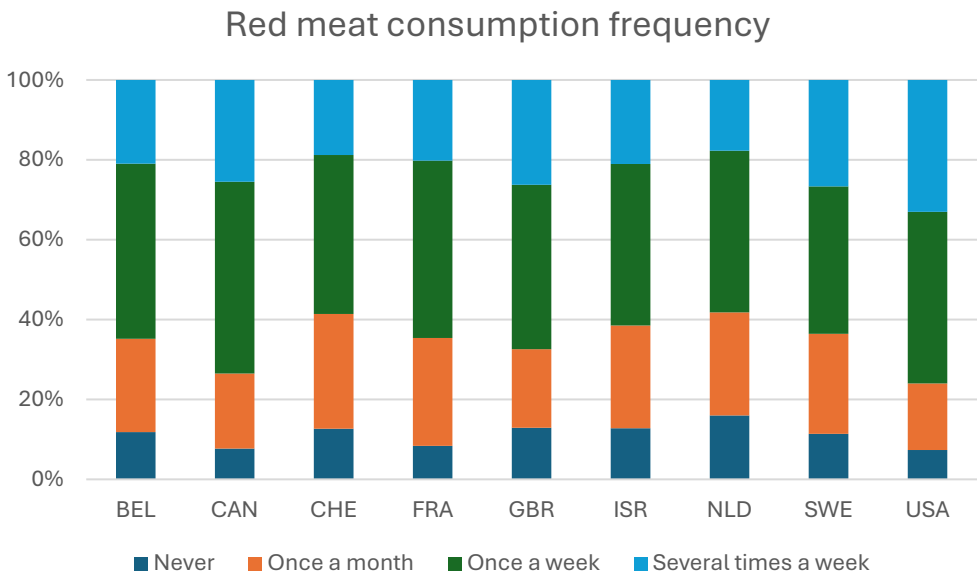

Fig. 1: Consumption frequency of red meat, by country

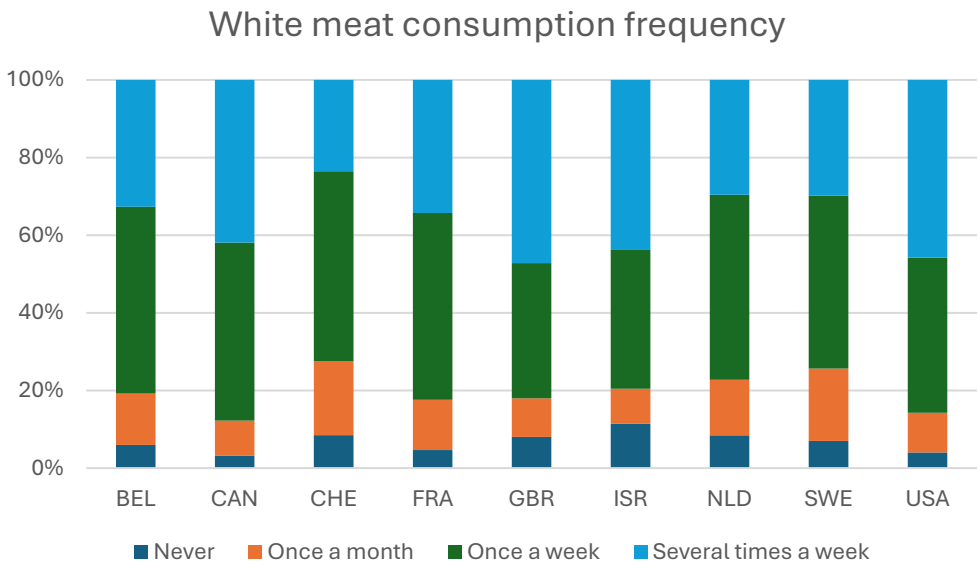

Fig. 2: Consumption frequency of white meat, by country

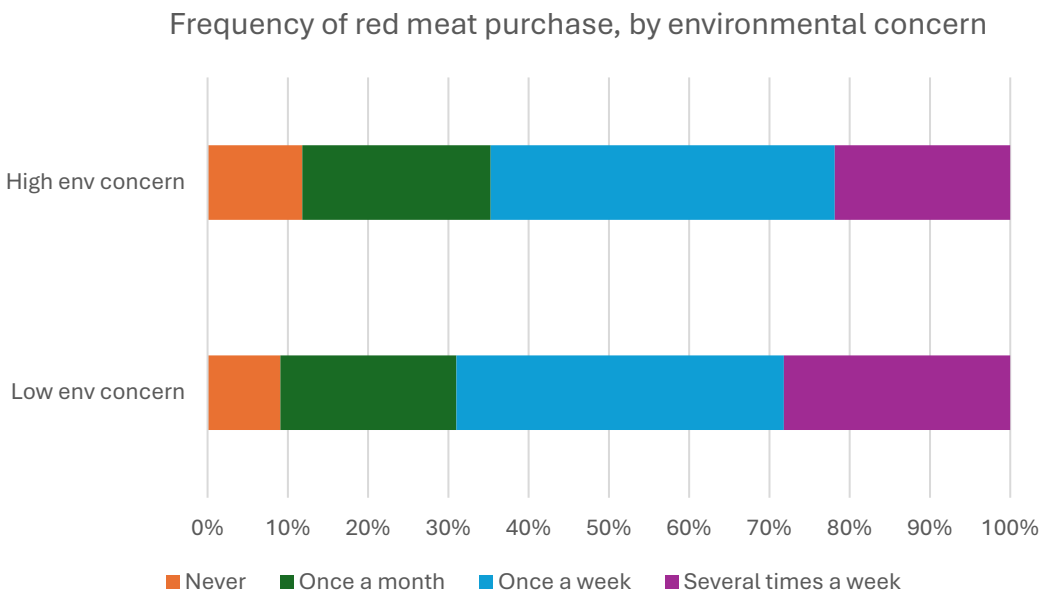

Fig. 3: Consumption frequency of red meat, by level of environmental concern

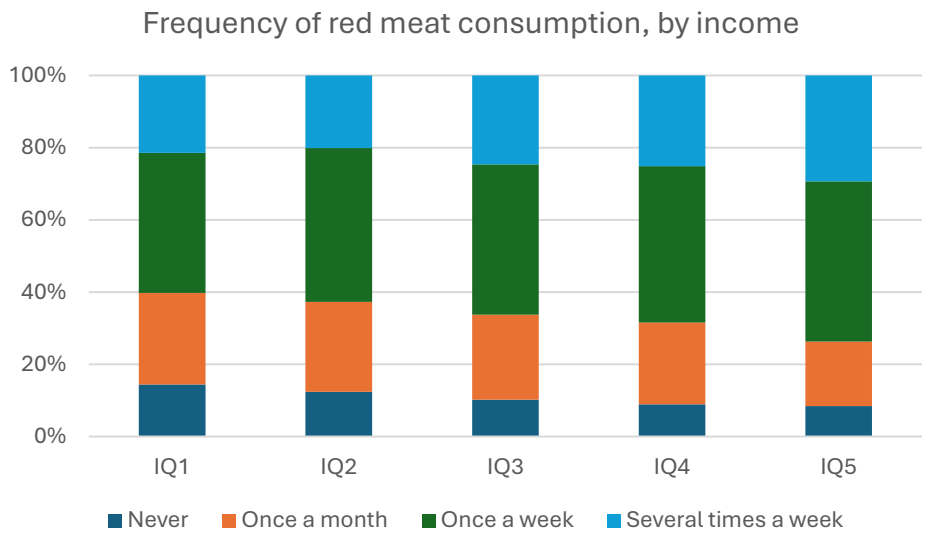

Fig. 4: Frequency of consuming red meat, by income quintile

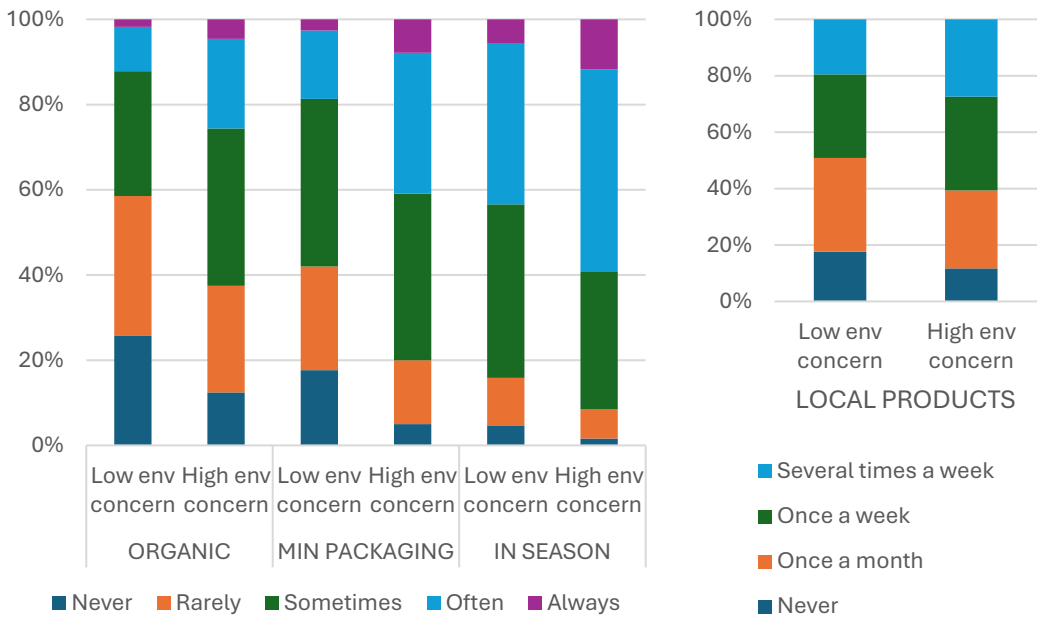

Fig. 5: Purchase frequency of organic food, products with minimal packaging, in-season, and locally-grown products, by level of environmental concern

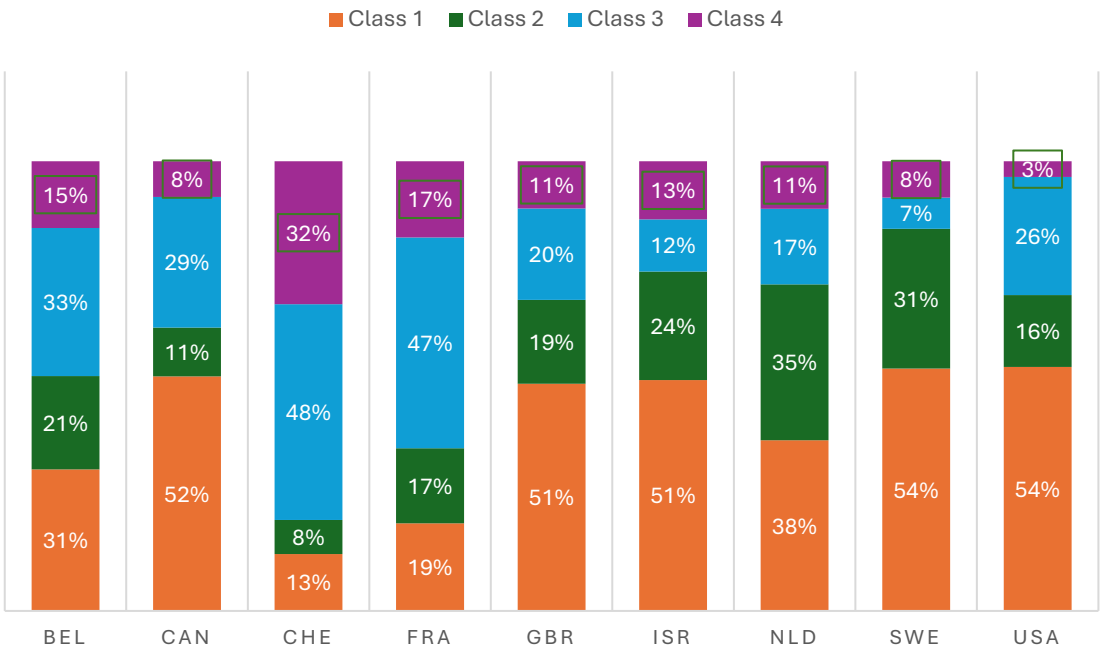

Figure 6. Probability of class membership by country