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Sustainable food consumption as policy objective: where does the European Union stand?

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Abstract

Sustainable food consumption is a priority of the EU's Farm to Fork strategy, yet gaps remain in understanding consumer sustainable choices. Drawing on Eurobarometer data, this paper analyzes environmental perceptions of respondents by socioeconomic characteristics, categorizing consumers into two groups based on food purchasing priorities. Probit results show that higher education and better economic conditions increase the likelihood of prioritizing health and environmental concerns. However, pro-environmental factors are not uniformly understood across groups. Therefore, awareness campaigns emerge as effective drivers of sustainable consumption, suggesting policymakers should expand existing initiatives, develop long-term educational programs, and tailor interventions to consumer segments.

1. Introduction

In its pursuit of becoming a leading carbon-neutral economic power by 2050, the EU recognizes the role of sustainable food consumption (SFC) in achieving the goals of the Farm to Fork (F2F) strategy (European Commission, 2020; Notarnicola et al., 2017). Despite political efforts to reach carbon neutrality in food systems, current consumption patterns remain unsustainable (Laestadius & Wolfson, 2019), contributing to high greenhouse gas (GHG) emissions, water pollution, and biodiversity loss (Notarnicola et al., 2017). Promoting SFC is therefore crucial for mitigating climate change and advancing sustainable growth and food security (Benvenuti et al., 2019; Myers et al., 2013).

Food consumption presents a dual challenge: while it contributes to environmental degradation, it is also essential in ensuring food security and protecting human health (Azzurra et al., 2019; Myers et al., 2013). Although food production is responsible for one-third of all anthropogenic GHG emissions globally (Crippa et al., 2021), there are substantial opportunities for demand-side mitigation. Carlsson-Kanyama & González, (2009) show that food diets vary in their emissions potential, with meals rich in animal protein being associated with resource-intensive and high-emission production systems. Reducing meat consumption, for instance, could lower environmental impacts more effectively than intensifying the production of livestock feed (Ripple et al., 2014). This suggests that dietary changes serve as a viable strategy for sustainable development, provided consumers gradually shift toward food produced Moss et al.through low-impact systems (Garnett, 2011).

Encouraging sustainable practices among consumers, such as influencing household purchasing patterns and everyday consumption choices (Ivanova et al., 2020), may lead to beneficial environmental outcomes and a corresponding reduction in GHG emissions (Moss et al., 2010). When consumers choose what food to buy, they indirectly influence both food production methods and market dynamics, prompting companies to reconsider their social responsibilities (Grunert, 2011; De Carvalho et al., 2016). Nevertheless, the concept of SFC remains ambiguous, and it is unclear how consumers perceive sustainability or how best to guide their food choices toward more sustainable options (de Boer & Aiking, 2021; van Bussel et al., 2022a).

SFC encompasses various aspects including environmental impacts, animal welfare, economic factors, and ethical issues. (Verain et al., 2021). Assessing consumer perceptions of food sustainability is important for designing effective policy interventions and providing meaningful guidance to increase market demand for sustainable food alternatives (van Bussel et al., 2022a). Recent literature indicates that consumers differ in their beliefs and prioritization of sustainability dimensions (Feucht & Zander, 2018; Hartikainen et al., 2014; Peano et al., 2019) and that they generally hold positive attitudes towards sustainability related concerns, such as environmental and social issues (Grunert, 2011; Feucht & Zander, 2018).

Sustainable consumption has recently gained prominence in EU political agendas. The F2F strategy is the primary food policy framework, aiming to promote sustainable consumption through various measures, including improving access to, the adoption of, and affordability of sustainable foods and diets (European Commission, 2024b). Key political priorities include strengthening information about food sustainability and ensuring their procurement. However, Just & Gabrielyan, (2016) argue that the design of effective policy interventions must account for consumer heterogeneity by tailoring strategies that are specific to socioeconomic traits. While classical behavioral models focus mainly on prices and food-related information to drive changes in consumption, contemporary political challenges arise from insufficient attention to consumer segmentation and limited understanding of their perceptions, attitudes, and preferences regarding sustainable food options. Changing food habits is inherently difficult due to socio-cultural preferences, marketing influences, and environmental factors (Carrus et al., 2018; Flaherty et al., 2018). Moreover, even if consumers recognize the importance of food sustainability, their purchasing behaviors may not always reflect this awareness (Vermeir & Verbeke, 2006). Therefore, developing a holistic understanding of current food sustainability

perceptions across different socioeconomic groups in the EU could support the implementation of the F2F strategy's regulatory proposals.

In this context, this paper aims to examine the current profile of European consumers and how different socioeconomic groups perceive sustainability issues in their food purchasing decisions. Specifically, we use the Eurobarometer 93.2 cross-sectional dataset collected from August to September 2020. A Probit model is estimated to analyze the socioeconomic characteristics and environmental perceptions of two distinct consumer groups, differentiated by the priority factors influencing their food purchasing decisions.

The main novelty of this paper lies in identifying relationships between the socioeconomic characteristics of EU consumers and their respective preferences for food produced through more sustainable systems. We contribute to the existing literature on consumers perceptions and acceptance of sustainable food attributes as a policy objective (Baig et al., 2024; Berthold et al., 2024; Hartmann & Siegrist, 2017; Hueppe & Zander, 2025; Mensah et al., 2024) by providing robust insights into the social groups whose consumption patterns aligns with the goals of the F2F strategy. By critically analyzing existing tools aimed at promoting sustainability along the food supply chain (FSC), we offer valuable information to EU policymakers regarding consumers' acceptance of and knowledge about sustainable food options. These findings can support the design of more effective information campaigns and help tailor food-related policies according to the needs of different social groups.

2. Food Perception and Consumption

A growing body of literature recognizes the potential of sustainable diets to reduce agriculture-related environmental impacts (Osei-Owusu et al., 2022). Food consumption habits not only directly affect food production but also have broader implications for public health, social cohesion, and economic development (Reisch et al., 2013a). While the motivation to promote sustainable diets is clear, definitions of *sustainable consumption* and *sustainable food* vary. According to Li & Kallas (2021), sustainable food encompasses multiple aspects, including affordability, fairness, environmental impact, health, nutrition, taste, production methods, energy consumption, GHG emissions, animal welfare, and human well-being. Sustainability perspectives depend on context and are shaped by a complex array of intertwined socioeconomic conditions, which are neither uniformly understood nor communicated (Torán-Pereg et al., 2023). In this respect, viable political and private propositions to foster sustainable

consumption are only possible when strategically assessing the ways consumers perceive food attributes in their purchasing decisions (White et al., 2019). Food consumption is rooted in sentiments driven and reinforced by marketing campaigns, which often support supply chains that are detrimental to the environment (Peattie & Peattie, 2009). This suggests that policies should target not only consumers but also a broad range of stakeholders who influence production and consumption patterns.

Policymaking has historically assumed that food consumption is driven by utility-maximizing behavior (Just & Gabrielyan, 2016), meaning that, for example, adjusting prices, taxes, and product supply would be sufficient to promote vegetarian diets. However, this assumption is contested, with critics arguing that normative analyses generalize consumer behavior and assume a uniform response to economic shocks (Miljkovic, 2005). Several studies explore the influence of consumers' social and cultural attributes on specific consumption behaviors. For instance, the consumption of unhealthy diets by lower-income households is often linked to the high cost of healthier items (Golan et al., 2008). Additionally, highly educated consumers are generally associated with healthier eating habits, presumably due to being more informed about nutrition and health (Drichoutis et al., 2005). Nonetheless, such associations are not universally agreed upon, as food preferences are influenced by a range of behaviors and interests, as well cultural and socioeconomic factors (Just & Gabrielyan, 2016). Indeed, taste often plays a significant role in consumption decisions rather than considerations related to health and nutrition (Binkley & Golub, 2011).

According to EU goals to promote sustainable food consumption, political and economic incentives should be coupled with a closer understanding of EU consumers' perceptions and priorities when buying food. Although sustainability issues have been progressively acknowledged by various societal groups, several uncertainties remain (Torán-Pereg et al., 2023). Sustainable food also involves stage-specific elements such as the use of energy, water, and resources, as well as waste management and GHG emissions from production, retailing, cooling, packaging, and transportation (WHO, 2019). In the related literature, sustainable diets have been analyzed based on existing technologies, with an expectation of achieving higher productivity by making small changes to production systems (Herrero et al., 2020). Although technological advancements alone do not lead to sustainable production and consumption, they are key to supporting the transition of food systems towards sustainability and should be accompanied by political incentives. These incentives should also consider the local, cultural, and socioeconomic characteristics of consumers groups (Hall & Dijkman, 2019). Meanwhile,

policymakers should take into account the characteristics of diverse EU consumer groups to create consistent policy tools that stimulate the continuous adoption of, and appreciation for alternative foods produced through sustainable practices.

3. Methods

This section begins by presenting the data and stylized facts (3.1), followed by the model specification (3.2).

3.1. Data and Stylized Facts

The dataset is drawn from two sources. The first is the 93.2 Eurobarometer, which surveys a total of 27,237 individuals across 27 EU member states regarding their perceptions and attitudes toward aspects of food sustainability. This data is combined with a range of systematically collected EU consumer initiatives that provide cross-country information about consumers engagement in promoting sustainability along the FSC (Moreira-Dantas et al., 2022).

The Eurobarometer survey includes demographic questions as well as citizens' expectations regarding agriculture, the EU's Common Agriculture Policy (CAP), and efforts to make food systems fit for the future. The survey employs a mixed methodology, combining face-to-face interviews, probabilistic online panels, and push-to-web techniques to allow for regional and country-specific representativeness.

A dichotomous dependent variable is generated based on the survey question (QB1:a,b): *"When you buy food, which of the following are the most important to you? Firstly and secondly"*. Consumers choose their priorities among the response options: *Your ethics and beliefs* (whether the item complies with your ethics and beliefs); *Food safety* (e.g. if there is a risk in eating this food); *Cost*; *Nutrient content* (e.g. the amount of vitamins, fibre, proteins); *Taste*; *Where the food comes from* (e.g. geographical origin); *Convenience* (e.g. the easiness to use, prepare); *Minimally processed*; *Amount of shelf-life available*; *Its impact on the environment and climate* (e.g. carbon footprint).

Consumers are clustered into two distinct groups using a dichotomous "traffic-light" variable. Red consumers are those whose first priority is "cost, convenience and amount of shelf-life available" and whose second is any of the remaining possible answers. Green consumers, by contrast, prioritize "ethics and beliefs, food safety, nutrient content, taste, where the food comes from, minimally processed food, and food's impact on the environment and climate" as their

primary concern, with any other option listed as their secondary priority. Coupling health- and environmental-related responses is a meaningful way to represent SFC, as it is directly aligns with health-related claims (Mancini et al., 2017). The FAO highlights that FSC involves "diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations" (FAO, 2010).

The main explanatory variables are respondents' socio-economic characteristics, pro-environmental perceptions, and willingness to pay. Additionally, cross-country consumer initiatives are considered to assess the effect of awareness campaigns in food perception. A total of 13 consumer initiatives, either led by country-specific civil organizations, associations, and NGOs, or by EU-wide public programs, aim to address food-related consumption issues and promote awareness of food sustainability. To evaluate the relationship between these initiatives and consumers categories, EU countries are classified into four levels based on the scope and nature of their initiatives (Table 1).

Table 1. Description of initiatives, countries and coding

Description	Countries	Code
Countries that only have initiatives promoted by the EU	Sweden, Finland, Czech Republic, Hungary, Estonia, Latvia, Malta, Slovakia, Slovenia, Portugal	0
Countries with EU initiatives and one additional national initiative	Denmark, Spain, Ireland, Luxembourg, Austria, Cyprus, Lithuania, Poland, Bulgaria, Romania, Croatia	1
Countries with EU initiatives and two additional national initiatives	Belgium, Greece, France, The Netherlands	2
Countries with EU initiatives and more than two additional national initiatives	Germany, Italy	3

Source: Moreira-Dantas et al. (2022).

Variable responses are assessed by distinguishing between Western and Northern European countries and Eastern and Southern European countries. Such regional aggregation is based on Cling et al., (2020), who identified marked differences in the performance of Sustainable Development Goal indicators in these two European regions.

3.2. Estimation Strategy

A Probit model is estimated to assess the determinants of consumers' priorities when purchasing food, based on the "traffic-light" classification. As explained above, we distinguish between consumers that prioritize mostly health and environmental issues (green consumers) and those who prioritize cost, convenience, or shelf life (red consumers). The model is specified as:

$$(PrY_i = 1|X_i) = \sum \beta_j X_{ij} + \varepsilon_i \qquad (1)$$

where i denotes the i-th observation in the sample, Pr is the probability of the outcome, β_j represents the regression coefficients of the explanatory variable X_j, and ε_i is the error term, assumed to follow a standard normal distribution: $\varepsilon_i \sim \mathrm{N}(0,1)$. The Probit coefficients are estimated using the maximum likelihood method. The probability that consumers will fall in the so-called green category is given as P = P[y_i = 1], while the probability that consumers will fall into the red category is P = P[y_i = 0].

The model is estimated with standard errors clustered at the country level, reflecting the fact that EU countries differ in their acceptance and realization of sustainability initiatives proposed under the European Green Deal (e.g. renewable energy and investment for sustainable ventures) (Panarello & Gatto, 2023). Therefore, this allows for a robust assessment of any arbitrary correlations within EU member states while assuming independence between them.

As extensions of model (1), we consider heterogeneous effects of several explanatory factors that we allow to vary by educational level and by self-reported social class.

4. Main results

According to the summary statistics of our dataset, approximately 74 percent of the sample is composed of green consumers, namely those who prioritize elements such as health, nutrition, food origin and environmental impact when purchasing food. The empirical model includes several socioeconomic characteristics and three pro-environmental covariate groups built with information obtained from the answers to the following sets of survey questions: (i) four questions regarding perceptions of agricultural practices and sustainability; (ii) two questions about the factors that are important in deciding what food to buy; and (iii) two questions regarding the willingness to pay more for sustainable food. The number of country-specific consumer initiatives is included as a categorical variable. Survey responses range from “tend to disagree” to “totally disagree,” as well as from “tend to agree” to “totally agree.” For the purposes of analysis, the first two categories are grouped and coded as “disagree” and the latter two as “agree”. The same coding approach is applied to questions related to “importance”. Table 2 presents detailed descriptive statistics of the variables used.

Table 2. Summary statistics

Variable	Variable description	Mean	St. dev	Min	Max
Outcome Variable					
Green consumer	Red consumer= 0; Green consumer=1	0,74	0,43	0	1

Independent variables					
Socioeconomic characteristics					
Female	Female =1; 0 otherwise	0,53	0,49	0	1
Education	Primary level= 0; Secondary level=1; Graduate level= 2	0,69	0,86	0	2
Age	Respondent age	50,63	17,69	15	99
Age squared	Respondent squared age	2877	1789	225	9801
Social class	Low=0, Middle=1, High=2	0,70	0.63	0	2
Occupation	Student, unemployed, retired=0; Unskilled manual worker=1; Skilled manual worker=2; Business proprietors and employed professionals=3	1,30	1,17	0	3
Easiness to pay bills	How often the respondent faces difficulty to pay bills Most of the time=0, eventually=1, never=2	1,61	0,62	0	2
Community	Rural area= 0; Small and middle town=1; Large town=2	1,96	0,79	2	2
Pro-environmental perceptions					
CAP priority	How important is the CAP priority "Help tackle climate change"? 0= Not important; 1= Important	0,88	0,31	0	1
Organic food	Organic products produced with better environmental conditions. 0= Do not agree; 1= Agree	0,79	0,40	0	1
Farming	EU farmers need to change the way they work in order to fight climate change even if that means that EU agriculture will be less competitive. 0= Do not agree; 1= Agree	0,70	0,45	0	1
Trade standards	Agricultural imports from any origin should only enter the EU if their production has complied with the EU's environmental and animal welfare standards. 0= Do not agree; 1= Agree	0,38	0,48	0	1
Regulation standards	Regulations should force farmers, fishers, food manufacturers, shops and retailers, restaurants and cafés to meet more stringent sustainability standards. 0= Do not agree; 1= Agree	0,83	0,37	0	1
Important elements when buying food					
Product label	How important are labels when buying food? 0= Not important; 1= Important	0,51	0,49	0	1
Short supply chain	When buying food, how important is that the food is produced in short supply chains?	0,85	0,34	0	1

	0= Not important; 1= Important				
Willingness to pay					
Willingness to pay	Are ready to spend more money for food which protects your health and the planet? 0= Do not agree; 1= Agree	0,73	0,43	0	1
Pay carbon footprint	You are prepared to pay 10% more for agricultural products that are produced in a way that limits their carbon footprint. 0= Do not agree; 1= Agree	0,97	0,94	0	1
Country level consumer initiatives					
Consumer Initiatives	National and EU-wide consumers' initiatives EU initiatives only=0; EU initiative and 1 additional national initiative=1; EU initiative and 2 additional national initiatives=2; EU initiative and more than two additional national initiatives =3	1,04	0,94	0	3
Geographic areas					
East-South Europe	Countries located in East and South Europe	0,62	0,48	0	1

Notes; Number of observations=27237. Source: Eurobarometer 93.2.

Model (1) is estimated using only socioeconomic characteristics as regressors, as shown in column (1), and only pro-environmental variables in column (2) (Table 3). Subsequently, both sets of characteristics are included in column (3). The estimated coefficients for level of education, self-defined social class, difficulty paying bills, and occupation are similar across these three specifications. The main results suggest that higher levels of education and better economic conditions are significantly associated with a higher likelihood of consumers prioritizing health and environmental concerns when buying food products at a 1% level ($p < 0.01$). Interestingly, the results concerning consumers' perceptions of environmental variables are mixed. While organic agriculture presents a positive and significant association with the likelihood of being a green consumer, other variables related to the green transition do not show the expected relationship with consumer perceptions. For instance, product labels seem to be more important for consumers that care about price and convenience. Similarly, agricultural trade standards, which are designed to ensure the quality, fairness, and safety of food entering the EU (European Commission, 2024a), seem to be more relevant to consumers who prioritize price over environmental issues (negative significant coefficient). Regarding willingness to pay, green consumers are more likely to pay a premium for food that protects their health. However, no statistical association is identified for food produced with a lower

carbon footprint. Moreover, there are significant statistical differences between consumers in North-Western and South-Eastern EU countries. Consumers are more likely to fall into the green category in the former country group. Likewise, respondents living in countries with a higher number of consumer initiatives are more likely to prioritize health and the environmental concerns in their food choices.

In summary, the main results provide evidence of significant differences in how socioeconomic and environmental variables influence the likelihood of consumers prioritizing health and environmental aspects in their food consumption.

Table 3. Estimation results

Outcome binary variable: Green consumers=1	(1)	(2)	(3)
Explanatory factors:	Socioeconomic	Environmental	Both
Variables:			
Female dummy	0.0345		0.0142
	(0.0304)		(0.0255)
Education (post-secondary)	0.184***		0.117***
	(0.0436)		(0.0447)
Education (graduate)	0.217***		0.182***
	(0.0456)		(0.0410)
Age	0.0118***		0.00881**
	(0.0039)		(0.00378)
Age squared	-0.0001***		-0.00008**
	(0.00004)		(0.00003)
Social class (middle)	0.238***		0.171***
	(0.0303)		(0.027)
Social class (high)	0.442***		0.332***
	(0.0549)		(0.0405)
Easy to pay bills (from time to time)	0.159**		0.130*
	(0.0785)		(0.0691)
Easy to pay bills (always)	0.320***		0.244***
	(0.104)		(0.0847)
Occupation (unskilled manual worker)	0.00905		0.0237
	(0.0403)		(0.0355)
Occupation (skilled manual worker)	0.0218		0.0444
	(0.0283)		(0.0306)
Occupation (employed professionals)	0.148***		0.162***
	(0.0395)		(0.0436)
Large city	0.0165		0.00583
	(0.0363)		(0.0332)
CAP priority		0.0413	0.0695
		(0.0553)	(0.0516)
Organic food		0.149***	0.121***
		(0.0278)	(0.0278)

Farming		0.0303	0.0269
		(0.0291)	(0.0271)
Trade standards		-0.102***	-0.104***
		(0.0371)	(0.0349)
Regulation standards		-0.0437	-0.0263
		(0.0487)	(0.0462)
Product label		-0.0987***	-0.101***
		(0.0245)	(0.0247)
Short supply chain		0.249***	0.245***
		(0.0342)	(0.0361)
Willingness to pay		0.502***	0.425***
		(0.0401)	(0.0344)
Pay carbon footprint		0.0432	0.0227
		(0.0462)	(0.0455)
Number of consumer initiatives		0.0470	0.0664*
		(0.0420)	(0.0400)
North-West EU		0.217***	0.109
		(0.0784)	(0.0803)
Observations	26586	27237	26586
$Pseudo\ R^2$	0.0357	0.0561	0.0744

Note: Clustered standard errors at the country level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Interactions between education and social class (Tables 4 and 5, respectively) capture the heterogeneity of effects across different levels of education and self-defined social class (used here as a proxy for income). Interactions of consumer initiatives and regions are also provided to assess how consumer engagement influences the likelihood of falling into the green consumer category. The perceived environmental benefits of organic agriculture are more strongly associated with green consumer status as education levels increase. Results hold for variables related to the importance of short supply chains in food purchases and the willingness to pay for food that protects a consumer's health and the environment. Social class interaction results are similar, with the only exception of perceptions of organic agriculture for respondents who are defined to be of high economic class (Table 5). Likewise, consumers that have higher levels of education and higher social classes are more likely to pay more for food that protects their health and the environment.

Table 4. Estimation results by educational level

Outcome binary variable: Green consumers=1	(4) with education interactions
Variables:	
Female	0.0225
	(0.024)
Education (post-secondary)	-0.0502
	(0.136)
Education (graduate)	0.0726
	(0.062)
Age	0.00885**

	(0.0037)
Age squared	-0.000085**
	(0.00003)
Social class (middle)	0.165***
	(0.027)
Social class (high)	0.327***
	(0.043)
Easy to pay bill (from time to time)	0.161***
	(0.06)
Easy to pay bill (always)	0.302***
	(0.069)
Occupation (unskilled manual worker)	0.0200
	(0.037)
Occupation (skilled manual worker)	0.043
	(0.03)
Occupation (employed professionals)	0.147***
	(0.041)
Large city	-0.013
	(0.033)
CAP priority	0.0546
	(0.049)
Farming	0.0241
	(0.026)
Trade standards	-0.025
	(0.044)
Product label	-0.103***
	(0.023)
Pay carbon footprint	0.0192
	(0.044)
Education (primary)*Organic food	0.101**
	(0.04)
Education (post-secondary)*Organic food	0.219***
	(0.052)
Education (graduate)*Organic food	0.140***
	(0.036)
Education (primary)*Trade standards	-0.065
	(0.049)
Education (post-secondary)*Trade standards	-0.173***
	(0.055)
Education (graduate)*Trade standards	-0.143***
	(0.048)
Education (primary)* Short supply chain	0.208***
	(0.036)
Education (post-secondary)* Short supply chain	0.272***
	(0.091)
Education (graduate)* Short supply chain	0.318***
	(0.066)
Education (primary)*Willingness to pay	0.411***
	(0.031)
Education (post-secondary)*Willingness to pay	0.500***
	(0.043)
Education (graduate)*Willingness to pay	0.438***
	(0.067)
initiatives=0*North West=1	0.281***
	(0.057)

initiatives=1*North West =0	-0.041
	(0.071)
initiatives=1*North West =1	0.135*
	(0.071)
initiatives=2*North West =0	0.590***
	(0.053)
initiatives=2*North West =1	0.111
	(0.081)
initiatives=3*North West =0	0.343***
	(0.05)
initiatives=3*North West=1	0.335***
	(0.053)
Observations	26586
$Pseudo\ R^2$	0.0814

Note: Clustered standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table 5. Estimation results by social class

Outcome binary variable: Green consumers=1	(5) Social class interaction
Variables:	
Female	0.022
	(0.024)
Education (post-secondary)	0.119**
	(0.048)
Education (graduate)	0.182***
	(0.036)
Age	0.0087**
	(0.0037)
Age squared	-0.00008**
	(0.00003)
Social class (middle)	0.296***
	(0.074)
Social class (high)	0.381***
	(0.126)
Easy to pay bill (from time to time)	0.157**
	(0.061)
Easy to pay bill (always)	0.298***
	(0.069)
Occupation (unskilled manual worker)	0.019
	(0.037)
Occupation (skilled manual worker)	0.042
	(0.03)
Occupation (employed professionals)	0.149***
	(0.041)
Large city	-0.014
	(0.033)
CAP priority	0.055
	(0.048)
Farming	0.023
	(0.027)
Trade standards	-0.027
	(0.044)
Product label	-0.103***
	(0.023)
Pay carbon footprint	0.017
	(0.044)
Social class (low)*Organic food	0.159***
	(0.044)
Social class (middle)*Organic food	0.110***
	(0.028)
Social class (high)*Organic food	-0.056
	(0.095)
Social class (low)*Trade standards	-0.050
	(0.053)
Social class (middle)* Trade standards	-0.134***
	(0.039)
Social class (high)* Trade standards	-0.203***
	(0.061)
Social class (low)**Short supply chain	0.259***
	(0.044)

Social class (middle)* Short supply chain	0.195***
	(0.048)
Social class (high)* Short supply chain	0.376***
	(0.083)
Social class (low)*Willingness to pay	0.426***
	(0.038)
Social class (middle)*Willingness to pay	0.419***
	(0.037)
Social class (high)*Willingness to pay	0.535***
	(0.102)
Consumer Initiatives=0*North West=1	0.279***
	(0.058)
Initiatives=1*North West =0	-0.04
	(0.072)
Initiatives=1*North West =1	0.137*
	(0.071)
Initiatives=2*North West =0	0.593***
	(0.054)
Initiatives=2* North West =1	0.110
	(0.08)
Initiatives=3* North West =0	0.344***
	(0.05)
Initiatives=3*North West =1	0.333***
	(0.053)
Observations	26586
$Pseudo\ R^2$	0.0814

Note: Clustered standard errors at the country level in parentheses: * p < 0.1, ** p < 0.05, *** p < 0.01.

As robustness checks, three sets of results are presented (Table 6): one for each geographical region considered (North-Western and South-Eastern EU countries) and a third model with country fixed effects. The estimated coefficients remain similar to those presented in Table 4, indicating that individuals with better socioeconomic conditions and higher education levels tend to have stronger perception regarding health and sustainable food options when compared to those in other social strata, reinforcing our main findings. Organic food and short supply chains are acknowledged as key attributes of sustainable food in all three specifications. The prioritization of trade and regulation standards, in turn, is related to a lower probability of falling into the green category in North-Western EU countries and in the fixed effects specification. Estimated coefficients for product labels remain similar and statistically significant, a fact suggesting that the informational content provided by food labels may not effectively influence consumer perceptions or may not be perceived as credible or relevant.

Table 6. Estimation results by EU region and with country fixed effects

Outcome binary variable: Green consumers=1	(6)	(7)	(8)
Regions:	North West EU	South East EU	All regions & country FE
Variables:			

Female	0.068	-0.0015	0.0362
	(0.049)	(0.029)	(0.022)
Education (post-secondary)	0.0568	0.160***	0.0926***
	(0.051)	(0.059)	(0.033)
Education (graduate)	0.291***	0.0963**	0.189***
	(0.053)	(0.044)	(0.037)
Age	0.0174***	0.00420	0.00822**
	(0.005)	(0.004)	(0.003)
Age squared	-0.00012**	-6.21e-05	-7.82e-05**
	(5.76e-05)	(4.57e-05)	(3.59e-05)
Social class (middle)	0.140***	0.168***	0.155***
	(0.05)	(0.031)	(0.027)
Social class (high)	0.291***	0.292***	0.301***
	(0.064)	(0.06)	(0.043)
Easy to pay bill (from time to time)	0.0842	0.144*	0.179***
	(0.125)	(0.077)	(0.062)
Easy to pay bill (always)	0.241*	0.257***	0.312***
	(0.141)	(0.092)	(0.069)
Occupation (unskilled manual worker)	-0.0291	0.0521	0.00918
	(0.055)	(0.042)	(0.041)
Occupation (skilled manual worker)	0.0239	0.0549	0.0408
	(0.038)	(0.036)	(0.026)
Occupation (employed professionals)	0.089**	0.233***	0.144***
	(0.045)	(0.054)	(0.039)
Large city	-0.026	0.013	-0.0069
	(0.056)	(0.038)	(0.031)
CAP priority	0.028	0.086	0.052
	(0.064)	(0.072)	(0.046)
Organic food	0.118***	0.115***	0.114***
	(0.032)	(0.035)	(0.03)
Farming	0.075	0.0038	0.026
	(0.052)	(0.025)	(0.024)
Trade standards	-0.177***	-0.066	-0.100***
	(0.031)	(0.046)	(0.036)
Regulation standards	-0.0932*	0.016	-0.024
	(0.053)	(0.065)	(0.042)
Product label	-0.151***	-0.075***	-0.101***
	(0.039)	(0.029)	(0.027)
Short supply chain	0.345***	0.203***	0.227***
	(0.075)	(0.037)	(0.035)
Willingness to pay	0.546***	0.370***	0.416***
	(0.043)	(0.039)	(0.033)
Pay carbon footprint	-0.008	0.029	0.04
	(0.052)	(0.06)	(0.042)
Consumer initiatives	-0.0037	0.113**	0.130
	(0.049)	(0.048)	(0.205)
North West EU			0.086
			(0.210)
Constant	-0.770***	-0.525***	-0.625***
	(0.254)	(0.189)	(0.204)

Observations	10,077	16,509	26,586
$Pseudo\ R^2$	0.0911	0.0588	0.0869
Country FE	NO	NO	YES

Note: Clustered standard errors at the country level in parentheses: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Finally, the estimated coefficient for the count variable *consumer initiatives* is only statistically significant and positively signed for South-Eastern EU countries in column (2), emphasizing the uneven effects of political and civil engagement to promote SFC across EU member states.

5. Discussion

The estimation results suggest that EU consumers who prioritize environmental and health concerns when buying food products perceive sustainability differently. While food-related concepts such as organic agriculture and short supply chains show a positive relation to sustainable consumption, others such as product labels, trade, and regulation standards are relevant only for consumers that care about non-environmental aspects. Respondents with higher levels of education and better socioeconomic conditions are more likely to consume food that is both beneficial for their health and the environment. Furthermore, respondents who are willing to pay more for sustainable food are more likely to fall into the green category. However, there is no significant association between a respondent's willingness to pay more for food with a that of prioritizing a low carbon footprint. Additionally, consumer initiatives play a crucial role mainly in South-East EU countries in supporting sustainable consumption.

Food consumption is a central component of the F2F strategy (European Commission, 2024b), given its potential to reshape food markets and production towards sustainable pathways. Everyday food choices impact the carbon footprint, energy consumption, waste management, and environmental effects along the entire FSC (Khanam et al., 2022). Thus, even a modest change in consumption patterns would yield substantial progress toward sustainable development in the EU (Khanam et al., 2022). Likewise, by considering political reforms envisioned by the F2F strategy, the central challenge remains in implementing actions for cross-sectoral policy integration, where proposals are synergic, foster collaborative accomplishments among diverse actors, and can represent consumers' demands (Bazzan et al., 2023). Consumption-related policies should be designed to achieve homogeneous understandings about sustainability, such that consumers purchase food products by perceiving elements grounded on healthy and low-impact diets (Ammann et al., 2023). Moreover, market instruments (e.g. bans, subsidies, restrictions, taxes) should be regulated in such a way as to ensure that available food products are aligned to sustainability processes and are affordable (Ammann et al., 2023; Lee et al., 2021).

Our results support the findings within previous literature on the role of education, indicating that more educated consumers are typically better informed about environmental issues and are more likely to support SFC (Grunert et al., 2014). Higher awareness often leads to more sustainable and healthier food choices (Mancini et al., 2017). Education supports the green transition by harmonizing information about sustainable processes and how they are prioritized. It also influences the a consumer's willingness to pay for healthier or lower-carbon food options (Macdiarmid et al., 2021), and spurs political interests regarding food choices (Meyer, 2015). Yet in the EU, decarbonizing the food sector calls for policies that engage consumers across all educational and socioeconomic backgrounds, ensuring that SFC is not limited to specific groups.

The empirical results obtained for covariates that proxy for income suggest that respondents of higher socioeconomic class and those with better paid jobs are more likely to prioritize their health and the environment when buying food products. These findings are in line with the literature indicating that high-income consumers are less responsive to price fluctuations (Steenhuis et al., 2011). Low-income households, in turn, pay proportionally more if green products have higher prices (Aschemann-Witzel & Zielke, 2017). Furthermore, consumers without financial constraints are more likely express preferences for animal welfare (Howard & Allen, 2010), organic food (Aschemann-Witzel & Zielke, 2017), and are willing to pay for food produced under low-emissions systems (Khanam et al., 2022; Schleich & Alsheimer, 2024). In fact, income and education variables are closely linked, as higher educated individuals often have better paying employment. Likewise, consumers with improved socioeconomic conditions have more possibilities to inform themselves about green products.

Perception of pro-environmental variables indicate a very uneven understanding of sustainable concepts within and across consumer groups. While some topics like organic agriculture and short supply chains seem to follow green consumption patterns, trade and agricultural standards, as well as product labels, seem to be more important to consumers who value non-sustainable concepts when buying food.

Our results concerning organic agriculture and short supply chains indicate that consumers generally associate these two concepts with a healthy diet consisting of locally produced food. These results are supported by van Bussel et al., (2022a) in their systematic review of sustainable consumption, highlighting an overall lack of knowledge about food-related sustainability. While some consumers recognize environmental impacts generated by food

production, other consumers are not able to understand that their respective consumption patterns are related to environmental problems

Food labels aimed at improving transparency in SFC and production through voluntary and compulsory mechanisms (Lorenz-Spreen et al., 2020; Stevens, 2010), should be designed to inform consumers and to facilitate the transition to sustainable consumption patterns. Unfortunately, some labels as well as provided information could inadvertently mislead or confuse consumers (Horne, 2009; Reisch et al., 2013b). For instance, while labels describing energy use may generally influence domestic consumption (Khanam et al., 2022; Peters et al., 2013), those describing carbon emissions have a negligible effect on lowering carbon footprint consumption (Taufique et al., 2022), a finding consistent with our results.

Geographical differences are also linked to the way EU consumers engage with sustainable consumption, as perceptions on pro-environmental issues vary by country. This result is in line with Zepeda et al., (2013) who found that cultural differences influence both consumption patterns and environmental concerns within the EU. North-Western EU countries have a solid tradition of environmental concerns that are related to social and economic performance (Zepeda et al., 2013). This implies that policies and regulations must adapt to regional conditions, such that interventions account for current civil demands. Consumer initiatives and social engagement vary across EU member states, with South-Eastern countries mainly having general initiatives promoted by the EU, while North-Western countries maintain initiatives promoted by consumer groups, associations, and NGOs. The different effects found across EU regions show the importance of civil engagement in promoting green consumption and reinforce the need for food awareness initiatives promoted by both civil society and governments.

Since food prices, eco-labels, sustainable standards, and socioeconomic characteristics are distinct components of healthy and sustainable consumption, EU regulatory proposals would benefit from integrating these elements to spot potential responses to taxes or subsidies. Regulating food prices alone would not result in desirable consumption adjustments, as there is evidence from European countries indicating that consumption of complementary non-healthy food products increases after food tax interventions (Cornelsen et al., 2015). Therefore, given that there is no "*one size fits all*" policy mechanism, regulations should consider and support information and knowledge transfer among consumer groups, ensuring that citizens

are informed about the benefits and impacts of food production and consumption (van Bussel et al., 2022b).

To transform food systems, the F2F strategy could reallocate financial resources along the FSC (Wesseler, 2022) and integrate political and market interventions as well as information about food products to (un)informed civilians. Behavioral change takes time, so investing in long-term educational trainings would foster conscious consumption, which could make consumers reflect on their moral and cultural values (Stanszus et al., 2017). Although the EU acknowledges the transformative potential of awareness campaigns (EC, 2017), educational action remains modest and uneven, widening the knowledge gap across consumer groups and member states. Thus, policy proposals should increase investments in consumer initiatives and support existing ones to foster food production and consumption awareness. Moreover, current policies should take a holistic approach to understanding food demand and consumer behavior, tailoring interventions to each member state's industrial and agricultural conditions in addition to their social demographics.

While current sustainable consumption seems to be a niche market where only well-educated and high-income individuals are more sensitive to food-related environmental impacts, concerns remain very diffuse and even misguided. Therefore, F2F policies should not only enable access to green products to the broader public but also support the facilitation of information and knowledge transfer about sustainable diets in the long run.

6. Conclusions

This paper considers and empirically analyzes the role of socioeconomic factors, pro-environmental perceptions, and consumer awareness campaigns as determinants of SFC in the EU. The main results suggest that consumers with higher levels of education and wealth are more likely to prioritize health and environmental concerns when buying food. This indicates that sustainable food is currently part of a niche market where individuals with information and financial means are more likely to access them. Food-related pro-environmental concepts are vague, and are not uniformly understood across consumer groups, even in those more sensitive to environmental concerns. Nevertheless, organic food and short supply chains are widespread concepts easily linked to sustainable diets. In contrast, product labels and regulation standards are more important for consumers that prioritize prices and convenience. The variety of labels and information provided by both voluntary and compulsory certification schemes often

prevent a unified understanding of what is being promoted. As a result, existing efforts may fall short in effectively improving environmental perceptions.

Food sustainability involves a range of interconnected elements, ranging from economic, political, cultural, behavioral, and environmental matters. Advancing SFC is challenging due to the complexity of specific components and their integration. To succeed, the F2F strategy must integrate top-down and bottom-up strategies to design suitable interventions according to consumers characteristics and demands. Consumer engagement remains modest and unequal across EU members, with North-Western countries showing higher involvement in food awareness campaigns. Therefore, improving the outreach of existing initiatives, supporting new ones, as well as investing in long-term educational programs designed for different consumer groups are crucial steps to bridge the knowledge gap. Moreover, these initiatives should work in synergy with economic and political interventions, enabling consumers to connect food consumption to environmental and health impacts, adjust their behaviors accordingly, and become more influential in shaping political decisions.

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