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The role of environmental and social sustainability attributes in food choices

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Extended Abstract

The agri-food supply chain is currently far from being sustainable due to its negative contribution to environmental degradation, climate change, public health and social equity. Individuals as consumers play a key role in favouring the transition towards a sustainable food system. Switching towards more sustainable food consumption patterns can trigger changes on the supply side and contribute to policy efforts aimed at pursuing sustainable development. From a global and European policy perspective, both the 2030 Agenda of the United Nations and the European Green Deal, in the form of the Farm to Fork strategy, address the achievement of a sustainable food system.

In this context, the aspects such as the drivers and barriers to sustainable consumption, consumer behaviour towards sustainable choices and how to effectively tackle unsustainable food habits have become paramount. As a result, a considerable strand of literature has focused on sustainable food choices. Nonetheless, several points remain unexplored: *i*) the extent to which environmental and social attributes, in the form of labels, are effective in promoting sustainable production and consumption patterns; *ii*) the decision-making process underlying sustainable attributes, and *iii*) the contribution of sustainable attributes relative to the other food attributes in driving sustainable food choices.

Favouring the transition towards a sustainable food system requires deeper knowledge of the role of sustainability attributes in triggering sustainable food choices among consumers.

Therefore, to fill the research gaps in the existing literature, this thesis aims to provide a better understanding of the effect of environmental and social sustainability attributes on food choices and investigate the decision-making process adopted by food consumers when choosing sustainable products.

The thesis is based on four research articles combining several quantitative methods. The first research article applies a systematic and meta-analytical approach to analyse the consumer willingness to pay (WTP) for environmental and social sustainability labels provided in scientific literature. The study aims to disentangle the effect of the different kinds of information underlying the label on the WTP while controlling for methodological variability across the case studies. To date, this is the most extensive meta-analysis on WTP regarding sustainability attributes, with 131 articles, and the only one that looks at the WTP

across labels according to their breadth of formulation, sustainability dimension and specific category of information. The study reveals that the premium price for sustainability in food products varies considerably depending on the type of information disclosed to the consumers. Social and ethical aspects are less likely to be considered than environmental-related issues in public opinion. Not all sustainability facets are considered equally important among consumers at the point of purchase, although there is a growing concern for sustainability issues. Additionally, the study demonstrates that referring to the overarching category of sustainability labels is misleading since the topic is extremely complex and the heterogeneity in the WTP depends on the type of information provided to the consumers.

The second research article implements a discrete choice experiment to investigate preferences for social sustainability labelling in the case where the ethical issue recalled by the label is of concern among consumers. The study aimed to explore the potential demand for a fair labour label that certifies the wine was produced through the fair treatment of workers in Italy, where the exploitation of migrant labour has become a preeminent social plague. The findings outlined the existence of a premium for the fair working conditions label in the Italian market, emphasising that social labelling is valued by consumers when the underlying ethical issue is familiar and close to them. Therefore, the study reveals that an overarching scheme on sustainability tackling unfair labour condition in agriculture would satisfy a potential market demand while promoting improvements in the protection of agriculture workers.

The third research article considers different decision paradigms, namely the traditional Random Utility Maximization and the more recent Random Regret Minimization, to untangle the behavioural mechanisms underlying the decision-making process that bring consumers to choose sustainable options. The utility maximization decision rule postulates that people are rational and choose to maximize their expected utility. The regret minimization approach, instead, assumes that individuals act to minimize their anticipated regret. Regret arises when a foregone option outperforms the chosen one. Applying a choice experiment, the study aims to investigate how food consumers relatively value the provision of different pro-environmental packaging alternatives while assessing which decision rule drives their choice behaviour. The study outlined that the preference patterns change depending on the decision rule adopted by consumers. Hence, the heterogeneity in consumer choices lies in at least two different dimensions: taste, but also behavioural mechanism.

Surprisingly, the majority of the sample adopted the regret minimization decision rule in their decision-making process substantiating that regret feelings underlies most of sustainable food choices. Therefore, evaluating all decision-makers and their choices as only driven by utility considerations can lead to a partial understanding of the phenomenon.

The fourth article is grounded on the food value framework and investigates how the product attributes asset influence the final choice for sustainable food. The study aims to assess the most important attributes to consumers when it comes to sustainable food choices and provides a market segmentation based on the attributes' relative preferences in the product purchase decision. A cross-national investigation was conducted among Danish and Italian consumers to implement a Best-Worst Scaling method. The findings indicate that the drivers of sustainable food choices relate more to self-centred values, i.e. private attributes, rather than society-centred values, i.e. public attributes. Three distinct consumer segments are based on different preference patterns for their purchase decisions: the first group favouring Price, Taste and Appearance values (the "private benefit seekers"); the second one prioritizing sustainability-related values, namely Environmental Impact, Fairness and Animal Welfare (the "sustainability focused"); and the last one attaching higher importance to Naturalness and Healthiness (the "naturalness and health driven"). The second and the third consumer segments were found to share the same profile in term of sustainability-related self-identities. Therefore, raising-awareness and information campaigns aimed to promote sustainable and healthy dietary patterns can be combined to strengthen their effectiveness since they apply to consumers who share a similar profile in terms of self-identities.

Overall, the thesis provides an overview of consumers' preferences for sustainability attributes and behavioural insights that can be useful to design sustainable policy and marketing strategies. Labelling was found to promote informed choices and enhance the demand for more sustainable alternatives in the case of already established preferences or in the case of proximity and familiarity with the issue underlying the label. Since not all facets are equally important across consumers, food labelling should be addressed as a part of the policy tool belt rather than the main instrument to achieve a "completely sustainable" food system, namely an agri-food chain which contributes to all the different pillars in a balanced manner. Policy and marketing instruments should be tailored according to the different consumer segments and their privileged attributes when making sustainable food choices, to

be complementary rather than selective in their coordinated actions aimed to encourage sustainable consumption patterns. The current work advances the scientific debate on food labelling stressing that generally referring or concluding on “sustainability labels” may be misleading as the field is extremely complex, heterogeneous and multifaceted. Moreover, other perspectives, not simply limit to utility maximization, needs to be taken into account to fully comprehend the decision-making process of consumers for sustainable food choices.

Keywords: Systematic review, Meta-regression, Sustainable food choices, Ethical consumption, Food label; Sustainability label, Fair working conditions; Food values, Choice experiment; Random Regret Minimization, Hybrid latent class; Pro-environmental behaviour, Best-Worst Scaling, Self-Identity.

Table of Contents

List of research articles

The thesis is based on the following research articles:

1. Piracci, G., Lamonaca, E., Santeramo, F. G., Boncinelli, F.*, & Casini, L. *Environmental and social issues not equally matter: A meta-analysis for food labelling*.

2. Piracci, G.*, Boncinelli, F., & Casini, L. *Wine consumers' demand for social sustainability labeling: Evidence for the fair labor claim*.

3. Piracci, G., Boncinelli, F.*, & Casini, L. *Investigating consumer preferences for sustainable packaging through a different behavioural approach: A Random Regret Minimization application.*

4. Piracci, G.*, Casini, L., Contini, C., Stancu, C. M., Lähteenmäki L. *Which attribute is the most important in sustainable food choices? An analysis using the Food Value framework.*

I INTRODUCTION

General introduction

Individuals as consumers play a key role in favouring the transition towards a sustainable food system. Switching towards more sustainable eating patterns can trigger changes on the supply side as well as align, thus contribute, to policy efforts aimed to pursue sustainable development. A food system can be deemed as sustainable if it "delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised" (p. 1, FAO, 2018). From a global and European policy perspectives, the achievement of a sustainable food system is of primary importance, as outlined both in the 2030 Agenda (United Nations, 2015) and the European Green Deal, in the form of the Farm to Fork strategy (European Commission, 2020).

With respect to the FAO definition, the agri-food supply chain is currently far from being sustainable due to its negative contribution to environmental degradation, pollution, climate change, public health and social equity (Reisch et al., 2013; SAPEA, 2020). Agri-food productions generate, among others, 18 Gt CO_2 equivalent annually and account for about one-third of the world's total greenhouse gas (GHG) emissions (Crippa et al., 2021). About 80% of the world's extremely poor population is concentrated in rural areas and depends on agricultural activities for their livelihood (FAO, 2017; de La O Campos et al., 2018). Furthermore, agricultural work is characterised by seasonality and uncertainty. There are often reports of labour rights infringements and the exploitation of workers in the agricultural sector (Hunt, 2014). These points further emphasise the urgent need to tackle sustainable development challenges in the agri-food domain (Aschemann-Witzel et al., 2019), thereby leading to significant changes in the current human activities to tackle unsustainable production and consumption patterns (Alfredsson et al., 2018).

Food consumers have shown increased concern towards the previously stated aspects, resulting in a growing interest in sustainable food production and consumption (Grunert et al., 2014; Annunziata et al., 2019). This increasing involvement affected the potential impact of sustainability considerations on consumer decision-making processes, and the potential role of sustainability as a product attribute in the evaluation of food products (Vermeir & Verbeke, 2008). As a result, in the last decades, food producers and retailers have extended their supply by adding specific food attributes which can be referred to as sustainability

attributes (Van Loo et al., 2015; Annunziata et al., 2019; Bangsa & Schlegelmilch, 2020). The concept of sustainability was first introduced by the Brundtland Report in 1987. The report defines sustainable development as the "development that meets the needs of the present generation without compromising the ability of future generations to meet their needs" (WCED, 1987). The economic, environmental, and social pillars are the three recognized essential dimensions of the sustainability concept (Elkington, 1997). In the current thesis, instead, the term "sustainable" with respect to food attributes encompasses only the environmental and social spheres, in line with other studies (see, among the others, Grunert et al., 2014; Janßen & Langen, 2017; Van Loo et al., 2017; Asioli et al., 2020; Bangsa & Schlegelmilch, 2020). In other words, food characteristics are deemed as sustainable if implying the production of positive externalities for the whole society, such as environmental benefits or ethical and social outcomes. Food attributes incorporating private gains, e.g., health or nutritional aspects, were excluded from the category. The assumption is that sustainability attributes differentiate products according to non-use characteristics (public attributes), while healthy, taste or nutritional attributes relate to the individuals' direct use of the food (private attributes), consistently with previous authors (see, for instance, Teisl & Roe, 1998; Lusk & Briggeman, 2009).

Sustainability attributes can be very heterogeneous, addressing one or more sustainability aspects and configure as credence attributes, i.e., consumers cannot assess them through search, experience or even after having the product tested (Nelson, 1970; Darby & Karni, 1973; Caswell & Mojduszka, 1996). The most commonly recruited communication tools include labels, and claims, despite sustainable features may also be signalled through point-of-purchase information, narrative claims, advertising, commercials, media coverage, or corporate websites (Du et al., 2010; Bangsa & Schlegelmilch, 2020).

The following sections will deepen the aspects of sustainability labelling and sustainable food choice behaviour to provide the literature background of this thesis. Next, the main motivations and research questions that the thesis aims to address are provided. The chapter ends with a brief overview of the studies conducted to answer the research questions.

Sustainability labelling

In the last three decades, sustainability labelling has gained attention in the modern world, as emphasised by the policymakers' interests, the economic efforts of public and private actors to adhere to sustainability voluntary[1] standards, and the growing amount of scientific publications focusing on it (Asioli et al., 2020). The Ecolabel Index (2022) currently tracks 147 sustainability labels in the food domain worldwide. Janßen and Langen (2017) coined the phrase "the bunch of sustainability labels", whereas Torma and Thøgersen (2021) refer to "the sustainability labelling landscape" to depict the current situation. Indeed, existing sustainability labels can be extremely heterogeneous, and simultaneously, strictly intertwined. This mirrors the underlying concept, i.e. sustainability, which is primarily a complex and multidimensional issue. So far, no common definition or official classification has been proposed for sustainability labelling, resulting in ambiguity and confusion about what can or cannot be recognised as such.

As a communication tool, sustainability labelling carries out multiple functions. Firstly, these claims[2] allow consumers to differentiate between conventional products and foods obtained in compliance with ethical and environmental standards, thereby enabling them to make informed decisions (Grunert et al., 2014), and also allow them to take into account the environmental and social impacts of their food choices (Van Loo et al., 2017). Given their communicative function, sustainability labels can also be seen as a means to reduce information asymmetries (Akerlof, 1978) between producers and consumers (Teisl & Roe, 1998).

Secondly, labels represent a distinctive symbol that signals to consumers certain product features or distinguishable production methods (de Boer, 2003). Therefore, sustainability labels enable the establishment of product differentiation, both across and within the food category (de Boer, 2003; Thøgersen et al., 2010), consequently creating the potential for a premium price. Indeed, in the last three decades, the proliferation of voluntary sustainability schemes can be interpreted as a sign of success. Thus, labelling acts as a stimulus for the adoption of more sustainable competitive strategies for companies that do not want to lose

[1] The current analysis is focused on labels associated with environmental and social standards not legally imposed but adopted on a voluntary basis, e.g., Organic, Fairtrade, Rainforest Alliance or Animal Welfare certifications. Compliance with the standard is certified upon verification by an independent third party.

[2] In the present work, the words labels and claims are used as synonyms.

market shares (Vecchio & Annunziata, 2015). Nevertheless, switching from conventional to sustainability-labelled products increases the production costs (labelling, adhesion to the voluntary programme, certifying authority). Therefore, when deciding on the adoption of sustainability labels, reaching a price premium is a prerequisite for producers and retailers in order to maintain profitability. Against this background, assessing the consumer willingness to pay (WTP) for sustainability labelling becomes crucial for the effective implementation of this tool to promote sustainable production and consumption patterns. This is the reason the WTP constitutes one of the main outcomes of interest of this thesis work.

Lastly, sustainability labels represent one of the promising "soft approach" policy instruments aimed at encouraging voluntary changes towards more sustainable consumption patterns (OECD, 2001; Hoogland et al., 2007; European Commission, 2012; Reisch et al., 2013; Garnett et al., 2015; Noblet & Teisl, 2015; Van Loo et al., 2017). In this regard, one of the priority objectives stated by the European Commission (2012) is to foster sustainability and healthy food consumption patterns through information provision and awareness-raising tools. These include consumer educational campaigns, implementation of sustainability labelling provision, advertising, and marketing strategies, printed materials and websites, and other information-based tools (European Commission, 2012). The new Farm to Fork (F2F) Strategy indeed, points in this direction (European Commission, 2020). The F2F is a part of the European Green Deal policy aimed at guiding the alignment with the 2030 Agenda and the achievement of the Sustainable Development Goals (SDG) (United Nations, 2015). The strategy comprises the proposal for the implementation of a harmonised sustainable food labelling framework at the European level that embraces the nutritional, climatic, environmental and social aspects of food production. The so-called soft policy approaches, i.e. policies supporting informed choices, tend to be preferred by policymakers over hard policy measures, i.e. policies targeting the market environment, such as fiscal measures, regulations, and mandatory standards (Noblet & Teisl, 2015).

Consumer preferences for sustainability labels have been widely investigated. Consumer choice behaviour for organic labels has received large scientific attention (Aprile et al., 2012; Schäufele & Hamm, 2018) but also other environmental labels such as the food miles (Akaichi et al., 2017; Caputo et al., 2013), the carbon footprint (Van Loo et al., 2015), the water footprint (Grebitus et al., 2016), the biodiversity protection (Bazzani et al., 2020) and

GHG management (Tait et al., 2019). Even if to a lesser extent, social labels have also been considered, mainly in the form of the Fairtrade label (Onozaka & McFadden, 2011; Van Loo et al., 2015) and the animal welfare certifications (Grunert et al., 2018). However, articles tend to focus on specific sustainability labels and selected product categories, thus it is difficult to derive overall conclusions or evidence on food sustainability labelling (Grunert et al., 2014).

Sustainable food choice behaviour

A growing body of research has been focusing on preferences and drivers for sustainable food consumption. Consumer sustainable choice behaviours have been traditionally investigated under the utility maximization paradigm, which postulates that people are rational and choose to maximize their expected utility. Nevertheless, behavioural economics and psychology drew attention to systematic deviations from purely rational behaviours (see, for instance, Simon, 1955; Kahneman & Tversky, 1979; Thaler, 2015). Since then, different behavioural paradigms departing from utility maximization have been implemented to capture the cognitive aspects left out of this classic framework. However, which decision rule among those drives sustainable food choices has never been addressed so far in the literature.

Concerning the drivers of sustainable food choices, many studies underline the importance of product familiarity and trust towards sustainability attributes (De Pelsmacker et al., 2005; Krystallis & Chryssohoidis, 2005). Several works showed that the acceptance of sustainable products can be positively influenced by consumers' knowledge, environmental concerns, involvement and previous purchase experiences (Cannoosamy et al., 2014; Liu et al., 2017; Van Loo et al., 2017). Indeed, consumers used to purchase ethical-labelled foods have higher premiums than inexperienced consumers and show higher perceived importance of social issues (Cao et al., 2021).

Considering the role of consumer personal characteristics, the meta-value of Self-Transcendence and Openness-to-Change were found to be positively related to consumer preferences for ethical attributes (Fitzsimmons and Cicia, 2018). As regards, the role of cultural worldviews, collectivist and egalitarian consumer types tend to be willing to pay considerably more for a label certifying fair wages to farmers, a purely public attribute, if

compared to the enhanced quality of the product, which is private (Hindsley et al., 2020). Onozaka and McFadden (2011) found that consumers who feel that their actions can play a role in improving sustainability tend to value sustainability attributes more. Indeed, a high level of Perceived Consumer Effectiveness motivates consumers to translate their positive attitudes towards sustainable products into actual behaviour (Vermeir & Verbeke, 2006). However, many studies' findings highlight that consumer concern and interest in sustainability issues do not necessarily translate into actual responsible choice behaviour (Vermeir & Verbeke, 2006; de Boer et al., 2007; Krystallis et al., 2009; de Barcellos et al., 2011; Moser, 2016), in literature this phenomenon is commonly referred to as the attitude-behaviour gap (Vermeir & Verbeke, 2006; Carrington et al., 2010; Bray et al., 2011).

Many context-related factors were also found to successfully encourage sustainable product choices. For example, information disclosure positively influences the choice and the WTP for sustainability attributes (Aoki et al., 2019; Klaiman et al., 2016; Rousseau & Vranken, 2013). However, information has a positive impact as long as consumers positively perceive the communication (i.e. credible and interesting). Conversely, exaggerated information (i.e. less credible) results in null or counterproductive effects (Uchida et al., 2014). Considering the marginal effects, the negative impact of wrong communication looms larger than the influence of positive information (Cao et al., 2021; Chen et al., 2015). This is easily explained by the fact that consumers have low levels of trust in unfamiliar sustainability claims (Janssen & Hamm, 2014) and sustainability signals in general (Chen et al., 2015). Since sustainability attributes are credence attributes provided by the producer side, consumers will favour the sustainable food product if they perceive the sustainability attribute to be truthful. Thus, the effectiveness of sustainability attributes is built upon the credibility of the institutions designated to cope with the information asymmetries (Rousseau & Vranken, 2013). Consistently, the preference for sustainable food is also a function of the consumers' perceived regulatory efficacy: it increases when the consumer is familiar with or believes and trusts the effectiveness of the food regulatory system underlying the sustainability attributes (Janssen & Hamm, 2012; Van Loo et al., 2014; Shahabi Ahangarkolaee & Gorton, 2021).

Moreover, raising-awareness instruments, such as the information provided through eco-labelling itself, appear to be able to strengthen only the existing preferences in choosing sustainable alternatives rather than inducing new ones. This was demonstrated by Zhou et

al. (2017); who also assessed that higher involvement in pro-environmental behaviours encourages eco-labelled food choices, confirming the spillover potential of engaging in green actions (Thøgersen & Noblet, 2012).

Among the raising-awareness tools, also behavioural interventions, e.g., green nudges, can push consumers towards making more sustainable eating choices (Van Loo et al., 2017; Reisch, 2021). According to Schubert (2017), sustainability labelling itself can be classified as a subset of green nudges aimed at fostering responsible behaviours by leveraging on individuals' salience heuristics.

Other than consumer characteristics and situational factors, product-related factors (e.g., the other product attributes) may affect preferences for sustainable foods. Many studies have reported that in different purchasing contexts and product categories, consumers do not consider sustainability attributes as the most valuable (Momberg et al., 2012; Van Loo et al., 2015). For instance, price, convenience, ingredients, and brand resulted to be more influential in the decision-making process (Meijboom & Brom, 2012). As sustainability attributes are traded off against other product characteristics such as price, taste, convenience, brand, origin, health-related aspects, and even other kinds of sustainability claims (Onozaka & McFadden, 2011; Gracia et al., 2014; Onozaka et al., 2016), the product attributes asset influences the final choice for sustainable food (Bangsa & Schlegelmilch, 2020). However, how consumers relatively value sustainability attributes and the other food attributes has received scarce attention in research so far.

Motivation and research objectives

As pointed out in the previous literature review, a nourished strand of literature focuses on sustainable food consumption. Nonetheless, several points remain unexplored.

First, the shift towards a fairer food system is constrained by the correction of market failures in that food products are primarily marketable goods. The failure lies in the lack of economic compensation for the provision of environmental and social positive externalities. SLs, as market-based tools, can contribute to amending this pecuniary mismatch by inducing consumers to pay a premium price for sustainability labelling attributes, thus remunerating the supply of public goods (Walter, 2020; Blandon & Ishihara, 2021). Nonetheless, sustainability labels can be effective in this sense only if the actual consumer WTP is

observed. Moreover, assessing the WTP for food attributes is an informative indicator of the acceptability of citizens of different sustainability practices (Clark et al., 2017). Results stemming from the literature on the premium price for sustainability labels are extremely heterogeneous due to the plethora of existing labels, in addition to the multiple facets of sustainability and the peculiarities of each case study (e.g. the methodology applied or the food category carrying the label). Therefore, it is not feasible to derive overall conclusions. Due to this reason, the extent to which environmental and social attributes, in the form of labels, are effective in promoting sustainable production and consumption patterns is still debatable.

Second, when referring to food products, the concept of sustainability is very often narrowed down to the environmental dimension while neglecting the social aspects. The evident disproportion between the social and environmental pillars might be because sustainability has been primarily defined under an ecological perspective and a conspicuous awareness of the current society is related to environmental degradation or climate change (Bangsa & Schlegelmilch, 2020). The essential requirement for the successful dissemination of sustainability schemes is that consumers are willing to pay a premium to cover the higher costs stemming from the implementation of these practices. However, the extent to which consumer is willing to pay more for the provision of social sustainability labelling has been scarcely investigated so far. The awareness and proximity to the underlying issue may affect consumers' reaction to the provision of social sustainability certification, however, this point remains unaddressed in research.

Third, the decision-making process underlying sustainable attributes is far from being obvious. Alternative to the classic Random Utility Maximization (RUM) behavioural paradigm, Chorus (2010) proposed the Random Regret Minimization (RRM) approach, the underlying assumption of which is that individuals act to minimize their anticipated regret. This mechanism relies on the anticipated emotion (i.e., regret) that may be experienced as a consequence of individual decision outcomes (Loomes & Sugden, 1982). Regret arises when a foregone option outperforms the chosen one according to one or more attributes. RRM models have never been used in the frame of sustainable food choices. In this situation, anticipated regret is suspected to afflict individual choices in a twofold manner. On the one hand, choosing the pro-environmental alternative may arise regret from the immediate benefits waived by discarding the anti-environmental alternative, e.g. the one with more

convenience features or lower price (Zhang et al., 2021). Conversely, deciding on the anti-environmental option may generate regret due to the loss in potential long-term benefits for the environment and social welfare from not engaging in an environmental-friendly choice (Zhang et al., 2021). Given these reasons, it can be expected that regret minimization plays a key role in the consumer decision-making process for sustainable foods, along with the well-established utility maximization paradigm.

Lastly, the contribution of sustainable attributes compared to the other food attributes in driving sustainable food choices has never yet been assessed. Generic food is primarily considered by consumers in terms of taste and price (Lusk & Briggeman, 2009), whereas, in the case of sustainable food products, it is expected that the environmental outcomes and social or ethical impacts of food production would be the most relevant attributes for their purchase decisions. Conversely, in the literature, individuals were found to associate sustainability with healthy eating, traditional foods, and nourishment (Barone et al., 2020). In the study by Stancu et al. (2020), the taste was found to be one of the most important external motivations in driving sustainable food behaviour in the buying phase. Moreover, previous research underlined the existence of a close connection between consumer perceptions of health issues and sustainability when it comes to diets (Van Loo et al., 2017). However, little is known about how food attributes asset affect preferences for sustainable foods, specifically, how the consumer trades off between the different attributes when making sustainable food choices is still unexplored.

These considerations have led to the following research questions in the present thesis.

RQ1. How do consumers value the different sustainability labels?

RQ2. What drives the heterogeneity in the WTP for sustainability labels?

RQ3. What is the effect of social labelling on consumer preferences, in the case of proximity and awareness of the issue underlying the label?

RQ4. Which behavioural mechanisms drive sustainable food choices?

RQ5. Which food attributes are the most important to consumers in sustainable food purchase decisions?

Table 1 gives an overview of the research questions of the thesis and how these were addressed through the research papers.

Table 1. Research design of the thesis.

Research questions	Study
RQ1. How do consumers value the different sustainability labels?	Study 1: Meta-regression analysis on consumer WTP for sustainability labels
RQ2. What drives the heterogeneity in the WTP for sustainability labels?	Study 1: Meta-regression analysis on consumer WTP for sustainability labels
RQ3. What is the effect of social labelling on consumer preferences, in the case of proximity and awareness of the issue underlying the label?	Study 2: Choice experiment on the introduction of a fair labour label in Italy
RQ4. Which behavioural mechanisms drive sustainable food choices?	Study 3: Choice experiment on pro-environmental packaging alternatives, considering both the RUM and RRM approaches
RQ5. Which food attributes are the most important to consumers in sustainable food purchase decisions?	Study 4: Best Worst Scaling applying the food value framework (Lusk & Briggeman, 2009)

Summary of research articles

The thesis is based on four research articles. This collection of studies is focused on social and environmental sustainability attributes and the decision-making process driving sustainable food choices. All the research required to meet the thesis' objectives and to investigate the research questions has been carried out by combining different quantitative procedures directly related to discrete choice analysis. Data are collected through a literature review process on choice experiment results (meta-data), proper choice experiments and best-worst scaling method. Table 2 provides an overview of the data sources used for the four research papers included in this dissertation. More detailed descriptions of the study samples and research methods are provided in each research paper. A summary of the studies is elaborated in the remainder of this section.

Table 2. Research design and data sources.

Application	Type of data	Sample	Methodology applied
Study 1:	Secondary data	Studies on the WTP for sustainability labels (n = 131)	Meta-regression analysis
Study 2:	Primary data (survey)	Italian consumers (n = 500)	Choice Experiment
Study 3:	Primary data (survey)	Italian consumers (n = 395)	Choice Experiment, including the RRM framework
Study 4:	Primary data (survey)	Danish and Italian consumers (n = 1000)	Best Worst Scaling

The first research article applies a systematic and meta-analytical approach to analyse the consumer WTP for environmental and social sustainability labels provided in scientific literature. The aim of the study is to disentangle the effect of the different kinds of information underlying the label on the WTP while controlling for methodological variability across the case studies. To date, this is the most extensive meta-analysis on WTP for sustainability attributes, with 131 articles, and the only one that looks at the WTP across labels according to their breadth of formulation, sustainability dimension and specific category of information. The study reveals that the premium price for sustainability in food products varies considerably depending on the type of information disclosed to the consumers. Social and ethical aspects are less likely to be considered than environmental-related issues in public opinion. Not all sustainability facets are considered equally important among consumers at the point of purchase, although there is a growing concern for sustainability issues. Therefore, market-based interventions, such as food labels, should be regarded as a part of the policy tool belt rather than the main instrument to develop a food system that contributes to all the different pillars of sustainability in a balanced manner. Additionally, the study demonstrates that referring to the overarching category of sustainability labels is misleading since the topic is extremely complex and the heterogeneity in the WTP depends on the type of information provided to the consumers.

The second research article implements a discrete choice experiment to investigate preferences for social sustainability labelling in the case where the ethical issue recalled by the label is of concern among consumers. The study was aimed to explore the potential demand for a fair labour label that certifies the wine was produced through the fair treatment

of workers in Italy, where the exploitation of migrant labour has become a preeminent social plague. The findings outlined the existence of a price premium for the fair working conditions label in the Italian market, emphasising that social labelling is valued by consumers when the underlying ethical issue is familiar and close to them. Therefore, the study reveals that an overarching scheme on sustainability tackling unfair labour condition in agriculture would satisfy a potential market demand while promoting improvements in the protection of agriculture workers.

The third research article considers different decision paradigms, namely the traditional RUM and the more recent RRM, to untangle the behavioural mechanisms underlying the decision-making process that bring consumers to choose sustainable options. The utility maximization decision rule postulates that people are rational and choose to maximize their expected utility. The regret minimization approach, instead, assumes that individuals act to minimize their anticipated regret. Regret arises when a foregone option outperforms the chosen one. Applying a choice experiment, the study aims to investigate how food consumers relatively value the provision of different pro-environmental packaging alternatives, namely the loose format and bioplastic packaging, while assessing which decision rule drives their choice behaviour. The study outlined that the preference patterns change depending on the decision rule adopted by consumers. Therefore, the heterogeneity in consumer choices lies in at least two different dimensions: taste, but also behavioural mechanism. Surprisingly, the majority of the sample adopted the regret minimization decision rule in the context in their decision-making process substantiating that regret feelings underlies most of sustainable food choices. Policymakers and marketers of food industries need to carefully consider the differences in the decision mechanism of consumers when implementing strategies to encourage pro-environmental consumption patterns. Notably, our findings elucidate on the importance to embrace other perspectives as well, and not simply limit to utility maximization, to fully comprehend the decision-making process of consumers for sustainable foods.

The **fourth research article** is grounded on the food value framework and investigates how the product attributes asset influence the final choice for sustainable food. The study aims to assess the most important attributes to consumers when it comes to sustainable food choices

and provides a market segmentation based on the attributes' relative preferences in the product purchase decision. A cross-national investigation was conducted among Danish and Italian consumers to implement a Best-Worst Scaling method. The findings indicate that the drivers of sustainable food choices relate more to self-centred values, i.e. private attributes, rather than society-centred values, i.e. public attributes. Three distinct consumer segments are based on different preference patterns for their purchase decisions: the first group favouring Price, Taste and Appearance values (the 'private benefit seekers'); the second one prioritizing sustainability-related values, namely Environmental Impact, Fairness and Animal Welfare (the 'sustainability focused'); and the last one attaching higher importance to Naturalness and Healthiness (the 'naturalness and health driven'). The second and the third consumer segments were found to share the same profile in term of sustainability-related self-identities. Therefore, raising-awareness and information campaigns aimed to promote sustainable and healthy dietary patterns can be combined to strengthen their effectiveness since consumers interested in these aspects share a similar profile. The study emphasises the need for effective policy and marketing instruments to be tailored according to the different consumer segments and their privileged values, to be complementary rather than selective in their coordinated actions aimed to encourage sustainable food choices.

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II PAPERS

Research article 1. Environmental and social issues not equally matter: A meta-analysis for food labelling

Abstract

Sustainability labelling is an extremely complex, multifaceted and debated topic. Through a systematic and meta-analytical approach, we disentangled the informative content of environmental and social labels on food products. We found large heterogeneity in premium prices for sustainability labels, depending on the information disclosed. Generally referring to "sustainability" may be misleading: not all facets are considered equally important across consumers. The policy interventions should combine hard and soft measures to achieve both environmental and social sustainability in the food system.

Keywords: Systematic review, Meta-regression, Sustainable food choices, Ethical consumption, Animal welfare.

Introduction

The plethora of existing Sustainability Labels (SLs) signals a growing interest from both the supply and demand sides towards sustainability issues (Asioli et al., 2020). The Ecolabel Index (2022) tracks 147 food SLs worldwide. According to the Retail Forum for Sustainability (2011), labelling can address sustainability as either a holistic concept[3] or by separately considering its pillars, i.e. the environmental and social dimensions[4]. Environmental sustainability covers any action aimed at protecting and preserving the

[3] The concept of sustainability was first introduced by the Brundtland Report in 1987. The report was centred on the definition of sustainable development as the "development that meets the needs of the present generation without compromising the ability of future generations to meet their needs" (WCED, 1987).

[4] The economic, environmental, and social pillars are the three recognized essential dimensions of the sustainability concept (Elkington, 1997). However, our study acknowledges that sustainability attributes of products can be expressed only through the environmental and social axes, in line with previous works (Grunert et al., 2014; Janßen & Langen, 2017; Asioli et al., 2020; Bangsa & Schlegelmilch, 2020). This choice is due to the fact that what can be included in the economic dimension of sustainability labels is still controversial. We assume that the economic sense of the labels relies on the profitability of the instrument and, thus, on the capability of the attribute to generate a premium price to compensate for the sustainability practices implemented on the producer side.

environment, whereas social sustainability relates to the needs and well-being of individuals (Retail Forum for Sustainability, 2011).

As for the labels which incorporate the environmental dimension of sustainability, the global organic market was estimated at €106 billion in 2019 (Willer et al., 2021). The world sales of seafood products, as certified by the Marine Stewardship Council[5] (MSC), reached more than US$10 billion during the biennial period 2019–2020 (MSC, 2020). Furthermore, between 2010 and 2018, the sales revenue for foods labelled Fairtrade, the most popular certification among the social ones, grew by 124%, while the premium prices increased by 267% (Bhavsar et al., 2021).

Notwithstanding this, the agri-food supply chain is still far from being sustainable, mainly because of its conspicuous contribution to environmental degradation, pollution and climate change, and its negative impact on public health and social equity (Reisch et al., 2013; SAPEA, 2020). These points emphasise the urgent need to tackle the sustainable development challenges (Aschemann-Witzel et al., 2019), as emphasized by the 2030 Agenda on Sustainable Development Goals (United Nations, 2015).

The switch towards a fairer food chain is constrained by the correction of market failures in that food products are primarily marketable goods (SAPEA, 2020). The failure lies in the lack of economic compensation for the provision of environmental and social positive externalities. SLs, as market-based tools, can contribute to amending this pecuniary mismatch by inducing consumers to pay a premium price for sustainability labelling attributes (Walter, 2020; Blandon & Ishihara, 2021). Therefore, the premium for SLs can potentially cover the cost of the provision of environmental or social benefits related to the food production process, remunerating the supply of public goods (Bougherara & Combris, 2009). Nonetheless, SLs can be effective in this sense only if the actual consumer willingness to pay (WTP) can be detected.

A large body of research has been focusing on estimating the premium price for SLs. However, results stemming from this stream of literature are extremely heterogeneous due to the plethora of existing labels, the multiple facets of sustainability, and the peculiarities

[5] The MSC label, established in 1997, is one of the most important sustainable fisheries certifications worldwide. The aim of the programme is to encourage improvements in key issues related to sustainable seafood production, such as stock assessment, total allowable catch enforcement, proactive fisheries engagement in management and transparency and efficiency of fishing rights management (Lim et al., 2018).

of each case study (e.g. the methodology applied or the food category carrying the label). Therefore, it is not straightforward to derive overall conclusions.

Investigating the availability of a premium price for SLs can be crucial for the implementation of effective labels. Moreover, assessing the WTP for food attributes is an informative indicator of the acceptability of citizens for different sustainability practices (Clark et al., 2017).

We conducted a meta-analysis to: (*i*) systematise evidence on consumer preferences for SLs; (*ii*) evaluate consumer premium prices for sustainability labelling; and (*iii*) disentangle possible sources of heterogeneity in WTP estimates, possibly due to the types of SLs and the methodological differences.

Previous reviews and meta-analyses of consumer WTP provide a partial investigation of the sustainability-related issues, such as animal welfare (Lagerkvist & Hess, 2011; Clark et al., 2017), organic production (Katt & Meixner, 2020), carbon footprint (Rondoni & Grasso, 2021) and environmental impacts (Bastounis et al., 2021), or explored sustainability labelling of specific food categories, such as wine (Schäufele & Hamm, 2017). The studies lack of considerations on the relative importance of the different sustainability issues for consumers. A remarkable study is the paper by Li and Kallas (2021), who conducted a first pilot study with a meta-review on WTP for SLs on foods. Unlike this study, we assessed the heterogeneity in consumers' WTPs for SLs according to the label broadness (i.e. specific and generic information), the sustainability dimension underlying the label (i.e. environmental and social issues), the specific category of the label (i.e. environmental impact, production method, animal welfare, social fairness or sustainable production-related labels), and the economic value of the carrier food products (i.e. high-priced and low-priced foods). Our research expands the findings of Li and Kallas (2021) also in other ways. They use a sample of 80 studies (80 observations) including heterogeneous WTP-elicitation methods (e.g. choice experiments, contingent valuation methods, auctions and survey questions). Differently we have considered 110 scientific works, with multiple observations each (in total our sample consists of 648 observations), with the same experimental technique (i.e. choice experiments): our study is therefore larger and more controlled, both desirable characteristics that will lead to more reliable – internally and externally valid – findings. We provide the most extensive meta-analysis on WTP for sustainability attributes,

and the only one that looks at the WTP across labels according to their type, sustainability dimension and specific category of information.

Our analysis is also very relevant from a policy perspective. The European Farm to Fork (F2F) Strategy[6] proposes the implementation of a harmonised sustainable food labelling framework that embraces the nutritional, climatic, environmental and social aspects of food production (European Commission, 2020a). Therefore, communitarian sustainability labelling has been announced as one of the instruments of the European policy mix targeting the transition towards a more sustainable food system. Based on these premises, our findings are expected to outline remarkable insights concerning the implementation of a sustainability labelling scheme as an effective policy tool aimed at favouring the transition towards a sustainable food system, such as in the case of the European F2F Strategy.

Moreover, the multidimensionality and highly fragmented nature of sustainability imply that consumers may potentially trade off between different and specific sustainability aspects. Assessing the relative impact of the different sustainability concerns currently targeted by food labelling can be relevant to both policy and marketing strategies with regard to which sustainability issues can be proficiently addressed through food labelling and which ones, being less considered, need to be tackled through other types of information-provision actions.

Background

As a communication tool, sustainability labelling carries out numerous functions. First, it empowers consumers to distinguish foods produced in compliance with certain standards from conventional products. Consequently, consumers can make informed decisions, taking into account the environmental and social impacts of their food choices (Grunert et al., 2014; Van Loo et al., 2017). Second, SLs represent one of the soft-approach policy instruments aimed at encouraging voluntary changes towards more sustainable consumption patterns through information provision (Noblet & Teisl, 2015; Van Loo et al., 2017; European Commission, 2020b). In addition, communication through labelling can also mitigate the market barrier caused by information asymmetries between producers and consumers

[6] The F2F Strategy is one of the pillars of the European Green Deal policy, which aims to guide the alignment to the 2030 Agenda and the SDGs.

(Rousseau & Vranken, 2013). Finally, on the supply side, labels represent a distinctive symbol that signals to consumers certain product features or distinguishable characteristics of production methods (de Boer, 2003). Therefore, SLs enable producers to establish product differentiation, both across and within the food categories, and consequently allow for the creation of a potential premium price. However, such premium, as well as the market shares, for SLs can dramatically change depending on the food product (Ardeshiri & Rose, 2018; Dahlhausen et al., 2018), country of sale (Akaichi et al., 2020; Menozzi et al., 2020), origin (Lim, Hu, & Nayga, 2018), retailer (Asche et al., 2015) and, most importantly, type of SL (Van Loo et al., 2014; Janßen & Langen, 2017).

Existing SLs can be extremely heterogeneous and, at the same time, strictly intertwined. This mirrors the underlying concept itself, i.e. sustainability, which is primarily a complex and multidimensional issue. Janßen and Langen (2017) coined the phrase "the bunch of sustainability labels," whereas Torma and Thøgersen (2021) refer to "the sustainability labelling landscape" to depict the current situation. So far, no common definition or official classification has been proposed for SLs, resulting in ambiguity and confusion about what can or cannot be recognised as sustainability labelling. Therefore, we developed the following conceptual framework to classify the labels as the basis for our analysis.

Conceptual framework: A classification proposal

Applying the most basic criterion and drawing upon the study of Torma and Thøgersen (2021), labels can be distinguished according to their broadness, i.e. whether they are specifically formulated or generically formulated. Specific labelling addresses single and precise issues of sustainability (e.g. the organic or carbon footprint[7] labels); generic labelling[8] refers to the overarching concept of sustainability or, at least, to the overall

[7] Carbon footprint labelling was first introduced in the United Kingdom (UK) in 2007 and aimed to communicate the total amount of carbon dioxide emissions of a product (or other GHG emissions converted to carbon dioxide emissions) considering its entire life cycle. Currently, different types of carbon footprint labels exist worldwide (see, for an extensive review, Rondoni & Grasso, 2021).

[8] In their comprehensive review, Torma and Thøgersen (2021) address generic labelling with the phrase "meta-sustainability labelling". The term has been defined by Dendler (2014) as a scheme "that condenses existing product labels and other communication measures into an overarching sustainability message". It is worth pointing out that, although carrying the same prefix, this concept has nothing to do with the name of the methodology applied in the current study, i.e., meta-analysis.

environmental or social performance of the product (e.g. the sustainable product claim or the eco-friendly label).

The second partitioning rule is based on the sustainability dimensions (as per Grunert et al., 2014; Van Loo et al., 2014; Asioli et al., 2020). To this end, labels can be grouped as either environmental or social. The former pertains to the environmental dimension of sustainability and signals ecological issues such as pesticide level reduction (e.g. pesticide-free), GHG emissions (e.g. carbon footprint labelling), biodiversity protection (e.g. biodiversity friend) or the adoption of environmentally friendly production methods (e.g. the organic or biodynamic farming[9] certifications). On the other hand, social labels address ethical or moral aspects, such as concern for animal welfare (e.g. the "Certified Humane" or the free-range[10] label), the improvement of profit distribution in marginalised countries (e.g. the fairtrade label), concern for workers' conditions (e.g. the Social Accountability SA8000) or the endorsement of the food chain based on direct marketing (e.g. farmers' products or community-supported agriculture labels).

Additionally, SLs can simultaneously involve both environmental and social issues (Janßen & Langen, 2017; Bangsa & Schlegelmilch, 2020). The most vivid example in this group is the organic label when referring to animal-based foods, as it jointly addresses agriculture practices with lower environmental impacts and respect for animal welfare conditions (Janßen & Langen, 2017). Likewise, the Rainforest Alliance certification programme guarantees both the environmental protection of farms and forests and the promotion of workers' rights and communities' well-being (Ecolabel Index, 2022). The generic label sustainable product also pertains to this partitioning since the term sustainability may be interpreted in both directions.

Adding to the complexity, SLs can be further classified according to their basic scope of applicability and, thus, with respect to the information they provide. As a result, it is possible

[9] Biodynamic farming was conceived in 1924 by Dr Rudolf Steiner. The biodynamic method favours the use of specific herbal preparations to guide the decomposition processes in compost. All synthetic chemical pesticides, fertilisers and transgenic contamination are strictly avoided in biodynamic agriculture (Ecolabel Index, 2022). The associated label is Demeter Biodynamic.

[10] The free-range system is a poultry management system different from the conventional battery cage system. Depending on the regulatory institution (e.g. the European Commission or the United States Department of Agriculture), the free-range product must comply with specific requirements related to the poultry farming conditions, such as feed, stocking density, minimum age of slaughter, amount of area available per animal and access to open-air spaces.

to identify the following five macro-categories: (*i*) environmental impact; (*ii*) production method; (*iii*) animal welfare; (*iv*) social fairness; and (*v*) sustainable production. Labels in the first group aim to signal the specific environmental outcomes associated with food production (e.g. the reduced water usage, the pesticide-free or the eco-friendly labels). The information delivered to consumers is focused on the ecologically positive impact of the food. The second group of labels, i.e. the method of production, informs consumers that the food has been produced in compliance with specific sustainable production processes. The labels aim to communicate the food's production method and the associated regulatory framework. The well-established organic label belongs to this group and is the most important SL worldwide (Lernoud et al., 2018). Other remarkable examples are the MSC, the biodynamic and the Aquaculture Stewardship Council (ASC)[11] certifications. The third class is the animal welfare labelling, which addresses all kinds of information related to respect for livestock and poultry conditions (e.g. animal-friendly, free-range or grass-fed[12]). On the other hand, labels in the social fairness class aim to inform about specific facets of social sustainability directly connected to the enhancement of human conditions (e.g. fairtrade, workers' welfare or cause-related marketing[13]). Finally, the sustainable production labelling contains information targeting the overarching concept of sustainability without addressing any specific issue, such as the use of the terms "sustainable product" or "made from sustainable agriculture". The classification systems for SLs are summarised in Table 1.

[11] The Aquaculture Stewardship Council label comprises farm-level standards for aquaculture systems and seafood chains. The requirements concern, among others, the conservation of biodiversity, natural habitats and water resources, the responsible use of resources needed for aquaculture and the protection of fish health (Hinkes & Schulze-Ehlers, 2018).

[12] The grass-fed claim refers to animal-based products from livestock that have been fed only on grass rather than finished in a feedlot. The precise standards can differ depending on the regulatory institution. For instance, the American Grassfed Association (AGA) standards for the "Grassfed" label stipulate that animals must be fed a lifetime diet of forage, must be raised on pasture and not in confinement and must never be treated with hormones or antibiotics (Ecolabel Index, 2022).

[13] Labels focused on cause-related marketing aim to promote and signal products whose purchase leads to target-oriented donations through classical charity organisations or programmes (Langen, 2011). A few examples are "Wine for Life" and "Food for Life", two Italian initiatives run by the non-profit charity organisation Comunità di Sant'Egidio. The labels inform consumers that part of the money spent on the product purchase will be donated to combat the acquired immunodeficiency syndrome (AIDS) in Africa.

Table 1. Classifications of SLs according to different criteria.

Partitioning Criterion	Classes of SLs	Examples
Broadness of Formulation (*type*)	Specific	Organic, carbon footprint, fairtrade
	Generic	Sustainable product, eco-friendly, green food
Sustainability Dimension (*dimension*)	Environmental	Pesticide-free, biodiversity friend, biodynamic farming
	Social	Fairtrade, animal welfare, free-range
	Environmental and Social	Organic*, rainforest alliance
Scope and Information Provided (*category*)	Environmental Impact	Carbon footprint, water footprint, eco-friendly
	Production Method	Organic, Marine Stewardship Council, Aquaculture Stewardship Council
	Animal Welfare	Animal welfare, free-range, grass-fed
	Social Fairness	Fairtrade, workers' respect, cause-related marketing
	Sustainable Production	Sustainable product, made from sustainable agriculture

*If applied to animal-based foods.

We only considered food information related to the production of positive externalities for the whole society, such as the environmental benefits or ethical and social outcomes of the production process, for sustainability labelling. Food labelling pertaining or confounding to other consumption trends, most notably health or safety attributes (e.g. hormone-free or genetically-modified-organism-free indications) and origin information (e.g. region-of-origin, country-of-origin, protected designation of origin, protected geographical indication or food-miles indication), were not treated as SLs and hence, not included in our analysis. Such quality attributes incorporate private and self-gains for the individual, whereas SLs pertain to the public good dimension (Lusk et al., 2007; Asche et al., 2015)[14]. This is consistent with our research question as we aimed to determine if private market instruments, such as labelling, can help in fostering the provision of public goods in the agri-food chain. In addition, sustainable attributes (i.e. public attributes) differentiate food products

[14] The organic label was added to the analysis, even though several studies suggest that organic food purchase is also driven by consumer health (i.e., private concerns) (Magnusson et al., 2003; Schleenbecker & Hamm, 2013), besides the primary motivations related to environmental and animal welfare issues. However, it is the most extended sustainability standard in terms of area coverage and the one embracing the broadest range of agricultural products (Lernoud et al., 2018). For these reasons, organic production is deemed pivotal in the transition towards more sustainable dietary patterns (Aschemann-Witzel & Zielke, 2017), and we included the organic label in the study for a comprehensive analysis of the topic.

according to non-direct-use quality dimensions, whilst healthy, origin or nutritional attributes (i.e. private attributes) relate to the individual's direct use of the food (Teisl & Roe, 1998).

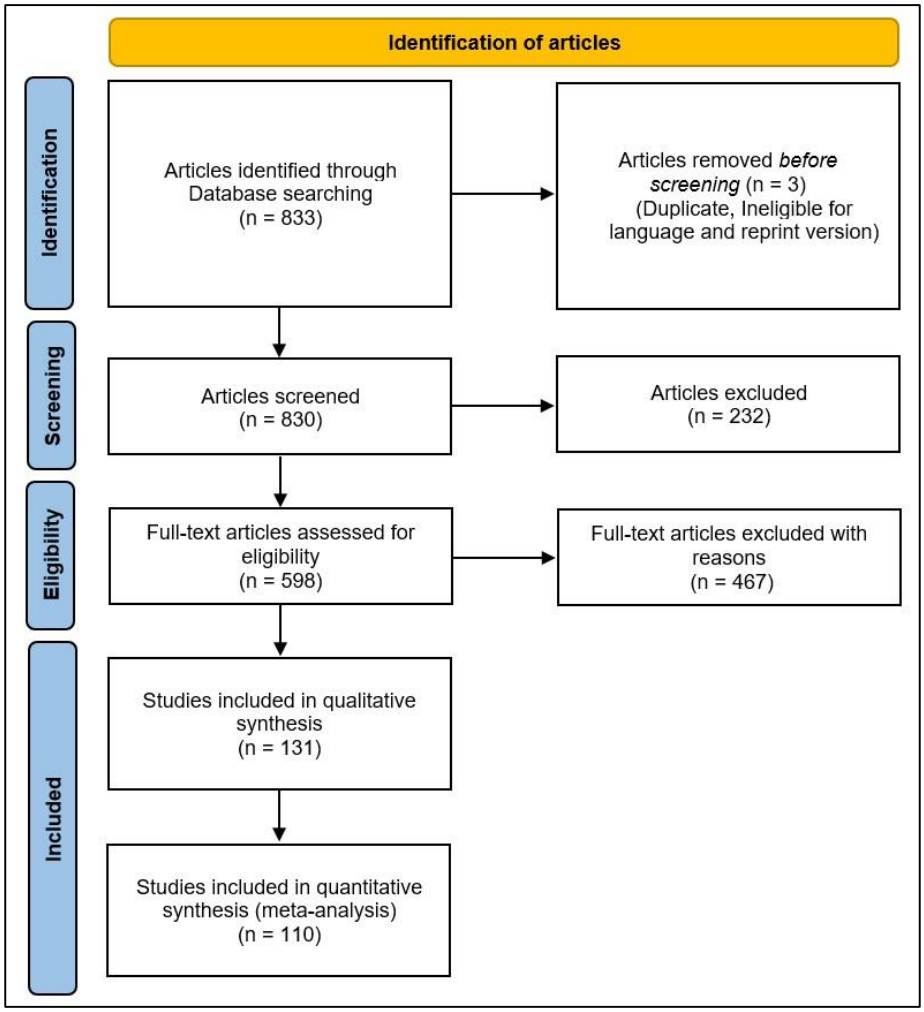
Methods

A meta-analytical approach, performed in accordance with the "Reporting guidelines for meta-analysis in economics" (Havránek et al., 2020), allowed us to combine and quantitatively synthesise empirical evidence from different studies on consumer WTP for SLs while seeking to identify heterogeneity sources among results (e.g. Stanley, 2001; Stanley et al., 2013).

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) protocol (Moher et al., 2009) presented in Figure 1, we carried out a systematic review of consumer studies focusing on SLs, published in the Scopus database. The search strategy, including the keywords used, is detailed in Appendix A. The eligibility of each article was assessed according to three general inclusion criteria. First, the work must be focused on consumer preferences for SLs on food products. Second, the aim of the work must be to elicit consumer WTP by applying the choice experiment method. Third, the results must report the complete set of estimated coefficients from the model. The first criterion restricted the analysis to food products and allowed us to focus on consumer acceptance of sustainability attributes[15]. The second criterion permitted the selection of homogeneous studies according to the elicitation method applied for the WTP estimates. Previous meta-analyses (e.g. Clark et al., 2017; Printezis et al., 2019) conclude that different experimental techniques can provide significantly different WTP measures. Therefore, we narrowed it down to the most used technique. Finally, thanks to the third criterion, we were able to construct a measure of consumers' WTP that was consistent across studies, which ultimately enabled a more robust comparison between the literature findings. From 833 articles, we selected 131 eligible studies satisfying all three inclusion criteria (Figure 1).

[15] We did not restrict eligibility to empirical work. Studies focusing on methodological issues of discrete choice modelling (such as Bello & Abdulai, 2016; Olsen & Meyerhoff, 2017; Caputo et al., 2018), which satisfied all three inclusion criteria, were equally considered.

Figure 1. The PRISMA flow diagram.



From the selected studies, along with each food product reference price[16], we collected the parameters of the SL attribute and the price attribute with related standard errors (or t-statistics) estimated through discrete choice models. The former measures the consumer's marginal utility for the SL presence on the food, while the latter measures the consumer's marginal utility for the price of the food. We retrieved 1,287 observations due to the different types of SLs included per study. Moreover, in case they were multiple, we collected all the estimates for the SL parameter available in the article to account for the complete literature

[16] The reference price denotes the actual market price for the conventional food under investigation reported in each article. In case a reference price was not given, we averaged the price levels applied in the choice experiment, as per Lusk et al. (2005) and Santeramo and Lamonaca (2021).

evidence rather than selecting a privileged model specification (Stanley, 2001; Santeramo & Lamonaca, 2019). In this phase, we preliminarily checked for the presence of publication selection bias using the funnel plot technique. The results are reported in Appendix B. The analysis revealed that publication selection bias was not an issue in our sample.

Building upon the study by Santeramo and Lamonaca (2021), we derived a common and comparable metric of the consumer's WTP for SLs across studies. The WTP index ($Index_{WTP}$) was computed as the percentage variation in the total WTP for the product due to the presence of the label:

$$Index_{WTP} = \frac{\frac{\beta_{label}}{-\alpha_{price}}}{P_{ref}} \quad (1)$$

As models for discrete choices are linear in the utility functions, we took the negative ratio between the SL attribute parameter, β_{label}, and the price attribute parameter, α_{price}, to calculate the negative marginal rate of substitution between the two respective attributes. The marginal rate of substitution indicates the extent to which the consumer is willing to trade one attribute for another, keeping the utility constant. When at least one attribute is measured in monetary units, the (negative) ratio of the two parameters will provide the financial measure of the consumer's WTP for the non-monetary attribute[17] (Louviere et al., 2000; Hensher et al., 2015). The WTP obtained is robust under the assumption that the marginal utility of the price attribute of the model is negative and significant, in accordance with the economic theory. For this reason, we excluded from the sample all the observations with positive and non-significant estimates for the price parameter (126 observations). Afterwards, we normalised the measures of the WTP for SLs across articles using the reference price for the product[18], P_{ref}, in line with previous meta-regression analyses on food attributes (Lusk et al., 2005; Dolgopolova & Teuber, 2018).

[17] In case the estimates belonged to a model specified in WTP space, we treated the estimated coefficient of the SL as the WTP itself: $WTP_{\text{label}} = \beta_{\text{k}}$. Models in WTP space are reparametrised such that the coefficients enter the model already scaled by the price/scale parameter. Thus, they can directly be interpreted as the marginal WTP values for the non-monetary attributes (Train & Weeks, 2005; Scarpa et al., 2008).

[18] At this stage, we removed one article (Xu et al., 2018) because no reference price for the food was available in the study, and, thus, it was not possible to compute the WTP index.

The normalisation cancels out any difference in currencies, timing and units of measure across studies. As a result, the WTP index was chosen as our effect size for the meta-regression analysis since it allows the comparison of diverse studies on the same dimensionless scale (Stanley, 2001). A detailed analysis of the WTP index is reported in Appendix C, including the complete list of articles for the quantitative analysis (Table C3).
To investigate possible drivers of heterogeneity in consumer WTP for SLs, we estimated the following meta-regression model:

$$Index_{WTP} = \lambda + \varphi X + \rho K + \omega Z + \psi T + \varepsilon \quad (2)$$

where $Index_{WTP}$ is the vector of the observations for the dependent variable; λ is the vector of constant terms proxying the average premium price for SLs; φ, ρ, ω, and ψ are the parameters to be estimated; and ε is the vector of error terms which are assumed to be independently and identically distributed.
The matrix *X* contains variables related to the labels. The model in equation (2) is estimated in three specifications. First, we tested for the broadness of formulation (i.e. specific *versus* generic) of SLs. This specification includes a single variable related to SLs: a dummy equal to 1 for specific SLs and 0 otherwise. Second, we controlled for the sustainability dimension underlying the label (i.e. environmental, social, and environmental and social). In this case, the matrix *X* includes a dummy for environmental SLs and a dummy for SLs addressing both environmental and social issues (the social dimension of sustainability is treated as the baseline). Third, we disentangled the contribution of the scope and principal information provided to consumers through SLs. This specification includes dummies for labels providing information on environmental impacts, production methods, animal welfare and social fairness (labels on sustainable production are the baseline). In addition, we also estimated the third specification while discriminating between high-priced and low-priced food products. The product classification was operated considering the reference price of the product with respect to the average reference price by currency. We incorporated a control factor in each specification to consider whether the label was existent rather than potential, i.e. fictitiously implemented in the research just for the sake of the choice experiment.

The matrix of moderator variables related to the structural characteristics of the studies in the sample, *K*, includes the food category of the product carrying the label, the quantity of food, the region of the study (i.e. continents) and the sampled population (e.g. consumers and purchasers). Foods were grouped according to the Harmonised System nomenclature[19]. The quantity of food was specified as high or normal relative to the mean quantities per food retrieved from the studies (e.g. 200 g was classified as normal, whereas 1 kg was considered as high in relation to meat products; likewise, 1 L was classified as normal, whilst 1 gallon was considered as high in relation to milk). This regressor allowed us to capture the variability within food categories.

The matrix *Z* includes moderator variables related to the technical and methodological issues of the choice experiments, i.e. the experiment set-up (e.g. face-to-face interview, online survey and field and lab experiment), the experimental design applied (e.g. orthogonal, optimal orthogonal in the difference, efficient and Bayesian efficient), the number of presented food alternatives in each choice set and the number of total attributes describing the alternatives. We added to the empirical specification the set of variables related to the publication process (*T*) to discriminate between articles published before and after the years 2012 and 2018[20], the journal ranking according to the Scimago Journal & Country Rank (SJR) at the date of publication and the subject areas of the journal.

The main dependent and independent variables are described in Table 2

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[19] The Commodity Description and Coding System, commonly referred to as the Harmonised System, is an international nomenclature applied to classify traded products.

[20] The years 2012 and 2018 have been used as threshold years of publication because they represent the 20th and 80th percentiles of the distribution of the articles in the sample (Appendix C, Figure C2).

Table 2. Description and summary statistics of the variables included in the model.

Variables	Type	Description	Mean	Std. Dev.
Effect measure				
WTP Index	Continuous	Percent variation in the willingness to pay associated with the presence of the SL. Range [-0.94; 5.47]	0.27	0.44
Label-related information				
Specific	Dummy	1 if the label is specific, 0 if generic	0.93	0.26
Environmental	Dummy	1 if the label is related to the environmental dimension of sustainability, 0 otherwise	0.50	0.50
Social[a]	Dummy	1 if the label is related to the social dimension of sustainability, 0 otherwise	0.28	0.45
Environmental and Social	Dummy	1 if the label is related to both the environmental and social dimensions of sustainability, 0 otherwise	0.22	0.41
Environmental Impact	Dummy	1 if the label informs about the environmental impacts of the product, 0 otherwise	0.17	0.38
Production Method	Dummy	1 if the label informs about the production method of the product, 0 otherwise	0.51	0.50
Animal Welfare	Dummy	1 if the label informs about the animal welfare respect of the product, 0 otherwise	0.24	0.43
Social Fairness[a]	Dummy	1 if the label informs about the positive outcome on social fairness of the product, 0 otherwise	0.04	0.20
Sustainable Production	Dummy	1 if the label informs about the overall sustainability of the product, 0 otherwise	0.03	0.17
Potential Label	Dummy	1 if the label was fictitiously implemented for the study purposes, 0 if existing	0.30	0.46
Structural characteristics				
Beverages	Dummy	1 if the food belongs to the beverage category; 0 otherwise	0.02	0.15
Coffee	Dummy	1 if the food belongs to the coffee category; 0 otherwise	0.03	0.17
Dairy	Dummy	1 if the food belongs to the dairy category; 0 otherwise	0.04	0.19
Egg	Dummy	1 if the food belongs to the egg category; 0 otherwise	0.13	0.33
Fruit	Dummy	1 if the food belongs to the fruit category; 0 otherwise	0.14	0.35
Meat	Dummy	1 if the food belongs to the meat category; 0 otherwise	0.33	0.47
Seafood	Dummy	1 if the food belongs to the seafood category; 0 otherwise	0.06	0.24
Vegetable	Dummy	1 if the food belongs to the vegetable category; 0 otherwise	0.16	0.36
Baby food	Dummy	1 if the food belongs to the baby food category; 0 otherwise	0.03	0.16
Other categories[a,b]	Dummy	1 if the food belongs to the other less represented food categories; 0 otherwise	0.07	0.26
Food quantity	Dummy	1 if the food quantity is high; 0 if normal	0.44	0.50
Asia	Dummy	1 if the region of the study is Asia; 0 otherwise	0.09	0.28
Africa	Dummy	1 if the region of the study is Africa; 0 otherwise	0.02	0.13
Australia	Dummy	1 if the region of the study is Australia; 0 otherwise	0.02	0.16
Europe	Dummy	1 if the region of the study is Europe; 0 otherwise	0.57	0.50
North America[c]	Dummy	1 if the region of the study is North America; 0 otherwise	0.29	0.45

Variables	Type	Description	Mean	Std. Dev.
South America[a]	Dummy	1 if the region of the study is South America; 0 otherwise	0.01	0.11
Consumers	Dummy	1 if the sampled population in the study was consumers; 0 otherwise	0.14	0.35
Purchasers	Dummy	1 if the sampled population in the study was purchasers; 0 otherwise	0.53	0.50
Consumers & Purchasers	Dummy	1 if the sampled population in the study was consumers and purchasers; 0 otherwise	0.04	0.20
Residents	Dummy	1 if the sampled population in the study was residents; 0 otherwise	0.22	0.41
Academics[a]	Dummy	1 if the sampled population in the study was academics; 0 otherwise	0.01	
Methodological and technical issues				
Face-to-face interview	Dummy	1 if the choice experiment was administered through face-to-face interview; 0 otherwise	0.17	0.37
Online survey	Dummy	1 if the choice experiment was administered through online survey; 0 otherwise	0.60	0.49
Field experiment[c]	Dummy	1 if the choice experiment was administered through field experiment; 0 otherwise	0.20	0.40
Lab experiment[a]	Dummy	1 if the choice experiment was administered through laboratory experiment; 0 otherwise	0.03	0.17
Efficient design	Dummy	1 if the experimental design was efficient; 0 otherwise	0.33	0.47
OOD design	Dummy	1 if the experimental design was optimally orthogonal in the difference (OOD); 0 otherwise	0.15	0.35
Bayesian design	Dummy	1 if the experimental design was Bayesian efficient; 0 otherwise	0.15	0.35
Orthogonal design	Dummy	1 if the experimental design was orthogonal fractional factorial; 0 otherwise	0.26	0.44
Other designs[a]	Dummy	1 if the experimental design was fractional factorial, full factorial, random or saturated; 0 otherwise	0.08	0.28
Alternatives	Continuous	Total number of alternatives in the experimental design. Range [2; 8]	3.60	0.98
Attributes	Continuous	Total number of attributes included in the experimental design. Range [1; 12]	4.15	2.03
Publication process information				
Before 2012	Dummy	1 if the paper was published before 2012, 0 otherwise	0.10	0.30
Before 2018	Dummy	1 if the paper was published before 2018, 0 otherwise	0.62	0.49
Q1	Dummy	1 if the journal is in the 25th percentiles (Q1) of the SJR, 0 otherwise	0.47	0.50
Q2	Dummy	1 if the journal is in the 50th percentiles (Q2) of the SJR, 0 otherwise	0.47	0.50
Q3[a]	Dummy	1 if the journal is in the 75th percentiles (Q3) of the SJR, 0 otherwise	0.05	0.22
EEF	Dummy	1 if the subject area of the journal is Economics, Econometrics and Finance (EEF), 0 otherwise	0.75	0.43
ABS	Dummy	1 if the subject area of the journal is Agricultural and Biological Sciences (ABS), 0 otherwise	0.77	0.42
SS	Dummy	1 if the subject area of the journal is Social Sciences (SS), 0 otherwise	0.19	0.39

Notes: The mean for dummy variables represents the share of observations equal to 1. Std. Dev.: Standard Deviation. [a] set as the baseline in the model. [b] food categories with less than 10 observations, which are honey, chocolate, pizza, pasta and bread, flour and milling products, algae-based foods, oils and fats, jam, cereals and ready-to-eat meals. [c] dropped in the model due to multicollinearity.

The empirical relationship reported in (2) was estimated through a robust least square regression. To correct for heteroskedasticity, we assumed independence across studies and correlation among the observations within each study by applying a clustered structure of the error terms, as per Santeramo and Lamonaca (2021).

Meta-regression Results

The estimates reported in Table 3 show the effect of SLs on the WTP index, highlighting the contribution of specific SLs as compared to generic SLs (specification i); of labels covering the environmental dimension of sustainability with respect to the social dimension (specification ii); and of four categories of SLs, namely labels providing information on environmental impacts, production methods, animal welfare and sustainability of products, with respect to labels on social fairness (specification iii)[21]. When statistically significant, coefficients estimated for SLs were positive, indicating that information on sustainability positively influences the premium price of products with SLs. In a sensitivity analysis, specifications (i)–(iii) were estimated by including progressively different combinations of control factors[22], and the resulting evidence is consistent with the results of Table 3.

[21] In a sensitivity analysis (Appendix D, Table D1), we control for labels covering the social dimension of sustainability in the specification (ii). As described in Table 1, we considered five categories of SLs: environmental impact, production methods, animal welfare, social fairness and sustainable products. In Table 3, social fairness is the base category. Specification (iii) is estimated by alternatively using environmental impact, production methods, animal welfare and sustainable products as base categories (Appendix D, Table D1).

[22] The results omitted for brevity are reported in Appendix D, Tables D2 to D4.

Table 3. Meta-regression results.

Variables	Type (i)	Dimension (ii)	Category (iii)
Specific	0.04		
	[0.38]		
Environmental Dimension		0.19*	
		[1.84]	
Both Dimensions		0.15*	
		[1.75]	
Environmental Impact			0.29*
			[1.70]
Production Method			0.30*
			[1.91]
Animal Welfare			0.15
			[1.07]
Sustainable Production			0.25
			[1.22]
Constant	0.77*	0.60	0.53
	[1.74]	[1.51]	[1.24]
Observations	648	648	648
R-squared	0.19	0.20	0.21

Notes: Ordinary Least Square (OLS) estimation of equation (2). The dependent variable is the index of willingness to pay (WTP) associated with the presence of the sustainability labels (SLs). The control factors (variables for structural characteristics, methodological and technical issues, publication process information) are included in all specifications. The base category is generic SL in specification (i), social dimension in specification (ii) and social fairness in specification (iii). The t-statistics are in brackets. * Significant at the 10% level.

Through specification (i), we did not detect any significant effect of specific SLs as compared to generic SLs. Specific SLs are more dispersed than generic SLs, with a standard deviation of 0.45 for specific SLs and 0.33 for generic SLs, and a coefficient of variation[23] of 1.67 for specific SLs and 1.06 for generic SLs (Table 4). This indicates a greater heterogeneity in the percent variation in the WTP associated with the presence of a specific SL. The specificity of sustainability aspects (both dimensions and categories) involved in each SL may result in very different and sometimes opposite premium prices for SLs (the WTP index for specific SLs ranges between -0.94 and 5.47, Table 4). These specific effects may clear out each other impeding the identification of a common tendency. Overall, the type of SLs (specific *versus* generic) is not enough to disentangle the effects of the sustainability attribute on premium prices.

[23] The coefficient of variation, obtained as the ratio of the standard deviation to the mean, measures the extent of variability in the WTP index for each type, dimension and category of SLs.

Table 4. Descriptive statistics of WTP Index by label characteristics.

		Obs. (n)	Obs. (%)	Mean	Std. Dev	C.V.	Min.	Max.	Median
Total		648	100	0.27	0.44	1.63	-0.94	5.47	0.19
Label Characteristics									
Type	Specific	601	93	0.27	0.45	1.67	-0.94	5.47	0.19
	Generic	47	7	0.31	0.33	1.06	0.00	1.65	0.20
Dimension	Environmental	326	50	0.33	0.53	1.61	-0.47	5.47	0.21
	Social	181	28	0.20	0.34	1.70	-0.94	2.88	0.19
	Environmental and Social	141	22	0.24	0.30	1.25	-0.08	1.65	0.14
Category	Environmental Impact	113	17	0.34	0.57	1.68	-0.04	5.47	0.22
	Production Method	333	51	0.29	0.44	1.52	-0.47	3.28	0.18
	Animal Welfare	155	24	0.21	0.36	1.71	-0.94	2.88	0.18
	Social Fairness	27	4	0.16	0.22	1.38	-0.33	0.50	0.22
	Sustainable Production	20	3	0.27	0.40	1.48	0.03	1.65	0.10

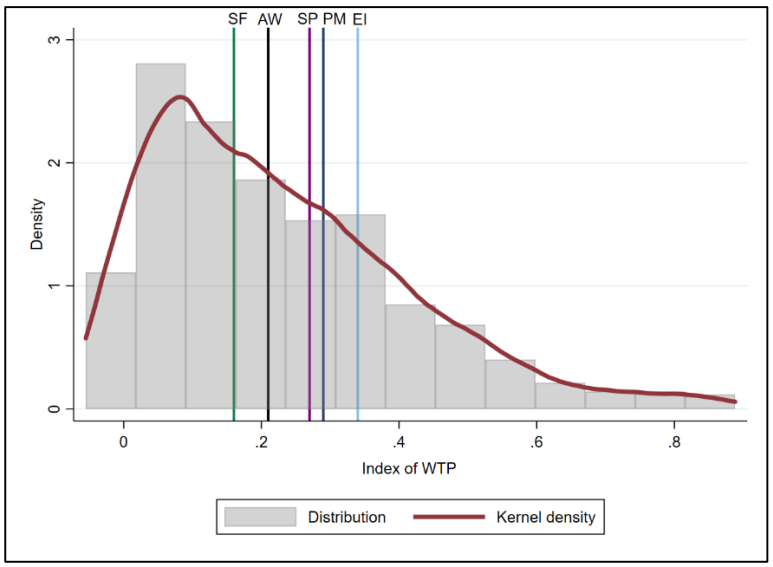
Notes: Obs: observations; Std. Dev.: Standard Deviation; C.V.: Coefficient of variation; Min.: Minimum; Max.: Maximum.

Regarding the dimensions of sustainability, we found that consumers are willing to pay 19% more for a product carrying an environmental SL. The results corroborate with previous studies, such as Van Loo et al. (2014), where the authors concluded that premium consumers are willing to pay for chicken breast products with carbon footprint labels ranging between 18% and 30%. We also found that the premium price is 15% greater for products with labels that include both the environmental and social dimensions. For instance, consider a meat-based product, beef, priced at 10.00 EUR/kg. An organic label certifying the adoption of both agriculture practices with lower environmental impacts (i.e. environmental dimension) and improved standards of animal welfare (i.e. social dimension) would increase the price of 1 kg of beef by 1.5 EUR with respect to a conventional beef product. Similarly, Burnier et al. (2021), evaluating the influence of socio-environmental attributes on the WTP for beef, find that consumers would be willing to pay between 1.83 and 3.03 USD/kg (equivalent to a range of 1.56 and 2.58 EUR/kg[24]) more for the sustainability certification.

[24] The conversion is based on the exchange rate USD/EUR on the publication date of the study by Burnier et al. (2021), i.e., 31 March 2021, available at the European Central Bank.

The positive correlation between the WTP index and SLs covering issues related to the environmental dimension or a mix of dimensions of sustainability is strengthened when specific categories of SLs are considered. The premium price increases by 29% on average for labels signalling the environmental outcomes associated with the production process (e.g. carbon footprint label or eco-friendly label) and by 30% for labels communicating production methods (e.g. organic label). Overall, there is a tendency to have larger premium prices for environmental SLs, whereas no significant effects are found for social SLs. On average, the premium price for SLs tends to be lower for SLs related to the social dimension of sustainability (Figure 2). For instance, the average WTP index is 0.20 for the social dimension (as compared to 0.33 for the environmental dimension) and 0.21 and 0.16 for animal welfare and social fairness, respectively (as compared to 0.34 and 0.29 for environmental impact and production method, respectively).

Figure 2. Distribution of the WTP index and average WTP by category.



Notes: The included values of the WTP index range from the 5th to the 95th percentiles. SF denotes the average WTP for labels in the social fairness category; AW indicates the average WTP for labels in the animal welfare category; SP signals the average WTP for labels in the sustainable production category; PM refers to the average WTP for labels in the production method category; EI represents the average WTP for labels in the environmental protection category.

Social SLs tend to be more impactful for high-priced products[25] (Table 5). High-priced animal-based products obtained with higher animal welfare standards increase the premium price by 86%. It emerges that, differently from the overall tendency, the social dimension of sustainability, limiting to the group of labels related to animal welfare, is worthwhile for a niche market, i.e. high-priced products.

Table 5. Meta-regression results by product price range.

	Average reference price by currency	
Variables	Low priced	High priced
Environmental Impact	0.22*	0.74**
	[1.82]	[2.13]
Production Method	0.17	1.03***
	[1.35]	[2.75]
Animal Welfare	0.03	0.86**
	[0.16]	[2.27]
Social Fairness	-0.20	0.45
	[-0.84]	[1.03]
Constant	0.69*	-1.55
	[1.75]	[-1.46]
Observations	485	163
R-squared	0.32	0.69

Notes: Ordinary Least Square (OLS) estimation of equation (2). The dependent variable is the index of willingness to pay (WTP) associated with the presence of the sustainability labels (SLs). The control factors (variables for structural characteristics, methodological and technical issues, publication process information) are included in all specifications. Products are classified as low or high priced according to the average reference price by currency. The t-statistics are in brackets. *, **, *** Significant at the 10, 5 and 1 percent level, respectively.

Additionally, the environmental dimension of sustainability matters the most for high-value products. The premium price is 74% higher for labels conveying information on environmental impacts and 103% greater when production methods are certified. Consumers are willing to pay more for low-priced products with labels with information on environmental impacts. However, the premium price for labels on environmental impacts is lower for low-priced than for high-priced products (+22% as compared to +74%). For instance, our reference product, beef, priced at 10.00 EUR/kg, is a high-priced product

[25] The results are robust to different classifications of products as low and high prices. The results of the sensitivity analysis and the classification of products in both classes are reported in Appendix D, Tables D5 to D7. Furthermore, we obtained consistent findings analysing the effect of label category on the WTP for products with different elasticities of demand (Appendix D, Table D8).

compared to other meat-based low-priced products, such as a small whole chicken (about 1 kg) priced at 4.00 EUR/kg. An environmental impact label would provide a premium price of 0.88 EUR/kg for the small whole chicken and 7.40 EUR/kg for the beef.

Discussion

To gather generalizable evidence on consumers' WTP for SLs, we reviewed 131 scientific publications and meta-analysed 110 studies. To date, this is the most extensive meta-analysis on WTP for sustainability attributes and the only one that looks at the WTP across labels according to their type, sustainability dimension and specific category of information.

Overall, we found that consumers are willing to pay on average 27% more for SLs on foods, in line with Li and Kallas (2021), which reports a premium of 29.5%. Nonetheless, our analyses point out that looking at the overall mean across all SLs can lead to a misleading and wrong conclusion since the field of SLs is extremely complex and multifaceted.

With regard to specific *versus* generic labelling, we did not detect any significant difference in the premium price. This was probably because the specific label group consists of such a diverse range of labels that any opposing impacts on the WTP index were probably cancelled out. On the other hand, the qualitative analysis of the literature indicates that generic SLs are less preferred by consumers as opposed to specific labelling (Viegas et al., 2014; Menozzi et al., 2020; Wu et al., 2020; Burnier et al., 2021), probably because they sound less salient and are not directly linked to the positive outcome they bring.

However, the establishment of an overarching (i.e. generic) SL has been advocated as a policy tool to spread sustainability information in the food domain and encourage sustainable food choices (for an extensive review on this topic, see Torma & Thøgersen, 2021). The future development of the European sustainability labelling announced in the F2F points in this direction (European Commission, 2020a). More research on the topic is needed to understand the extent to which a generic SL is effective or detrimental in promoting sustainable food consumption. As a matter of fact, the presence of a heterogeneous plethora of specific sustainability labelling schemes in the food market is recognised as a problem (Asioli et al., 2020). The reason is that they bring a broad range of diverse and overlapping information (Dendler, 2014) and potentially risk favouring consumers' overload and confusion while jeopardising labelling reliability and consistency (Van Loo et al., 2014;

Grebitus et al., 2018). We mapped 65 different sustainability facets addressed by specific labelling across 131 studies. Many works also corroborate the hypothesis that the simultaneous inclusion of multiple single-issue information may negatively impact consumers' product evaluation (Meas et al., 2015; Hinkes & Schulze-Ehlers, 2018; Charry et al., 2019). Consequently, different specific SLs may compete with each other by providing consumers with interrelated and overlapping utilities. Negative synergy effects, often recalled as substitution effects, may arise when combining several specific SLs on the same product. The non-proportionality between the WTP and the number of specific SLs could be explained as an embedding effect, meaning that consumers obtain utility from the concept of sustainability per se, whilst no additional value is gained by raising the degree of sustainability (Tebbe & von Blanckenburg, 2018). In this regard, it is worth researching whether adopting the generic labelling approach – which aims to provide consumers with a piece of holistic and unique information – instead of several specific labels is the key to achieving a more proficient spread of the sustainability communication in food products.

Concerning the dualism of sustainability dimensions involved in food labelling, the vast majority of articles included in our review (118 out of 131) deal with labels addressing the environmental dimension of sustainability, frequently mentioned as ecolabels. Conversely, we found that social labelling is less considered in the literature, in line with Bangsa and Schlegelmilch (2020). The research interest in the two sustainability pillars of food labelling seems to mirror the public opinion evaluation. Results from the meta-analysis corroborate the idea that people value the net collective gains from eco-friendly food-production practices and being informed through labelling of the environmental burden associated with the production of their food. Therefore, they are willing to pay more for the perceived improvement in the environmental quality, in line with Koistinen et al. (2013), Van Loo et al. (2014). Specifically, label information concerning production methods and environmental outcomes is the most impactful on the premium price for SLs. Our findings are consistent with previous works demonstrating that the production method certification commands stronger effects than other SLs, such as the animal welfare certification (Gross et al., 2021; Meyerding et al., 2018) or the social fairness certifications (Fitzsimmons & Cicia, 2018; Hinkes & Schulze-Ehlers, 2018), and that consumers highly appreciate labels attesting environmentally friendly practices, such as the carbon footprint logo and the "reduced water usage" claim (Caputo et al., 2013; Staples et al., 2020). On the other hand, the meta-analysis

stressed that social SLs are less valued among consumers compared to their environmental counterparts. There is an evident inconsistency between the accepted definition of sustainability, embracing both the environmental and social pillars, and what consumers value as sustainable in food and, thus, what they are willing to pay for it. Qualitative findings also confirm that preferences towards social attributes are controversial because, in some situations, consumers were found to be positively inclined towards the presence of ethical claims on food products (Van Loo et al., 2014; Lusk, 2019; Piracci et al., 2022), while in others, they disregarded or not paid attention to these claims for purchasing decisions (Rigby et al., 2016; Printezis & Grebitus, 2018; Soley et al., 2019). One of the reasons might be rooted in the fact that environmental concerns are somehow linked to health and safety consequences, for instance, those connected to environmental degradation. On the other hand, the social dimension of sustainability entirely focuses on improving the conditions of *others*, be it in the form of human beings or animals (Capitello & Sirieix, 2020). This may create distance as consumers can feel that these ethical purchasing decisions are not directly relevant to themselves and never will. In addition, sustainability has always been primarily interpreted under an ecological lens (Bangsa & Schlegelmilch, 2020). More recently, the environmental challenges have become more familiar and better known among consumers. Publications on SLs report that WTP can be strongly influenced by previous knowledge (Hinkes & Schulze-Ehlers, 2018; Ochs et al., 2019) and awareness (Janssen & Hamm, 2012) of the standard or of the underlying issue. Information provision and education-oriented tools have been proven effective in increasing the WTP and, hence, the acceptance of sustainability labelled food products (Rousseau & Vranken, 2013; Klaiman et al., 2016; Aoki et al., 2019).

In addition, the results of this study indicate that consumers' interest in food sustainability varies depending on the price range of the products. In the case of low-priced foods, people are willing to pay more for the overarching labels recalling the sustainability of the product (e.g. the "sustainable product" claim), regardless of any further specific information. On the other hand, when it comes to high-priced foods, consumers are not willing to trade off the detailed nature of the SLs for the more generic "sustainable product" claim. In this case, schemes involving specific aspects of sustainability (i.e. the environmental impact labels, the production method labels or the animal welfare labels) are the worthiest. Similar results were obtained in Contini et al. (2019) and Mazzocchi et al. (2019). Thus, we can infer that,

in low-priced products, the cost of processing more accurate information on sustainability is higher than the expected utility gained from the product. Therefore, consumers disregard the specific sustainability information. For instance, Naald and Cameron (2011) detected that individuals were unwilling to pay more for the "humanely raised" animal welfare certification on chicken breast. On the other hand, for high-priced goods within the same product category, such as ground beef or steak, consumers were willing to pay a considerable premium for the enhanced animal welfare label (Li et al., 2018; Burnier et al., 2021).

The premium for the animal welfare category of labels was found to be positive and significant only for the high-priced products, denoting that foods obtained through improved animal welfare standards can be regarded as a niche market. Our findings corroborate those of Clark et al. (2017) and Reisch et al. (2021) confirming that, although people exhibit much concern, the WTP for the animal welfare attribute is low.

The present work has several limitations. As it focuses on the WTP estimates stemming from choice experiment studies, it relies on both non-hypothetical and hypothetical measures; the latter of which could be overestimated due to the presence of hypothetical bias. Hypothetical choice experiments are not incentive-compatible (Carson & Groves, 2007) and the average WTP for a product obtained in hypothetical settings is higher than the one observed in real experimental conditions (Lusk & Schroeder, 2004). Nonetheless, several studies report that the marginal WTP for an attribute is equivalent in hypothetical and non-hypothetical contexts (see, for instance, Lusk & Schroeder, 2004; Taylor et al., 2010). Moreover, choice experiments are the most common stated preference method applied to study SLs (Lusk, 2018). Therefore, we opted for collecting the estimates from choice experiments to be able to achieve the most comprehensive representation of the phenomenon while preserving homogeneity according to the experimental method within the effect sizes. Indeed, considering multiple types of experimental techniques can provide different values in meta-regression studies (Printezis & Grebitus, 2018). In addition, the analysis is built upon the classification of SLs in categories that are not always exclusive, rather sometimes overlap each other. This is one of the drawbacks of dealing with such an extensive and multifaceted topic, as in the case of sustainability labelling. However, the systematic effort was intended to summarise the existing evidence of the literature concerning the SLs classification. All the followed rules and steps are described in the text and detailed in the appendixes in order to prove the consistency of our analysis and guarantee the replicability of our findings. The

transparent framework provided through this work can be updated as more evidence or systematic attempts become available (Clark et al., 2017).

Conclusions and Policy Implications

We applied a systematic and meta-analytical approach to analyse consumer WTP for SLs, with specific regard to disentangling the contribution of the different types of sustainability information provided through the label in terms of the broadness of formulation, underlying sustainability dimension and specific category.

We found no significant effects of generic information as compared to specific formulations on the premium price for SLs. The results are informative for policy strategies focusing on the implementation of a harmonised and overarching (i.e. generic) labelling system tackling sustainability, as is the case of the European F2F Strategy. Developing a comprehensive SL ruled by the government could guarantee transparency and increase consumer trust. Moreover, unambiguous communication would be effective to address consumer criticisms, such as scepticism, lack of knowledge of SLs or information overload. Nonetheless, further efforts are required on this research topic to uncover how citizens would react to the introduction of a generic label signalling the sustainability level of food. Future research should focus on how this type of intervention could prompt people to switch towards more sustainable purchasing patterns when the information provided is more easily interpretable and identifiable or, conversely, if single-sustainability-issue indications are communicated. These analyses would inform on how drawing the individual attention during the buying phase.

As for the importance of sustainability dimensions, we found that social and ethical labels tend to be less considered than the environmental-related issues. There is inconsistency between the concept of sustainability in people's minds and the accepted definition, which instead embraces both the environmental and social pillars. Public authorities and institutions must address and manage this growing distance between the citizens and the social policy agenda. Ethical priorities should be perceived as a core component of the path to a more sustainable society. Awareness campaigns should be utilised to emphasise that investments and policy actions alleviating poverty or improving living conditions, in turn,

can exert a substantial positive influence on environmental conservation efforts, thus, creating a virtuous circle (Blanco et al., 2022).

A further contribution is our focus on the price dimension. We have highlighted how the information on sustainability signalling the environmental outcomes of the product, the production methods or animal welfare improvements may lead to higher premiums when provided on expensive foods rather than low-priced products. The adoption of environmental and animal welfare certifications should be promoted in high-ended food categories, whereas the generic claim "sustainable product" is more appropriate on low-ended products. Similarly, food retailers should consider adjusting their market strategies and tailoring SLs specific to the market segment that their product falls within.

To conclude, our results stressed that not all sustainability facets are equally important among consumers at the point of purchase, although there is a growing concern for sustainability issues. The economic rationale behind this well-known attitude-behaviour gap is that individuals are not incentivised to pay a premium since their actions result in a minimum global outcome that cannot be instantly perceived (Bonnet et al., 2020). The main limitation in relying on SLs to provide public goods is the free-riding behaviour (Lusk et al., 2007). Consumers will likely purchase the cheaper non-certified foods as long as they can free-ride off the purchasing of sustainable foods by others. Due to these reasons, market-based interventions, such as food labels, should be regarded as a part of the policy tool belt rather than the main instrument to drive the sustainable transition. An integrated policy approach, combining hard and soft measures, is required to achieve complete sustainability in the food system, i.e. to develop a food system that contributes to all the different pillars of sustainability in a balanced manner (European Commission, 2020b). Labelling can support and encourage informed choices and strengthen the demand for more sustainable alternatives, which is particularly true in the case of already established preferences, such as the environmental-labelled products.

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Appendix

Appendix A.

The search strategy

The systematic review of the scientific publications focusing on sustainability labelling was carried out following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) protocol (Moher et al., 2009). The relevant studies were extracted in November 2020 from the Scopus database using a Boolean string resulting from the combination of the keywords reported in Table A1. The keys were identified consistently to the research objective. First, to select studies on sustainability labelling, both specific and generic label-related words were employed. The specific sustainability labels were chosen among the most applied sustainability labels in food consumer behaviour literature. Although less used sustainability labels (e.g., sustainable aquaculture, pesticide-free, fair labour) were not listed individually in the final string, the overarching key "sustainab*" was considered to be reported in the titles, keywords and abstracts of the studies, allowing to include this significant literature in the search as well. In addition, method-referred terms were employed to restrict the search on studies eliciting consumer willingness to pay for these attributes. Lastly, the sector-related terms were applied to narrow down the results to the agri-food system. Possible form variations of the keys were also included, for instance, "ecolabel" and "eco-label", to prevent the exclusion of publications applying different word specifications.

Table A1. Keywords applied in the search.

Label-related	Method-related	Sector-related
organic	wtp OR willingness to pay OR willingness-to-pay	food system
fairtrade OR fair-trade OR "fair trade"	consumer	food
ecolabel OR eco-label		agrifood OR agri-food
carbon footprint		agriculture
biodiversity		
animal welfare		
sustainab*		

The final syntax was refined after several trial combinations and reads as follows: ("WTP" OR "willingness to pay" OR "willingness-to-pay") AND ("organic" OR "fairtrade" OR "fair-trade" OR "fair trade" OR "ecolabel" OR "eco-label" OR "carbon footprint" OR "biodiversity" OR "animal welfare" OR "sustainab*") AND ("food system" OR "food" OR "agrifood" OR "agri-food" OR "agriculture") AND (consumer). This syntax was used as research key in titles, keywords and abstracts, limiting to peer-reviewed articles published in a scientific journal and in English language, consistent with previous review studies (see, for instance, Lagerkvist and Hess, 2011; Clark et al., 2017; Santeramo and Lamonaca, 2020). Given the wide variety of scientific literature captured by the keywords, the search was further refined limiting to the subject areas Economics, Econometrics and Finance (EEF) and Nursing (NUR). We filtered for EEF since our analysis primarily relies on the agricultural economics literature. We decided to extend the search also to NUR as this field encompasses a remarkable stream of literature on food consumer behaviour, otherwise, we would have lost significant contributions to the research. Thus, the initial set of studies identified for the systematic review resulted in 833 articles. After removing 3 duplicates, the remaining studies were screened based on titles and abstracts to gather only studies focusing on food products (232 articles excluded).

The eligibility of each article was assessed according to three general inclusion criteria: (*i*) the work is focused on consumer preferences for SLs; (*ii*) the aim is to elicit consumer WTP applying the choice experiment method; (*iii*) results must report the full set of estimated coefficients from the model. Concerning this last point, papers reporting the model estimates in an appendix or as supplementary material were treated as eligible (for instance, Lusk, 2019; Wuepper et al., 2019).

Appendix B.

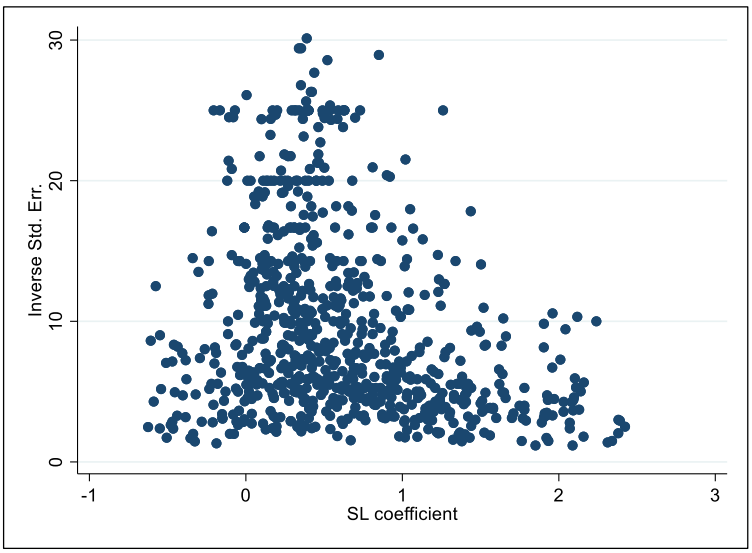
Detecting publication selection bias

Publication selection bias occurs when there is a remarkable preference by authors, reviewers and/or editors for publishing statistically significant results over the ones that do not reveal statistical significance. The relationship between the reported estimates and their standard errors or t-statistics is considered a reliable indicator to detect publication bias (Stanley, 2005; 2008). A funnel plot, which is the scatter diagram between estimated

coefficients for SLs and their precision, can provide a first examination of this relationship and is commonly applied for this purpose (Stanley, 2005; 2008).

Figure B1 shows the funnel plot for the literature on consumer WTP for SLs. In this case, the estimates retrieved from the literature are the coefficients of the SLs, elicited through discrete choice models. Moreover, the estimate precision is calculated as the reciprocal of its standard error, as per Stanley (2005, 2008). The graphical analysis points out that the estimates are distributed in form of a symmetrical inverted funnel, indicating that publication bias is not present.

Figure B1. Funnel plot for coefficients of SLs.



Appendix C

Descriptive analysis

The descriptive statistics for the WTP Index including all the observations (1,159) are in table C1. 86% of measures (998 observations) are positive, and 14% (998 observations) are negative or equal to zero. The majority (69%) refers to consumer samples treated as a whole, whilst the remaining observations (31%) derive from segmentation analysis (e.g., latent class models). Moreover, 82% of values are statistically significant, which is to say that were computed starting from a significant parameter for the SL attribute; conversely, 18% are not statistically significant. The 90% of the total distribution of the WTP Index (figure C1, panel

a) is positively skewed (skewness = 2.91) ranging between -0.30 and 2.79 (standard deviation = 0.40). Due to evident discrepancies in the distributions of significant versus non-significant measures and whole consumer samples versus segmented sample observations (figure C1, panel b), we conducted the MRA limiting to only significant WTP estimates deriving from the whole sample of consumers (110 articles and 648 observations)[26].

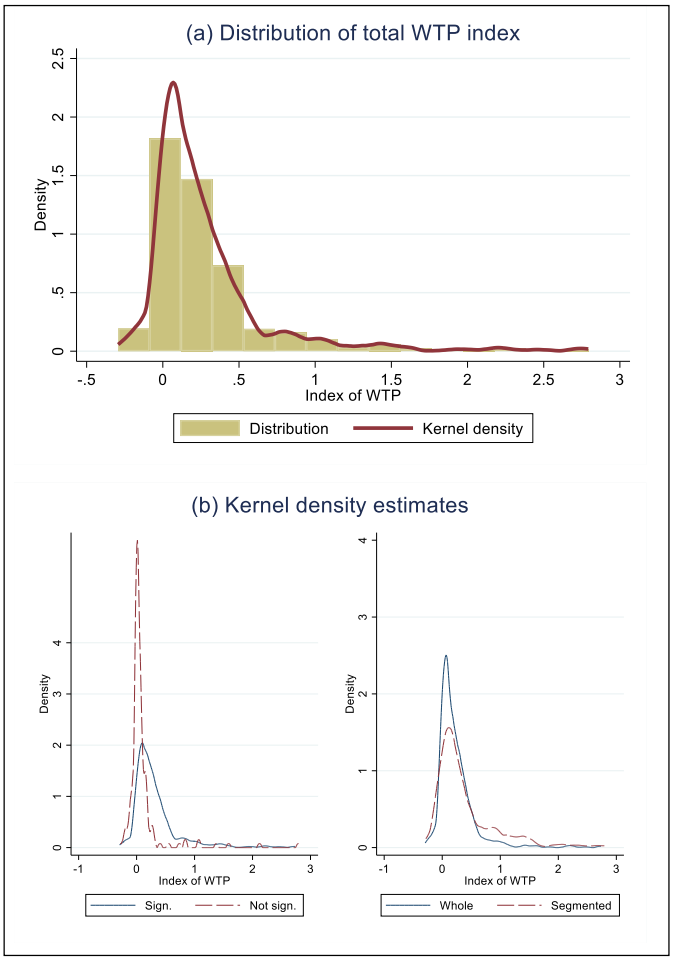
Table C1. Descriptive statistics of the WTP Index for SLs.

	Obs. (n)	Obs. (%)	Mean	Std. Dev	Min.	Max.	Median
Total	1159	100	0.71	4.38	-29.59	51.99	0.16
positive	998	86	1.13	4.13	0.00	51.99	0.21
negative or zero	161	14	-1.86	4.94	-29.59	0.00	-0.15
whole consumer sample	794	69	0.48	3.08	-23.99	51.99	0.15
segmented consumer sample	365	31	1.23	6.32	-29.59	33.34	0.21
significant	946	82	0.88	4.81	-29.59	51.99	0.21
significant from whole samples	657	57	0.57	3.38	-23.99	51.99	0.19
significant from segmented samples	289	25	1.60	7.00	-29.59	33.34	0.31
not significant estimates	213	18	-0.03	1.06	-9.09	4.15	0.02

Notes: Obs.: observations; Std. Dev.: standard devation; Min.: minimum; Max.: maximum.

[26] The initial sample of measures deriving from significant estimates and whole-sample analysis consists of 657 observations and 111 studies. We removed one article (Liljenstolpe, 2008) since it provided outliers estimates for the WTP index as compared to similar studies in the same publication year.

Figure C1. Graphical analysis of the index of WTP for sustainability labels (1159 observations).



Notes: Both the distribution and kernel densities include values of index of WTP ranging from the 5th to the 95th percentiles. Sign.= Significant observations; Not sign. = non significant observations.

Table C2. Descriptive statistics of the WTP Index by structural characteristics.

WTP Index		Obs (n)	Obs (%)	Mean	Std. Dev	Min.	Max.	Median
Total		648	100	0.27	0.44	-0.94	5.47	0.19
Average reference price	Low-priced products	485	75	0.27	0.43	-0.94	5.47	0.2
	High-priced products	163	25	0.29	0.47	-0.36	2.88	0.13
Food Category	Other[a]	46	7	0.55	0.96	-0.32	5.47	0.34
	Beverages	14	2	0.46	0.3	0.95	0.95	0.95
	Baby food	18	3	0.09	0.18	-0.32	0.63	0.09
	Coffee And Spices	20	3	0.31	0.21	1.01	1.01	1.01
	Dairy	24	4	0.20	0.21	-0.94	2.88	0.18
	Seafood	38	6	0.22	0.53	0.1	0.58	0.43
	Egg	83	13	0.20	0.17	0.07	5.47	1.8
	Fruit	93	14	0.32	0.49	0.91	0.91	0.91
	Vegetable	101	16	0.23	0.28	-0.33	2.74	0.08
	Meat	211	33	0.26	0.39	-0.43	1.45	0.23
Country	South America	8	1	1.13	1.01	0.16	2.88	0.78
	Africa	12	2	0.09	0.29	0	1.01	0
	Australia	16	2	0.08	0.23	-0.36	0.61	0.03
	Asia	57	9	0.36	0.32	0	1.45	0.33
	North America	186	29	0.23	0.3	-0.94	1.48	0.21
	Europe	369	57	0.28	0.49	-0.47	5.47	0.18

Notes: [a] include food categories with less than 10 observations which are honey, chocolate, pizza, pasta and bread, flour and milling products, algae-based foods, oils and fats, jam, cereals, ready-to-eat meal.

List of the papers included in the meta-analysis

Table C3. Articles included in the quantitative analysis.

Reference	Journal	Rank[a]	Country	Product category	Label
Adalja et al. (2015)	Agricultural and Resource Economics Review	Q1	USA	Meat	Pasture, Organic
Akaichi et al. (2020)	Nutrients	Q1	ESP	Meat	Organic, GHG emissions
Ankamah-Yeboah et al. (2019)	Marine Resource Economics	Q2	DEU	Seafood	Organic
Aprile et al. (2012)	International Journal of Consumer Studies	Q2	ITA	Oils and fats	Organic
Ardeshiri and Rose (2018)	Food Quality and Preference	Q2	AUS	Meat	Grass Fed, Organic
Balcombe et al. (2009)	Journal of Environmental Economics and Management	Q1	GBR	Pasta and bread	Green, Low Insecticide
Barreiro-Hurlé et al. (2008)	Food Quality and Preference	Q1	ESP	Beverages	Organic
Basu and Hicks (2008)	International Journal of Consumer Studies	Q3	DEU	Coffee and spices	Fairtrade
Bazzani et al. (2017)	Food Quality and Preference	Q2	ITA	Jam	Organic
Bello and Abdulai (2016)	American Journal of Agricultural Economics	Q1	NGA	Vegetable	Low Pesticide, Organic
Bi et al. (2015)	International Journal of Consumer Studies	Q2	USA	Beverages	Organic
Bienenfeld et al. (2016)	Agricultural Economics (United Kingdom)	Q1	USA	Milling Products	Organic, Eco-Friendly
Burnier et al. (2021)	Food Quality and Preference	Q1	BRA	Meat	Animal Welfare, Sustainable
Campbell and Doherty (2013)	European Review of Agricultural Economics	Q2	GBR	Meat	Animal Welfare
Cao et al. (2021)	Food Policy	Q1	CAN	Egg	Free Run, Free-Range, Enrichment Per Animal
Caputo et al. (2013)	Australian Journal of Agricultural and Resource Economics	Q2	USA, BEL	Vegetable	Organic, Carbon Footprint, Animal Welfare, Free-Range

Reference	Journal	Rank[a]	Country	Product category	Label
Carlucci et al. (2017)	Marine Resource Economics	Q2	ITA	Seafood	Organic
Carroll et al. (2013)	Journal of Agricultural and Resource Economics	Q2	USA	Vegetable	Organic
Castillo and Carpio (2019)	Journal of Agricultural and Applied Economics	Q3	ECU	Meat	Animal Welfare
Chalak et al. (2008)	Journal of Agricultural Economics	Q2	GBR	Pasta and bread	Green, Low Insecticide, Low Herbicide
Charry et al. (2019)	Agricultural and Food Economics	Q2	COL	Meat	Animal Welfare, Eco-Friendly
Chen et al. (2015)	AgBioForum	Q3	FRA	Seafood	MSC, Organic
Cosmina et al. (2016)	Appetite	Q1	ITA	Honey	Organic
Dahlhausen et al. (2018)	Agricultural Economics (United Kingdom)	Q1	DEU	Egg, Meat, Pasta	Animal Welfare, Organic
de Jonge et al. (2015)	Food Quality and Preference	Q2	NLD	Meat	Hallmark, Organic
De-Magistris et al. (2013)	American Journal of Agricultural Economics	Q1	ESP	Fruit	Organic
Drescher et al. (2014)	International Journal of Consumer Studies	Q2	DEU	Pizza	Organic
Erdem (2015)	Journal of Agricultural Economics	Q2	GBR	Meat	Animal Welfare
Fitzsimmons and Cicia (2018)	International Journal on Food System Dynamics	Q2	DEU, ITA	Vegetable	SA8000, Carbon Footprint, Eco-Friendly, Organic
Fonner and Sylvia (2015)	Marine Resource Economics	Q2	USA	Seafood	Eco-Friendly
Gallenti et al. (2019)	Agricultural and Food Economics	Q2	ITA	Beverages	Carbon Footprint
Gerini et al. (2016)	Journal of Agricultural Economics	Q1	NOR	Egg	Organic, Animal Welfare
Gilmour et al. (2019)	Agricultural Economics (United Kingdom)	Q1	USA	Vegetable	Organic
Gracia et al. (2014)	Journal of Agricultural Economics	Q2	ESP	Egg, Meat	Barn, Free-Range, Organic, Housing System, Transport System, Animal Welfare

Reference	Journal	Rank[a]	Country	Product category	Label
Grashuis and Magnier (2018)	Agribusiness	Q2	USA	Cereal, Dairy	Farmer's Cooperative
Grebitus et al. (2018)	Agribusiness	Q2	USA	Fruit	Pesticide Free
Gross et al. (2021)	Food Quality and Preference	Q1	DEU	Meat	Animal Welfare, Organic
He et al. (2020)	Canadian Journal of Agricultural Economics	Q2	USA	Fruit	Organic
Hempel and Hamm (2016)	International Journal of Consumer Studies	Q2	DEU	Dairy, Fruit, Meat, Flour and milling products	Organic
Hinkes and Schulze-Ehlers (2018)	Appetite	Q1	DEU	Seafood	ASC, Fairtrade, Eco-Friendly
Janssen and Hamm (2012)	Food Quality and Preference	Q2	DEU, CHE, CZE, ITA, DNK	Egg, Fruit	Organic, Biodynamic
Kemper et al. (2020)	European Review of Agricultural Economics	Q1	USA	Meat	Carbon Footprint
Kim et al. (2018)	Applied Economics Letters	Q3	USA	Dairy, Fruit	Organic
Klaiman et al. (2016)	Resources, Conservation and Recycling	Q1	USA	Beverages	Recyclable Packaging
Koistinen et al. (2013)	Food Quality and Preference	Q1	FIN	Meat	Organic, Animal Welfare, Carbon Footprint
Lagerkvist et al. (2006)	AgBioForum	Q2	SWE	Meat	Tailing Docking, Housing System, Immunocastration, Fixation, No Surgery
Latacz-Lohmann and Schreiner (2019)	Journal of Agricultural Economics	Q1	DEU	Meat	Transport, Anesthesia, Surface Per Animal, No Surgery, Enrichment Per Animal, Animal Bedding
Li et al. (2018)	Journal of Agricultural and Applied Economics	Q3	USA	Meat	GHG emissions, Animal Welfare
Lim and Hu (2016)	Canadian Journal of Agricultural Economics	Q2	CAN	Meat	Grass Fed

Reference	Journal	Rank[a]	Country	Product category	Label
Lim et al. (2018)	Marine Policy	Q1	USA	Seafood	MSC
Lusk (2019)	Agribusiness	Q2	USA	Egg	Cage-Free, Organic
Maples et al. (2018)	Journal of Agricultural and Applied Economics	Q3	USA	Vegetable	Less Water Usage, Low Pesticide, Farmer's Market, Pesticide Free
Mauracher et al. (2013)	Appetite	Q1	ITA	Seafood	Organic
Mazzocchi et al. (2019)	Wine Economics and Policy	Q1	ITA	Beverages	Biodiversity, Organic
McKendree et al. (2013)	Journal of Agricultural and Resource Economics	Q2	USA	Meat	Crates/Stall, Pasture
Meas et al. (2015)	American Journal of Agricultural Economics	Q1	USA	Jam	Small Farm, Organic
Menapace et al. (2011)	European Review of Agricultural Economics	Q1	CAN FRA, DEU, ITA, ESP,	Oils and fats	Organic
Menozzi et al. (2020)	Nutrients	Q1	GBR	Seafood	Sustainable
Mørkbak et al. (2014)	Journal of Economic Psychology	Q2	DNK	Fruit	Organic
Moser and Raffaelli (2012)	International Journal of Consumer Studies	Q2	ITA	Fruit	Organic, Integrated, GHG emissions
Naald and Cameron (2011)	Ecological Economics	Q1	USA	Meat	Animal Welfare
Ochs et al. (2019)	Food Policy	Q1	USA	Egg	Cage-Free, Enrichment Per Animal
Olsen and Meyerhoff (2017)	European Review of Agricultural Economics	Q1	DNK	Meat	Climate Friendly, Organic, Animal Welfare
Olynk et al. (2010)	Journal of Agricultural and Resource Economics	Q2	USA	Dairy	Crates/Stall, Pasture, Transport
Onken et al. (2011)	Agricultural and Resource Economics Review	Q3	USA	Jam	Organic
Ortega et al. (2015)	China Economic Review	Q2	CHN	Egg, Meat	Green Label, Animal Welfare, Organic

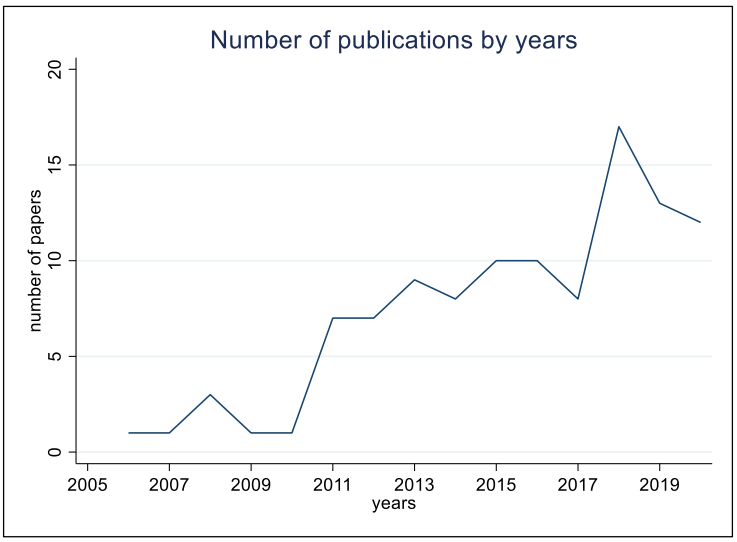
Reference	Journal	Rank[a]	Country	Product category	Label
Øvrum et al. (2012)	Food Policy	Q1	NOR	Dairy	Organic
Pallante et al. (2016)	Ecological Economics	Q1	NPL	Flour and milling products	Organic
Peterson and Burbidge (2012)	Journal of Agricultural and Resource Economics	Q2	JPN	Meat	Organic
Pozo et al. (2012)	Journal of Agricultural Economics	Q1	USA	Meat	Crate-Free, Pasture
Printezis and Grebitus (2018)	Ecological Economics	Q1	USA	Vegetable	Organic, CSA
Probst et al. (2012)	Food Policy	Q1	BFA, GHA, BEN	Ready-to-eat meal	Organic
Quan et al. (2018)	Agribusiness	Q2	CHN	Baby Milk	Organic
Radić and Canavari (2014)	Economia Agro-Alimentare	Q3	AUT	Fruit	Organic
Rigby et al. (2016)	Environmental and Resource Economics	Q2	AUS	Meat	Pasture
Rotaris and Danielis (2011)	Journal of Agricultural and Food Industrial Organization		ITA	Coffee and spices	Fairtrade
Rousseau and Vranken (2013)	Food Policy	Q1	BEL	Fruit	Organic
Rousseau (2015)	Food Quality and Preference	Q2	BEL	Chocolate	Organic
Sanjuán-López and Resano-Ezcaray (2020)	Journal of Agricultural Economics	Q1	ESP	Coffee and spices	Organic
Scarpa et al. (2007)	Journal of Agricultural and Food Industrial Organization		ITA	Vegetable	Integrated, Organic, Biodynamic
Scarpa et al. (2021)	Journal of Agricultural Economics	Q1	DEU	Oils and fats	Carbon Footprint, Organic
Scozzafava et al. (2020)	Appetite	Q1	ITA	Dairy	Organic
Shahabi Ahangarkolaee and Gorton (2021)	International Journal of Consumer Studies	Q2	IRN	Cereal	Organic
Soley et al. (2019)	Journal of Agricultural and Applied Economics	Q3	USA	Seafood	HBH
Syrengelas et al. (2018)	Applied Economic Perspectives and Policy	Q2	USA	Meat	Grass Fed

Reference	Journal	Rank[a]	Country	Product category	Label
Tempesta and Vecchiato (2013)	Food Quality and Preference	Q1	ITA	Dairy	Free Rearing
Thai et al. (2017)	International Journal of Economic Research	Q2	VNM	Vegetable	Organic
Tonsor (2011)	European Review of Agricultural Economics	Q1	USA	Meat	Crates/Stall, Small Farm
Uchida et al. (2014)	Food Policy	Q1	JPN	Seafood	Eco-Friendly
Van Loo et al. (2011)	Food Quality and Preference	Q1	USA	Meat	Organic
Van Loo et al.(2014)	Food Policy	Q1	BEL	Meat	Organic, Animal Welfare, Carbon Footprint
Van Loo et al. (2015)	Ecological Economics	Q1	USA	Coffee and spices	Rainforest Alliance, Fairtrade, Organic
van Osch et al. (2017)	Marine Policy	Q1	IRL	Seafood	Sustainable
Viegas et al. (2014)	Journal of Agricultural Economics	Q2	PRT	Meat	Animal Welfare, Eco-Friendly
Weinrich and Elshiewy (2019)	Appetite	Q1	DEU, NLD, FRA	Algae-based foods	Lower Environmental Impact, Organic
Wensing et al (2020)	Ecological Economics	Q1	DEU	Vegetable	Bio-Based Packaging, Compostable Packaging, Recyclable Packaging, Organic
Wu et al. (2020)	Journal of Agricultural Economics	Q1	CHN	Dairy	Organic, Green Label
Wuepper et al. (2019)	Journal of Economic Behavior and Organization	Q1	DEU	Coffee and spices	Less Water Usage, Organic
Xie et al. (2016)	Agricultural Economics (United Kingdom)	Q1	USA	Vegetable	Organic
Yang et al. (2020)	Food Policy	Q1	CAN	Seafood	Sustainable
(Yin et al. (2017)	China Agricultural Economic Review	Q3	CHN	Vegetable	Green Label, Organic
Yin et al. (2018)	Canadian Journal of Agricultural Economics	Q2	CHN	Baby Milk	Organic
Yin et al. (2019)	Agribusiness	Q2	CHN	Vegetable	Green, Organic

Reference	Journal	Rank[a]	Country	Product category	Label
Yip et al. (2017)	Canadian Journal of Agricultural Economics	Q2	USA	Seafood	CCA, Eco-Friendly, IMTA
Zhou et al. (2017)	Food Policy	Q1	CHN	Cereal	Green Label, Organic

Notes: [a]Journal rank provided by the Scimago Journal & Country Rank (SJR) at the date of publication and referred to the subject areas either Economics, Econometrics and Finance or Nursing. Q1, Q2 and Q3 stands for journals respectively in the 25th, 50th, 75th percentiles at the time of publication. GHG: Greenhouse Gases; MSC: Marine Stewardship Council; ASC: Aquaculture Stewardship Council; CCA: Closed Containment Aquaculture; IMTA: Integrated Multitrophic Aquaculture; CSA: Community Supported Agriculture; HBH: Home-grown by Heroes.

Figure C2. Published papers by year.



Note: 2021 excluded.

Appendix D

Sensitivity analyses

Model estimates with different base categories for the label-related variables

Table D1. Meta-regression results.

	Type	Dimension		Category				
Variables	(i)	(ii.a)	(ii.b)	(iii.a)	(iii.b)	(iii.c)	(iii.d)	(iii.e)
Specific SL	0.04							
	[0.38]							
Environmental Dimension		0.19*						
		[1.84]						
Social Dimension			-0.19*					
			[-1.84]					
Both Dimensions		0.15*	-0.04					
		[1.75]	[-0.52]					
Environmental Impact				0.04	0.29*	0.14	-0.00	
				[0.25]	[1.70]	[1.28]	[-0.01]	
Production Method				0.04	0.30*	0.14*		0.00
				[0.22]	[1.91]	[1.71]		[0.01]
Animal Welfare				-0.10	0.15		-0.14*	-0.14
				[-0.54]	[1.07]		[-1.71]	[-1.28]
Social Fairness				-0.25		-0.15	-0.30*	-0.29*
				[-1.22]		[-1.07]	[-1.91]	[-1.70]
Sustainable Production					0.25	0.10	-0.04	-0.04
					[1.22]	[0.54]	[-0.22]	[-0.25]
Constant	0.77*	0.60	0.79**	0.78	0.53	0.68*	0.83**	0.83*
	[1.74]	[1.51]	[2.02]	[1.60]	[1.24]	[1.68]	[2.08]	[1.94]
Observations	648	648	648	648	648	648	648	648
R-Squared	0.19	0.20	0.20	0.21	0.21	0.21	0.21	0.21

Notes: Ordinary Least Square (OLS) estimation of equation (2). The dependent variable is the index of willingness to pay (WTP) associated with the presence of the sustainability labels (SLs). The control factors (variables for structural characteristics, methodological and technical issues, publication process information) included in all specifications. The t-statistics are in brackets. *, ** Significant at the 10 and 5 percent level, respectively.

Model estimates with different combinations of control factors

Table D2. Meta-regression results for specification (*i*).

Variables	(1)	(2)	(3)	(4)
Specific	-0.04	0.06	0.03	0.04
	[-0.59]	[0.53]	[0.25]	[0.38]
Potential label		-0.01	-0.03	-0.04
		[-0.13]	[-0.42]	[-0.59]
Beverages		-0.01	0.11	0.06
		[-0.05]	[0.45]	[0.20]
Coffee		-0.10	-0.03	-0.05
		[-0.47]	[-0.15]	[-0.23]
Dairy		-0.31	-0.27	-0.29
		[-1.37]	[-1.15]	[-1.15]
Egg		-0.25	-0.14	-0.18
		[-1.24]	[-0.75]	[-1.05]
Fruit		-0.18	-0.04	-0.08
		[-0.71]	[-0.19]	[-0.43]
Meat		-0.22	-0.20	-0.13
		[-0.98]	[-0.95]	[-0.58]
Seafood		-0.32	-0.26	-0.26
		[-1.24]	[-1.08]	[-1.16]
Vegetable		-0.18	-0.12	-0.16
		[-0.78]	[-0.60]	[-0.68]
Baby food		-0.65***	-0.62***	-0.75**
		[-3.33]	[-2.91]	[-2.40]
Food quantity		0.02	0.02	-0.02
		[0.33]	[0.26]	[-0.21]
Asia		0.26*	0.25*	0.23
		[1.97]	[1.85]	[1.46]
Africa		-0.18	-0.18	-0.00
		[-1.60]	[-1.02]	[-0.01]
Australia		-0.12	-0.01	0.02
		[-0.97]	[-0.06]	[0.07]
Europe		0.05	0.09	0.11
		[0.58]	[0.65]	[0.82]
Consumers		0.07	0.11	-0.00
		[0.65]	[0.81]	[-0.01]
Consumers & purchasers		0.54*	0.58*	0.48
		[1.85]	[1.71]	[1.45]
Residents		0.18	0.21	0.20*
		[1.38]	[1.58]	[1.88]
Purchasers		0.02	0.13	0.05
		[0.24]	[1.03]	[0.34]
Face-to-face interview			0.04	0.08
			[0.32]	[0.62]
Online survey			0.08	0.01
			[0.52]	[0.03]
Efficient design			-0.22*	-0.27*
			[-1.85]	[-1.77]
OOD design			-0.30*	-0.35*
			[-1.71]	[-1.93]

Variables	(1)	(2)	(3)	(4)
Bayesian design			-0.19	-0.27
			[-1.16]	[-1.53]
Orthogonal design			-0.21	-0.21
			[-1.24]	[-1.31]
Alternatives			-0.06	-0.06
			[-1.47]	[-1.39]
Attributes			-0.00	-0.01
			[-0.08]	[-0.45]
Before 2012				0.00
				[0.02]
Before 2018				-0.17
				[-1.57]
Q1				0.04
				[0.43]
Q2				0.10
				[0.79]
EEF				0.01
				[0.04]
ABS				-0.06
				[-0.49]
SS				0.16
				[1.41]
Constant	0.31***	0.29	0.55	0.77*
	[4.82]	[1.28]	[1.41]	[1.74]
Observations	648	648	648	648
R-Squared	0.00	0.12	0.15	0.19

Notes: Ordinary Least Square (OLS) estimation of equation (2). The dependent variable is the index of willingness to pay (WTP) associated with the presence of the sustainability labels (SLs). Column (1) is the basic specification; the control factors are added in the following specifications: structural characteristics in column (2), methodological and technical issues in column (3), publication process information in column (4). The t-statistics are in brackets. *, **, *** Significant at the 10, 5 and 1 percent level, respectively.

Table D3. Meta-regression results for specification (*ii*).

Variables	(1)	(2)	(3)	(4)
Environmental dimension	0.13***	0.15*	0.16*	0.19*
	[3.10]	[1.85]	[1.84]	[1.84]
Both Dimensions	0.04	0.14**	0.15*	0.15*
	[0.86]	[2.13]	[1.92]	[1.75]
Potential label		-0.01	-0.03	-0.05
		[-0.18]	[-0.41]	[-0.62]
Beverages		-0.03	0.09	0.03
		[-0.12]	[0.36]	[0.10]
Coffee		-0.05	0.01	0.00
		[-0.25]	[0.08]	[0.00]
Dairy		-0.26	-0.21	-0.22
		[-1.21	[-0.94	[-0.92
Egg		-0.21	-0.09	-0.11
		[-1.07]	[-0.50]	[-0.68]
Fruit		-0.19	-0.05	-0.08
		[-0.75]	[-0.21]	[-0.44]
Meat		-0.14	-0.12	-0.02
		[-0.67]	[-0.58]	[-0.11]
Seafood		-0.35	-0.27	-0.25
		[-1.40]	[-1.13]	[-1.19]
Vegetable		-0.16	-0.11	-0.16
		[-0.74]	[-0.55]	[-0.68]
Baby food		-0.60***	-0.56***	-0.66**
		[-3.16]	[-2.69]	[-2.21]
Food quantity		0.03	0.03	-0.01
		[0.52]	[0.45]	[-0.12]
Asia		0.19	0.18	0.15
		[1.58]	[1.43]	[1.05]
Africa		-0.20*	-0.22	-0.02
		[-1.88]	[-1.23]	[-0.07]
Australia		-0.14	-0.04	0.02
		[-1.07]	[-0.19]	[0.07]
Europe		0.03	0.07	0.10
		[0.37]	[0.57]	[0.78]
Consumers		0.10	0.15	0.04
		[1.04]	[1.14]	[0.26]
Consumers & purchasers		0.54*	0.58*	0.48
		[1.90]	[1.73]	[1.47]
Residents		0.23*	0.27*	0.26**
		[1.74]	[1.91]	[2.21]
Purchasers		0.04	0.14	0.07
		[0.41]	[1.18]	[0.51]
Face-to-face interview			0.04	0.09
			[0.35]	[0.67]
Online survey			0.08	0.00
			[0.48]	[0.01]
Efficient design			-0.22*	-0.28*
			[-1.78]	[-1.86]
OOD design			-0.30*	-0.36**

Variables	(1)	(2)	(3)	(4)
			[-1.72]	[-1.98]
Bayesian design			-0.20	-0.27
			[-1.23]	[-1.62]
Orthogonal design			-0.20	-0.19
			[-1.24]	[-1.30]
Alternatives			-0.07*	-0.07
			[-1.72]	[-1.55]
Attributes			0.00	-0.01
			[0.03]	[-0.39]
Before 2012				0.03
				[0.17]
Before 2018				-0.19*
				[-1.72]
Q1				0.03
				[0.29]
Q2				0.11
				[0.80]
EEF				0.04
				[0.23]
ABS				-0.06
				[-0.51]
SS				0.17
				[1.48]
Constant	0.20***	0.20	0.43	0.60
	[6.18]	[0.96]	[1.21]	[1.51]
Observations	648	648	648	648
R-Squared	0.02	0.13	0.17	0.20

Notes: Ordinary Least Square (OLS) estimation of equation (2). The dependent variable is the index of willingness to pay (WTP) associated with the presence of the sustainability labels (SLs). Column (1) is the basic specification; the control factors are added in the following specifications: structural characteristics in column (2), methodological and technical issues in column (3), publication process information in column (4). The t-statistics are in brackets. *, **, *** Significant at the 10, 5 and 1 percent level, respectively.

Table D4. Meta-regression results for specification (*iii*).

Variables	(1)	(2)	(3)	(4)
Environmental Impact	0.19**	0.19	0.22	0.29*
	[1.99]	[1.52]	[1.53]	[1.70]
Production Method	0.13	0.19*	0.20*	0.30*
	[1.53]	[1.80]	[1.67]	[1.91]
Animal Welfare	0.05	0.05	0.06	0.15
	[0.57]	[0.44]	[0.43]	[1.07]
Sustainable Production	0.11	0.13	0.21	0.25
	[0.88]	[0.83]	[1.18]	[1.22]
Potential label		-0.01	-0.03	-0.03
		[-0.08]	[-0.45]	[-0.40]
Beverages		-0.04	0.08	0.02
		[-0.14]	[0.30]	[0.07]
Coffee		-0.04	0.02	0.03
		[-0.18]	[0.12]	[0.16]
Dairy		-0.27	-0.21	-0.24
		[-1.20]	[-0.94]	[-0.99]
Egg		-0.22	-0.10	-0.15
		[-1.09]	[-0.56]	[-0.94]
Fruit		-0.19	-0.05	-0.08
		[-0.76]	[-0.22]	[-0.47]
Meat		-0.15	-0.13	-0.06
		[-0.66]	[-0.61]	[-0.29]
Seafood		-0.33	-0.28	-0.26
		[-1.26]	[-1.09]	[-1.15]
Vegetable		-0.17	-0.12	-0.17
		[-0.73]	[-0.56]	[-0.70]
Baby food		-0.60***	-0.57***	-0.72**
		[-3.29]	[-2.90]	[-2.53]
Food quantity		0.04	0.03	-0.02
		[0.56]	[0.47]	[-0.18]
Asia		0.19	0.17	0.16
		[1.54]	[1.38]	[1.10]
Africa		-0.21*	-0.22	-0.03
		[-1.76]	[-1.17]	[-0.14]
Australia		-0.15	-0.04	-0.02
		[-1.18]	[-0.20]	[-0.08]
Europe		0.03	0.07	0.10
		[0.35]	[0.57]	[0.74]
Consumers		0.09	0.14	0.01
		[0.91]	[1.05]	[0.06]
Consumers & purchasers		0.54*	0.57*	0.46
		[1.87]	[1.69]	[1.41]
Residents		0.22*	0.27*	0.25**
		[1.73]	[1.87	[2.06]
Purchasers		0.03	0.14	0.06
		[0.37]	[1.17]	[0.43]
Face-to-face interview			0.04	0.09
			[0.33]	[0.71]
Online survey			0.07	0.00

Variables	(1)	(2)	(3)	(4)
			[0.44]	[0.01]
Efficient design			-0.22*	-0.29*
			[-1.79]	[-1.92]
OOD design			-0.31*	-0.36*
			[-1.72]	[-1.97]
Bayesian design			-0.20	-0.27
			[-1.25]	[-1.61]
Orthogonal design			-0.21	-0.21
			[-1.22]	[-1.38]
Alternatives			-0.07	-0.06
			[-1.61]	[-1.34]
Attributes			0.00	-0.01
			[0.03]	[-0.36]
Before 2012				0.03
				[0.16]
Before 2018				-0.19*
				[-1.77]
Q1				0.02
				[0.17]
Q2				0.10
				[0.79]
EEF				0.03
				[0.15]
ABS				-0.06
				[-0.50]
SS				0.18
				[1.59]
Constant	0.16*	0.16	0.40	0.53
	[1.84]	[0.89]	[1.17]	[1.24]
Observations	648	648	648	648
R-Squared	0.01	0.13	0.17	0.21

Notes: Ordinary Least Square (OLS) estimation of equation (2). The dependent variable is the index of willingness to pay (WTP) associated with the presence of the sustainability labels (SLs). Column (1) is the basic specification; the control factors are added in the following specifications: structural characteristics in column (2), methodological and technical issues in column (3), publication process information in column (4). The t-statistics are in brackets. *, **, *** Significant at the 10, 5 and 1 percent level, respectively.

Model estimates by different classifications of food products

Table D5. Meta-regression results by category of SLs and products' price range.

Variables	(iii.a)		(iii.b)		(iii.c)		(iii.d)		(iii.e)	
	Low priced	High priced	Low priced	High priced	Low priced	High priced	Low priced	High priced	Low priced	High priced
Environmental Impact	0.22*	0.74**	0.42*	0.29	0.19	-0.11	0.05	-0.29**		
	[1.82]	[2.13]	[1.75]	[0.79]	[1.48]	[-1.11]	[0.79]	[-2.26]		
Production Method	0.17	1.03***	0.37*	0.58	0.14	0.18			-0.05	0.29**
	[1.35]	[2.75]	[1.80]	[1.54]	[1.51]	[1.33]			[-0.79]	[2.26]
Animal Welfare	0.03	0.86**	0.23	0.40			-0.14	-0.18	-0.19	0.11
	[0.16]	[2.27]	[1.23]	[1.00]			[-1.51]	[-1.33]	[-1.48]	[1.11]
Social Fairness	-0.20	0.45			-0.23	-0.40	-0.37*	-0.58	-0.42*	-0.29
	[-0.84]	[1.03]			[-1.23]	[-1.00]	[-1.80]	[-1.54]	[-1.75]	[-0.79]
Sustainable Production			0.20	-0.45	-0.03	-0.86**	-0.17	-1.03***	-0.22*	-0.74**
			[0.84]	[-1.03]	[-0.16]	[-2.27]	[-1.35]	[-2.75]	[-1.82]	[-2.13]
Constant	0.69*	-1.55	0.49	-1.10	0.71**	-0.70	0.86**	-0.52	0.91**	-0.81
	[1.75]	[-1.46]	[1.16]	[-1.02]	[2.08]	[-0.77]	[2.37]	[-0.58]	[2.43]	[-0.86]
Observations	485	163	485	163	485	163	485	163	485	163
R-squared	0.32	0.69	0.32	0.69	0.32	0.69	0.32	0.69	0.32	0.69

Notes: Ordinary Least Square (OLS) estimation of equation (2). The dependent variable is the index of willingness to pay (WTP) associated with the presence of the sustainability labels (SL). The control factors (variables for structural characteristics, methodological and technical issues, publication process information) are included in all specifications. The products are classified as low or high priced according to the average reference price by currency. The t-statistics are in brackets. *,**,*** Significant at the 10, 5 and 1 percent level, respectively.

Table D6. Meta-regression results by category of SLs and products' price range.

Variables	Avg. ref. price by (all) currency		Median ref. price by (all) currency		Avg. ref. price by currency (EUR, USD, DKK)		Median ref. price by currency (EUR, USD, DKK)	
	Low priced	High priced	Low priced	High priced	Low priced	High priced	Low priced	High priced
Environmental Impact	0.22*	0.74**	0.21	0.57*	0.27*	0.96**	0.30	0.68*
	[1.82]	[2.13]	1.53	1.81	1.77	2.34	1.67	1.82
Production Method	0.17	1.03***	0.22	0.91**	0.29*	1.25***	0.34*	1.05**
	[1.35]	[2.75]	1.58	2.70	1.85	2.87	1.93	2.56
Animal Welfare	0.03	0.86**	0.08	0.66*	0.25	1.00**	0.30*	0.74*
	[0.16]	[2.27]	0.43	1.81	1.51	2.33	1.67	1.75
Social Fairness	-0.20	0.45	-0.18	0.35	0.12	0.75	0.20	0.54
	[-0.84]	[1.03]	-0.71	0.91	0.80	1.48	1.12	1.28
Constant	0.69*	-1.55	0.57	-1.93**	0.59	-2.35	0.68*	-2.17**
	[1.75]	[-1.46]	1.28	-2.35	1.56	-0.86	1.76	-2.12
Observations	485	163	460	188	410	125	377	158
R-squared	0.32	0.69	0.33	0.66	0.41	0.72	0.44	0.68

Notes: Ordinary Least Square (OLS) estimation of equation (2). The dependent variable is the index of willingness to pay (WTP) associated with the presence of the sustainability labels (SL). The control factors (variables for structural characteristics, methodological and technical issues, publication process information) are included in all specifications. The products are classified as low or high priced according to the average or median reference price by currency (all currencies versus the most represented currencies). The t-statistics are in brackets. * Significant at the 10 percent level.

Table D7. Products classification as low and high priced according to the reference price by currency.

	Median reference price by currency		Average reference price by currency	
Products	Low priced	High priced	Low priced	High priced
Atlantic salmon	0	2	0	2
King salmon	0	3	0	3
Lettuce	8	0	8	0
Pork cutlet	8	0	8	0
Sockeye salmon	0	1	0	1
Almonds	7	0	7	0
Apple	45	38	83	0
Applesauce	3	0	3	0
Baby milk	15	3	0	18
Wine	0	1	0	1
Beef	0	12	0	12
Beef steak	0	5	0	5
Blackberry jam	3	0	3	0
Boneless ribeye beef steak	0	2	0	2
Bread	5	0	5	0
Breakfast cereal	4	0	4	0
Broiler filet	4	0	4	0
Butter	1	0	1	0
Canned tuna	1	0	1	0
Carrot	8	0	8	0
Cereal	3	0	3	0
Char	0	3	0	3
Cheddar cheese	3	0	3	0
Cheese	2	0	2	0
Chicken	11	0	11	0
Chicken breast	36	0	36	0
Chocolate	1	0	1	0
Coffee	8	0	8	0
Cooked ham	0	4	4	0
Crab	0	1	0	1
Cured ham	5	0	5	0
Diced beef	0	2	0	2
Early potato	15	0	15	0
Egg	61	22	83	0
Extra virgin olive	0	1	0	1
Eye fillet	0	2	0	2
Finger millet flour	4	0	4	0
Fish	0	6	0	6
Fish loin	0	2	0	2
Flour	1	0	1	0
Fresh Medjool dates	1	0	1	0
Fresh broccoli	1	0	1	0

	Median reference price by currency		Average reference price by currency	
Products	Low priced	High priced	Low priced	High priced
Frozen fish fillet	0	6	0	6
Fruit juice	6	0	6	0
Ground beef	30	12	0	42
Ham lunchmeat	6	0	6	0
Honey	0	1	0	1
Leafy vegetables	1	0	1	0
Micro algae-based meal	0	4	4	0
Milk	18	0	18	0
Mince beef	0	7	0	7
Minced meat	0	4	0	4
Olive oil	0	6	0	6
Olive oil	0	1	0	1
Orange juice	0	1	1	0
Oyster	0	2	0	2
Pasta with egg	1	0	1	0
Pizza	1	0	1	0
Pork	7	0	7	0
Pork chop	34	0	34	0
Pork chops	5	0	5	0
Porterhouse	0	2	0	2
Premium wine	0	4	0	4
Raspberry	1	0	1	0
Ready-to-eat meal	0	1	0	1
Rice	5	0	5	0
Roast beef	0	2	0	2
Roasted ground coffee	6	0	6	0
Rump	0	2	0	2
Saffron	0	6	0	6
Salmon	0	2	0	2
Salmon fillet	0	5	0	5
Scotch fillet	0	2	0	2
Sea bass	0	1	0	1
Shrimp	0	1	0	1
Smoked ham	5	0	5	0
Steak	0	1	0	1
Strawberry	1	0	1	0
Strawberry preserves	1	0	1	0
Strip loin steak	0	1	1	0
Tomatoes	68	0	68	0
Trout	0	2	0	2
White wine	0	1	0	1
Red wine	0	1	0	1
Total	460	188	485	163

Table D8. Meta-regression results by elasticity of products.

	Elasticity of demand	
Variables	Lower than 0.5	Higher than 0.5
Environmental Impact	0.25	0.88***
	[1.41]	[7.18]
Production Method	0.27	0.82***
	[1.44]	[8.17]
Animal Welfare	0.09	0.65***
	[0.48]	[18.88]
Social Fairness	-0.09	1.42***
	[-0.46]	[16.33]
Constant	0.31	-1.54***
	[0.73]	[-16.90]
Observations	586	62
R-squared	0.24	0.96

Notes: Ordinary Least Square (OLS) estimation of equation (2). The dependent variable is the index of willingness to pay (WTP) associated with the presence of the sustainability labels (SL). The control factors (variables for structural characteristics, methodological and technical issues, publication process information) are included in all specifications. The value of the elasticity for each product is gathered from the USDA database of Demand Elasticities from Literature (data.ers.usda.gov). The t-statistics are in brackets. * Significant at the 10 percent level.

References

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Research article 2. Wine consumers' demand for social sustainability labeling: Evidence for the fair labor claim[27]

Abstract

This study aims to investigate consumer preferences for social sustainability labeling for wine. We explored the potential demand for a fair labor label that certifies wine produced through the fair treatment of workers in Italy, since the exploitation of migrant labor has become a preeminent issue in the country. We conducted a choice experiment on a sample of 500 consumers. Results indicated that they were willing to pay a considerable premium for wine produced by wineries that respects workers' rights and that there is a wide heterogeneity in consumer preferences for sustainability labeling according to the different dimensions underlying the label.

Keywords: Food label; wine marketing; fair working conditions; food values; ethical consumption.

Introduction

The pursuit of environmental and social sustainability is an important emerging trend influencing food consumption patterns (Reisch et al., 2013; Annunziata et al., 2019; Asioli et al., 2020). Sustainable production methods adopted by firms aim to adapt to this change in consumer demand; as a result, during the last decades, many voluntary certification schemes have been implemented, including in the wine sector (Pomarici and Vecchio, 2019). Most sustainability labels concerning wines rely primarily on environmental principles while neglecting the social aspects (Klohr et al., 2013; Szolnoki, 2013; Schäufele and Hamm, 2017; Nilipour, 2020). At the root of this disproportion could be the fact that the concept of sustainability has primarily declined under an ecological perspective and that a conspicuous concern of the current society is related to environmental degradation or climate change (for an extensive review, see Bangsa and Schlegelmilch, 2020). Notwithstanding this lack of

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attention, social sustainability stands out as one of the three pillars within the definition of sustainable development. In agriculture, this dimension has been found to encompass crucial topics such as farmers' quality of life, social justice, food security, and fair labor conditions (McKenzie, 2004; Diazabakana et al., 2014). The essential requirement for a successful dissemination of sustainability schemes is that consumers are willing to pay a premium to cover the higher costs stemming from the implementation of these practices. Hence, we aimed to explore consumer willingness to pay (WTP) for the provision of social sustainability labeling in the wine market.

The present study was conducted in Italy where there is a very strong and old tradition of winegrowing and winemaking. In 2018, Italy was the third largest global consumer of wine in absolute terms, with an estimated demand of 22.4 million hl, and the biggest world producer with 54.8 million hl, accounting for 19% of the total global wine production (OIV, 2019). Moreover, regarding social inequity, over the last years, the exploitation of migrant labor has drawn widespread attention from the Italian public, media, and policymakers. The last official report on Italian organized crime syndicates in agriculture indicates that irregular forms of employment occur at an estimated rate of 39% and that 400,000–430,000 agricultural workers (more than 50% of the total workforce) were employed without a regular contract or under *caporalato* conditions in 2015; among them, more than 132,000 are considered exposed to high risks of exploitation (Corrado et al., 2018; Osservatorio Placido Rizzotto, 2018; Macrì, 2019). *Caporalato* is a form of illegal gang-master system involving the recruitment, intermediation, and exploitation of irregular, underpaid farm labor that extends all across the country. Labor contractors and providers are responsible for human trafficking, forced labor, health and safety violations, economic exploitation, housing abuses, lack of holiday and/or sick pay, daily dismissals, and other severe infringement of human and worker rights (Zawojska, 2016; Williams and Horodnic, 2018; Melossi, 2021). In this regard, Seifert and Valente (2018) performed a counterfactual analysis applying the Synthetic Control Method to evaluate the causal effects of migrants' illegal recruitment and *caporalato* on labor productivity and wages in the wine supply chain in southern Italy. Results indicated that the illegal, hence underreported, workforce input in vineyards competes with and sometimes substitutes legal labor.

Corrado et al. (2018) and Williams and Horodnic (2018) conducted a comprehensive analysis of the phenomenon of worker exploitation in agriculture at the Italian and European

levels, respectively. They investigated drivers and possible initiatives to eradicate unfair labor practices. Among others, they suggested that the implementation of specific food certification schemes tackling this preeminent issue may prove effective given the growing public concern and consumer awareness. Food labels are considered one of the promising "soft approach" policy tools aimed at encouraging voluntary changes toward more sustainable diet by allowing consumers to make informed buying decisions (Reisch et al., 2013; Noblet and Teisl, 2015; Van Loo et al., 2017). To this end, the European Commission announced the proposal for a legislative framework for a sustainable food labeling system that covers the nutritional, climatic, environmental and social aspects of food products (European Commission, 2020). This action is provided within the new Farm to Fork Strategy which is part of the European Green Deal. A European labeling scheme for sustainability should be including critical social plagues such as labor exploitation in the agricultural sector, if this could effectively foster more sustainable food choices and production methods. Furthermore, the provision of information on workers' rights to consumers would possibly integrate and strengthen the new engagement with social fairness aspects and labor rights compliance of the European Union's Common Agricultural Policy (CAP) for the period 2023–2027 (European Commission, 2021).

Within the food domain, Drichoutis et al. (2017) is the only study that focuses on consumer acceptance regarding the certification of fair working conditions in agricultural production. They investigated Greek consumers' preferences for strawberries with fair labor claims, and they found that people were willing to pay an average premium of 0.53 €/500g (almost 70% more compared to the average price of conventional strawberries). No previous studies have assessed how consumers may value compliance to the standards guaranteeing respectful treatment to workers in the Italian context. Therefore, we sought to explore the impact of the introduction of a fair labor label that certifies wine produced without exploitation and discrimination of workers on consumer preferences. We investigated the Italian consumer demand for a potential fair labor certification and determined if consumers are willing to pay a premium for this attribute. In addition, we performed a segmentation analysis based on respondents' socio-demographic characteristics and personal orientation to better understand the source of taste heterogeneity. Moreover, since certifications addressing environmental concerns in production have already been found to be important drivers for wine preferences (Pomarici et al., 2018; Tait et al., 2019; Ruggeri et al., 2020; Scozzafava

et al., 2021), we also tested for complementarities or possible competition effects between different attributes pertaining to the social and environmental domain of sustainability.
To pursue our research objectives, we conducted a hypothetical choice experiment on a sample of 500 Italian wine consumers. Data obtained through the experiment were analyzed by applying the Random Parameter Logit model to detect consumers' taste heterogeneity and elicit marginal WTP values; then, the data were further inspected using a Latent Class Model to define and describe the potential market segments interested in fair labor certification. The article is structured as follows: the next section describes the methodology and econometric approach used in the study; after that, our results are presented and discussed; lastly, conclusions and the main implications of this work are reported.

Methods

To elicit consumer preferences for social sustainability attributes on wine, we applied a Choice Experiment (CE) approach. Since the fair labor label does not currently exist in the Italian wine market, we addressed this research gap by performing a hypothetical experiment. CEs are consistent with the Lancaster theory of consumer demand (Lancaster, 1966) and Random Utility Theory (McFadden, 1974) and are one of the most popular stated preference methods used in applied economics. One of their main advantages is that they allow to elicit the value of both private and public goods capturing the trade-offs between multiple products' attributes. For this reason, they have been extensively applied in food research (Syrengelas et al., 2018; Lin et al., 2020; Luckstead et al., 2021), as well as studies on wine preferences (Mueller Loose and Remaud, 2013; Ghvanidze et al., 2017; Boncinelli et al., 2019; Tait et al., 2019; Bazzani et al., 2020; Lim and Reed, 2020).
The data were collected by performing a cross-sectional online survey involving Italian consumers while incorporating the CE. The survey was conducted through a panel recruitment agency (Toluna Inc.) in April 2021. People over 18 years of age, i.e., the legal drinking age in Italy, who had purchased the product at least once were eligible to participate in the research. In addition, those who declared to never consume wine were screened out from the survey. Besides the CE, the survey was intended to collect consumers' socio-demographic characteristics, wine consumption habits, and the food values scale (Lusk and Briggeman, 2009). Lusk and Briggeman (2009) identified a set of food-specific properties

that motivates food choices and it has been extensively applied to explain consumer behavior (Bazzani et al. 2017; 2018; Yang and Hobbs, 2020). In our survey, respondents were asked to rate the importance of each food value in the purchasing decision for wine on a 7-point Likert scale ranging from 1 (not at all important) to 7 (extremely important). As per Lusk and Briggeman (2009), each food value was accompanied by a brief description. The items of the scale provided to the consumers were slightly adjusted for the wine-purchasing situation and described as follows: (*i*) Appearance (extent to which wine looks appealing); (*ii*) Safety (extent to which consumption of wine will not cause illness); (*iii*) Fairness (the extent to which all parties involved in the production of the wine equally benefit); (*iv*) Taste (extent to which consumption of the wine is appealing to the senses); (*v*) Environmental impact (effect of wine production on the environment); (*vi*) Naturalness (extent to which wine is produced without modern technologies); (*vii*) Origin (where the agricultural commodities were grown); (*viii*) Convenience (ease with which wine is consumed); (*ix*) Price (the price that is paid for the wine); (*x*) Tradition (preserving traditional consumption patterns); and (*xi*) Nutrition (amount and type of fat, protein, vitamins, etc.).

Product and attributes' selection

In the CE, participants were asked to make repeated hypothetical buying decisions for a bottle of red wine. Wines are very diversified, complex goods compared with any other food product and their supply varies according to a huge number of different attributes and context-related features (Lockshin and Corsi 2012; Boncinelli et al., 2020). To make the choice situation appear more realistic, consumers were instructed to imagine that they wanted to buy a bottle of Chianti Classico DOCG[28] wine for a special occasion. This specific consumption situation was defined because different purchasing occasions have been proven to condition the preference formation for wine (Hall et al., 2001; Boncinelli et al., 2019). The Chianti Classico designation of origin was chosen since it is one of the most prominent designations of origin in the Italian wine market (Casini et al., 2020) that simultaneously fits for special occasion choices (Scozzafava et al., 2018). With regards to the experimental

[28] The Italian DOCG (Denominazione di Origine Garantita e Controllata) label is a PDO (Protected Designation of Origin) certification. This Geographical Indication is a quality scheme recognized under EU Regulation (CE) 479/2008.

design, we selected five attributes regarding wine: the price, the fair labor condition claim, the 100% recycled glass label, the organic label, and the Wine Spectator quality score (table 1).

As wine prices vary across a very broad range[29], we set the monetary attribute levels as individual-specific (following Erdem, 2015). Specifically, before introducing the choice task, each respondent had to indicate the price range he/she usually paid for a bottle of red wine for a special occasion. We provided four options: (*i*) 5.50–12.49€; (*ii*) 12.50–19.49€; (*iii*) 19.50–26.49€; and (*iv*) 26.50–33.49. These price ranges cover 90% of the distribution of retail prices for Chianti Classico DOCG wine (IRI-Infoscan, 2017). We considered the reference price level as the average value in each segment. The other price levels were obtained as 20% and 40% increase and 20% decrease for each reference level. This mechanism provided realistic alternatives to respondents since the price levels in the choice tasks were consistent with their wine purchasing habits (for other choice experiments applying attribute levels pivoted from individual-specific reference levels, see Thiene et al., 2018; Boncinelli et al., 2020).

Given our research objective for exploring the social sustainability label's effect on consumers' wine preferences, we included the fair labor attribute as the absence or presence of the corresponding label on the wine bottle. The fictitious claim that we proposed reads as follows: "wine produced without the exploitation and discrimination of the workers" which was accompanied by a logo. The whole label was implemented starting from the existing fair labor label applied by COOP, one of the major Italian food retail chains, on its products. At the time the study was conducted, COOP's claim was absent on wine bottles. On the other hand, other social responsibility certifications were available (e.g., "S.A.8000", "V.I.V.A. sustainable wine", and "Equalitas"). However, these sustainability labels are unknown to most consumers or do not explicitly address the protection of workers' rights. In contrast, we opted for adjusting COOP's fair labor claim to our research purpose since it was clear and self-explanatory. This last feature is relevant as we wanted to avoid biasing consumer responses by instructing them on the meaning of the certification ex-ante.

[29] According to the 2017 IRI-Infoscan data, the large-distribution price range of PDO wine was 0.5–240 €/L in Italy, whereas the Chianti Classico DOCG price range was 2.5–67.9 €/L.

We included two other environmental attributes, namely the organic and recycled glass claim, to test for complementarities or potential competition effects between the social and environmental dimension of sustainability attributes. We assessed this by allowing for interaction effects in the experimental design. To this end, the organic certification was selected as it is the most well-known sustainability label. The levels were defined as the presence or absence of the European organic certification. However, organic certification cannot be considered an attribute of environmental sustainability stricto sensu. Indeed, many authors recognized the multiple halo effects exerted by the presence of organic labels with regard to manifold product dimensions. In other words, consumers tend to perceive organic products not only as more environmentally sustainable but also as, for instance, healthier, tastier, lower in calories, or more appealing with respect to their conventional counterparts (Lee et al., 2013; Wiedmann et al., 2014; Apaolaza et al., 2017). For this reason, we included in the experimental design a purely environmental attribute, namely the recycled glass label. It was presented to consumers as the absence or presence of the "100% recycled glass" claim. Lastly, the Wine Spectator score (Wine Spectator, 2021) was added using the 80/100 and 95/100 ratings as levels[30], because critic scores are an established quality cue among wine consumers (Costanigro et al., 2014; Williamson et al., 2016; Tait et al., 2019; Ruggeri et al., 2020) and are commonly adopted by Italian wine retailers.

Table 1. Attributes and Levels used in the CE.

Attribute	Levels
Organic	None[a], EU "Organic" label
Fair Labor	None[a], Fair Labor label
Recycled glass	None[a], "100% recycled glass" label
Wine Spectator Score	80/100[a], 95/100
Price (€/0,75 L bottle)	
Reference price 9€	7.20€, 9€, 10.8€, 12.6€
Reference price 16€	12.8€, 16€, 19.20€, 22.40€
Reference price 23€	18.40€, 23€, 27.6€, 32.2€
Reference price 30€	24€, 30€, 36€, 42€

Notes: [a] denotes the base level. The reference price depends on each individual response to the following: "Please, select how much would you spend to purchase a bottle of wine for a special occasion".

[30] The 80/100 and 95/100 Wine Spectator ratings correspond respectively to the following definitions: Very Good, a wine with special qualities; Classic, a great wine. These statements were not provided to the respondents during the survey.

As mentioned previously, no information about the fair labor claim, as well as the other attributes, was provided to consumers before the CE to avoid any learning effects. Before participants started the CE, a cheap talk script with a budget constraint reminder was applied as ex-ante hypothetical bias mitigation strategy (Cummings and Taylor, 1999). Furthermore, the choice sets and alternatives within each set were randomized among respondents to avoid order effects.

Experimental design

The full combination of the five attributes results in 64 (2^4 x 4^1) wine bottle profiles and 2,016 (64 x 63 x 0.5) unique choice sets. We applied a Bayesian D-efficient heterogeneous design (Sándor and Wedel, 2001; 2005) to allocate attributes and attribute levels among alternatives, reducing the number of choice tasks per respondent while considering heterogeneity for the reference price level. Heterogeneous designs consist of multiple simultaneously optimized sub-designs such that a group of respondents in the sample is assigned to only one of the different sub-designs. Sándor and Wedel (2005) demonstrated that heterogeneous designs are more efficient and robust for discrete choice model estimation than homogeneous designs (i.e., all respondents get the same design). Indeed, heterogeneous designs allow for a greater variation in the attribute levels, i.e., a higher number of choice sets, without increasing the cognitive burden for the respondents. Following Jonker and Bliemer (2019) and de Bekker-Grob et al. (2020), we generated a heterogeneous design consisting of 4 sub-designs with 16 choice sets each (one sub-design per each group defined by the four reference prices). Every sub-design was divided into two blocks of eight choice tasks to further reduce the cognitive burden on respondents and to mitigate fatigue effects. The combination of the four sub-designs was optimal in estimating a Multinomial Logit Model (MNL). MNL-optimized designs are proven to perform well in the estimation of Random Parameter Logit Models too (Bliemer and Rose, 2010). To obtain the Bayesian priors and gather the relative weight of each sub-design in the final heterogeneous design, a pilot survey was previously run on a sample of 78 respondents, implementing a D-efficient design with zero-fixed priors. Both in the pilot and final stage, the designs were specified to allow for the robust estimation of all main effects plus the two-way interactions among the three sustainability attributes. This provides the possibility to

test for complementarities or substitution effects between the social and environmental attributes. The design was constructed using the software Ngene (ChoiceMetrics, 2018). As a result, each choice set included two unlabeled alternatives of wine plus a no-buy option to avoid forcing the participants to choose one of the presented alternatives of wine. The choice task was displayed to participants in a visual format (see the Appendix for a sample choice task).

Econometric model

According to the Random Utility Models (McFadden, 1974), the utility that consumer *i* derives from the wine alternative *j* in the choice task *t* can be written as follows:

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} \quad (1)$$

where V_{ijt} is the systematic part of the utility function, and ε_{ijt} is the stochastic component capturing the unobservable determinants of choices. V_{ijt} can be expressed as

$$V_{ijt} = nobuy + \alpha Price_{ijt} + \boldsymbol{\beta}'\mathbf{X}_{ijt} \quad (2)$$

where *nobuy* is an alternative-specific constant for the no-buy option. *Price* enters the model as a continuous variable taking the experimentally designed price levels. α is the marginal utility of price, and **β'** is the vector of the parameters of the **X** attributes in the choice task *t*. Further, ε is the random error term i.i.d. Type 1 extreme Value. We estimated the parameters using a panel structured Random Parameters Logit Model with an Error Component (RPL-EC) (Scarpa et al., 2005; Scarpa et al., 2007) that accommodates for taste heterogeneity, assuming that β_i varies randomly across individuals. Moreover, the error component takes into account that the unobservable utilities from the two hypothetical wine alternatives in the choice tasks are more likely to be mutually correlated than with the no-buy option (Scarpa et al., 2005). The model allows to capture the extra variance of the purchasing alternatives by letting them share an extra zero-mean error term. Therefore, stemming from

Equation (2), two RPL-ECs were specified. Model 1 is estimated in utility space and can be written as follows:

$$U_{ijt} = nobuy + \beta_{1i}Fair\_labor_{ijt} + \beta_{2i}Organic_{ijt} + \beta_{3i}Recycled_{ijt} + \\ + \beta_{4i}Scores_{ijt} + \gamma_1(Organic*Fair\_labor)_{ijt} + \gamma_2(Organic*Recycled)_{ijt} + \\ + \gamma_3(Recycled*Fair\_labor)_{ijt} + \alpha PRICE_{ijt} + \eta_{ijt}(1 - Nobuy_{ijt}) + \varepsilon_{ijt} \quad (3)$$

where *Fair_labor*, *Organic*, *Recycled,* and *Scores* are dummy variables, taking the value of 1 if the wine has the fair labor, organic, 100% recycled glass labels and 95/100 Wine Spectator score, respectively, and 0 otherwise. The coefficients of these parameters were assumed to be independently and normally distributed, allowing individual preferences for these attributes to be either positive or negative. γ_s are the parameters of the interaction terms representing the shift in utility when the attributes are simultaneously present in the wine alternative and are assumed to be fixed, in addition to the price coefficient. η_{ijt} is the error component of the buying options specified as normally distributed.

To assess the robustness of our results and estimate the marginal WTP values, we employed a WTP space approach (Train and Weeks, 2005; Scarpa et al., 2008). The utility in Equation (3) may be reparametrized such that the coefficients enter the model already scaled by the price/scale parameter; hence, they can directly be interpreted as the marginal WTP values for the non-monetary attributes. Therefore, Model 2 is specified as follows:

$$U_{ijt} = \varphi_i [(-1) PRICE_{ijt} + nobuy + \omega_{1i}Fair\_labor_{ijt} + \omega_{2i}Organic_{ijt} + \omega_{3i}Recycled_{ijt} + \\ + \omega_{4i}Scores_{ijt} + \delta_1(Organic*Fair\_labor)_{ijt} + \delta_2(Organic*Recycled)_{ijt} + \\ + \delta_3(Recycled*Fair\_labor)_{ijt} + \eta_{ijt}(1 - Nobuy_{ijt})] + \varepsilon_{ijt} \quad (4)$$

where φ_i is the price/scale parameter following a log-normal distribution. ω and δ are the marginal WTP estimates. The remaining elements of Equation (4) are specified as in (3).

In addition, the variability in consumer tastes for sustainability labels was further inspected by estimating a Latent Class Model (LCM), the semi-parametric version of a mixed model such that the heterogeneity is modeled as discrete in C mass points. C is the number of classes assumed for the model specification (Hynes and Greene, 2016). Each class represents a group of consumers, and thus individual preferences are homogeneous within a class,

whereas they are heterogeneous between classes. Therefore, the parameters for each attribute are class-specific, β_c. The choice probability for individual *i* belonging to class *c* can be modeled as Multinomial Logit (Greene and Hensher, 2003). As the classes are latent to the analyst, the probabilistic assignment of individual *i* to one of the C classes also needs to be defined. The probability that the consumer *i* belongs to class *c* also takes the MNL form (Boxall and Adamowicz, 2002). Thus, the probability P_{ijt} that individual *i* chooses alternative *j* among J alternatives in the choice task *t*, unconditionally on the latent class the individual belongs to, can be expressed as the product of probabilities and is given by the following equation:

$$P_{ijt}=\sum_{c=1}^{C}\left[\frac{\exp(\boldsymbol{Z_i}'\boldsymbol{\theta_c})}{\sum_{c=1}^{C}\exp(\boldsymbol{Z_i}'\boldsymbol{\theta_c})}\frac{\exp(\boldsymbol{X_{jt}}'\boldsymbol{\beta_c})}{\sum_{j=1}^{J}\exp(\boldsymbol{X_{jt}}'\boldsymbol{\beta_c})}\right] \quad (5)$$

where $\mathbf{Z}_i$ is the vector of the observed respondent's characteristics; namely, the food values and the socio-demographic features, and $\boldsymbol{\theta}_c$ is the parameter vector for each class.
All the models were estimated using the maximum likelihood method in R (gmnl package).

Results and Discussion

A total of 500 Italian wine consumers completed the questionnaire. The descriptive statistics of the sample are reported in table 2. The respondents were mainly men (58.6%), with a median age of 43 years. Almost 70% of the sample was employed and declared to have a fair economic situation. Although all the socio-demographic categories were well represented, there was a slight predominance of younger respondents and well-educated categories.

Table 2. Descriptive statistics of the sample (n = 500).

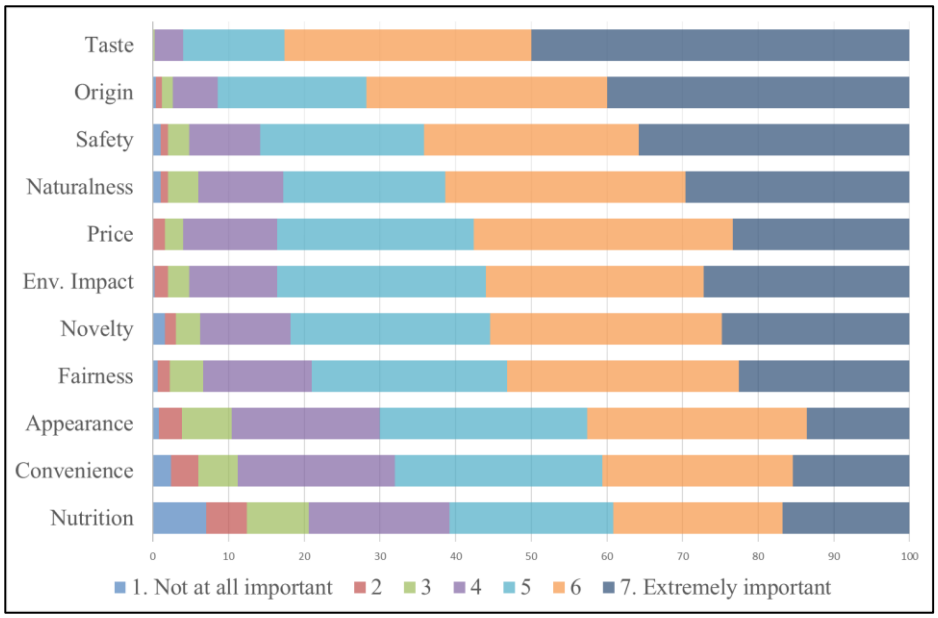
Characteristic	(%)
Gender	
Male	58.60
Female	41.20
Not declared	0.20
Age group	
18–34	24.40
35–54	57.00
> 54	18.60
Education	
Primary education	6.20
Secondary education	51.20
Tertiary education	42.60
Occupational status	
Employee	68.40
Student	7.40
Retired worker	2.80
Unemployed	9.40
Homemaker	12.0
Monthly Income[a]	
With high difficulty	3.40
With difficulty	6.20
With low difficulty	44.00
With ease	41.30
With high ease	4.80
Wine consumption frequency	
Less than once per month	2.4
Once or more per month	10
Once or more per week	47
Daily	40.6
Wine Subjective Knowledge (mean score)	4.64

Note: [a] Respondents' answers to the question: "How do you make ends meet?"

Figure 1 displays the individual ratings for the 11 food values. The top three stated food value items driving wine purchasing choices are Taste, Origin, and Safety, whereas

Appearance, Convenience, and Nutrition were noted to be the bottom three. In line with Yang and Hobbs (2020) referring to Canadian consumers, we found that Italian respondents deliberately stated to prioritize private attributes rather than the public ones when making purchasing decisions[31].

Figure 1. Individual ratings for the 11 food values.



Notes: Env. Impact indicates Environmental Impact. Bars are sorted from the most to the least important.

Table 3 lists the results from the two RPL-EC models, and as expected, the two models were consistent. As a concern for Model 1, the no-buy constant was negative and statistically significant, indicating that consumers increase their utility when choosing one of the two alternatives of wine. This suggests that the attributes selected in the experimental design were relevant to consumers' purchasing decisions for a bottle of wine. The price coefficient was also negative and statistically significant, which indicates that consumer utility decreases when price increases. The coefficients of the non-monetary attributes were all positive and statistically significant at 99%, proving that each one of them positively affects

[31] Public attributes relate to desirable unobserved qualities in foods whose production implies improvement in public goods or positive externalities for the society (such as eco-friendly, animal welfare, low greenhouse gas emissions, etc). Conversely, private attributes provide benefits strictly to those who consume these specific products (for instance, health properties, taste, and nutritional composition).

individual utility, albeit differently. In contrast, the interaction effect between the fair labor claim and the recycled glass label was not statistically significant. This outcome implies that the preference toward the fair labor wine does not depend on the importance people attach to the pure environmental dimension of sustainability, at least for the labels included in the experiment. Conversely, we found statistically significant interactions between the organic and recycled glass labels and between the organic and fair labor labels, both with a negative sign. In other words, our findings indicate a possible competition effect between the organic certification and the other two schemes, whilst no detrimental effect was observed between the social and pure environmental label. The results suggest that these certifications share part of the dimensions of wine quality and that the organic attribute captures heterogeneous and diverse interests, including social fairness benefits, as underlined in other food-related studies (Meas et al., 2015; De Marchi et al., 2016; Akaichi et al., 2020), and for wine preferences (Mueller Loose and Remaud, 2013). The standard deviation of the error component was statistically significant, confirming the hypothesis of heteroskedasticity across the utilities of the hypothetical alternatives. Furthermore, standard deviations of all attributes were significant, denoting a high variability in the parameters' distribution across the population. This highlights the strong heterogeneity in consumer tastes for the wine attributes being considered. Therefore, the implementation of RPL-EC was appropriate to the analysis.

Table 3. Results from the RPL-EC models specified in preference and WTP space.

	Model 1 Preference space model		Model 2 WTP space model	
	Coefficient	z-value	Coefficient	z-value
Random Parameters				
Organic	1.90***	13.99	9.58***	15.48
Fair Labor	1.41***	10.95	7.42***	12.61
Recycled glass	1.19***	9.26	5.59***	9.56
Wine Spectator Score	0.51***	8.86	2.90***	11.30
Non-Random Parameters				
Price	-0.18***	-20.19		
No Buy	-4.43***	-16.48	-24.81***	-28.26
Organic X Fair Labor	-0.53***	-4.26	-2.39***	-4.19
Organic X Recycled	-0.59***	-4.42	-2.56***	-4.14
Fair Labor X Recycled	-0.15	-1.09	-0.56	-0.95
Standard Deviations of Random Parameters				
Organic	1.80***	14.36	8.89***	17.53
Fair Labor	1.25***	10.65	6.01***	12.40
Recycled glass	0.79***	8.38	4.33***	10.64
Wine Spectator Score	1.07***	11.32	4.84***	12.65
Error component (η)	3.79***	19.41	23.11***	24.76
Participants	500		500	
Observations	4000		4000	
Akaike Information Criteria	6258.64		6259.29	
Bayesian Information Criteria	6409.69		6416.64	
Log-Likelihood	-3105.30		-3104.60	

Note: (***) indicates significance at a 1%

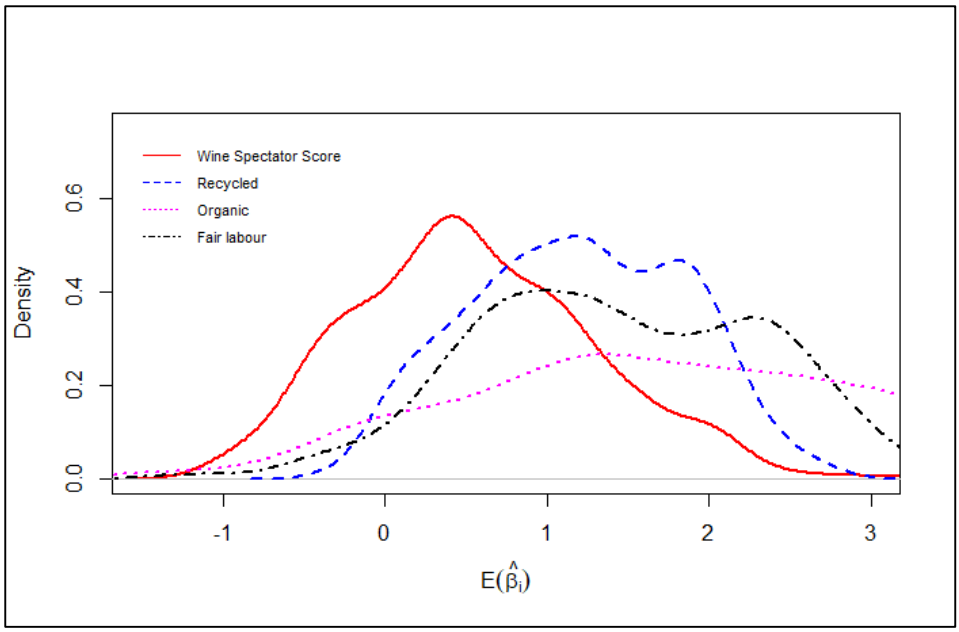
From the RPL-EC in WTP space, we derived the marginal WTP for the attributes. Considering the sustainability of the wine, the organic certification received the highest price premium (€ 9.58 per bottle). As expected, the organic attribute was the most preferred among

the sustainability labels on wine bottles. Lim and Reed (2020), Mueller Loose and Remaud (2013), Bazzani et al. (2020), and Ruggeri et al. (2020) also found evidence that the organic claim was the most valuable sustainability attribute for wine choices. This might be due to the fact that, among the sustainability certifications, the organic claim is the most trusted and familiar. The fair labor label ranked second, and, on average, consumers were willing to pay €7.42 more for a bottle of wine certified to be produced in compliance with fair labor conditions compared with the same wine without this guarantee. The result was unexpected since it refers to a fictitious label, although it is in line with previous findings by Drichoutis et al. (2017), applying the fair labor certification for strawberries. The plausible reason may be rooted in the fact that we likewise focused on a salient societal concern among Italian consumers. Other studies on the wine industry derived negligible interest toward social issues when compared with other environmental aspects, as seen in Mueller Loose and Remaud (2013), Ghvanidze et al. (2017), and Tait et al. (2019). However, in these cases, fair social attributes were addressed through a generic claim, for instance, "socially responsible" or "social responsibility", which may have resulted too vague or unclear to consumers. Indeed, Grunert et al. (2014) found that low usage of environmental or ethical labels is associated with little understanding by consumers. This corroborates our decision to opt for a direct and self-explanatory claim, albeit fictitious. The marginal WTP for the recycled glass label and the Wine Spectator quality score were €5.59 and €2.90 respectively. The latter was the least valued attribute, in contrast with Costanigro et al. (2014) and Tait et al. (2019). Probably, fixing the denomination of origin across the alternatives and asking participants to make buying decisions for a bottle of Chianti Classico DOCG wine was already a guarantee for strong quality to drive their choices. As an indication of the consistency of our findings, the estimated WTP for wine sustainability attributes were in line with the one elicited by Tait et al. (2019) and Ruggeri et al., (2020) for Sauvignon Blanc wine in California and Franciacorta DOCG wine in Italy respectively.

Figure 2 displays the distribution of the individuals' conditional mean for the parameter for each of the attribute considered, based on Model 1 estimates. Even though the curves were very different from each other, most of the respondents concentrated on the positive part of the distributions. The density for the Wine Spectator score was higher around zero and lower for negative conditional means. Conversely, both the organic and fair labor label were described by platykurtic curves with the largest part of the conditional means assuming

positive values. In addition, a consistent group of respondents exhibited values in the ties of the distributions, underlining the high preference heterogeneity for these attributes. As pointed out by the distributions, the vast majority of the sample (more than 80%) was found to be willing to pay a premium for the provision of the fair labor certification on wine bottles.

Figure 2. The distribution of the individuals' conditional mean for the wine attributes.



To further investigate the heterogeneity among consumer tastes, we ran a LCM using the food values, gender, age, and education as class membership predictors. We adopted a three-class structure as it was the model minimizing the Bayesian Information Criteria (BIC). In addition, we observed only a marginal improvement in the Akaike Information Criteria (AIC), switching from a 3- to 4-class representation.

Table 4 shows the results of the segmentation analysis. The price coefficient was always negative and statistically significant and, overall, all the classes were positively prone to the three wine sustainability labels proposed. Class 1 is the reference level in defining the effect of the individual characteristics on consumer preferences and accounted for the 43% of respondents. The fair labor claim ranked third among the SL and a possible competition effect with the recycled glass label was detected. Indeed, the interaction term was negative and significant ($p<0.1$). Class 2, which comprised 37% of the interviewees, attached positive

value to the sustainability attributes as well, albeit less pronounced in contrast to Class 1. This segment showed the lowest interest for the presence of the fair labor label. Moreover, as compared with the other groups, consumers were more sensitive to the Wine Spectator score and price attribute. In addition, they were the most interested in purchasing a bottle of wine, as denoted by the highest coefficient of the no-buy option. This segment was denoted by younger respondents, whereas the other two socio-demographic characteristics were not significant. With regard to the food values, Class 2 exhibited inferior attention to the Fairness aspect when making wine purchases, which was consistent with the magnitude of the fair labor coefficient. Conversely, they were significantly more attentive than Class 1 to the private attributes, i.e., Taste, Nutrition, Safety and Appearance, when making wine choices. Class 3 (20% of the sample) reported the same preference structure of the RPL-EC models for the sustainability labels. In this case, the fair labor label reported the highest coefficient. A remarkable detrimental effect was found when the social and organic certifications were simultaneously present on the bottle as the interaction term was negative and significant. Class 3 consisted of a higher proportion of female, younger and less educated consumers than Class 1 and 2. The probability of belonging to this segment was higher for individual devoting a stronger attention to public values (i.e., Fairness and Environmental Impact) and less consideration to Price and Taste with respect to the other two groups. We also found important emphasis on Nutrition, Tradition, Naturalness, Safety, and Appearance as food values driving their purchase decisions.

The LCM results confirm the high heterogeneity among consumer tastes for sustainability labeling. Overall, the segments of consumers were all positively inclined toward the three labels, differing only in the ranking order of the preference structure and in the magnitude of the relative weights in the utility functions. The group less involved in the sustainability of the wine devoted higher attention to private values (such as Safety or Taste); conversely, the class denoted by a higher interest in the fair labor claim attached more importance to public values (i.e., the fairness of the production system and the environmental impact). This suggests that consumers strongly associated with the fair labor certification gain utility from purely altruistic attributes rather than from the egoistic ones, in line with Briggeman and Lusk (2011) and Maaya et al. (2018).

Table 4. LCM results.

	Class 1		Class 2		Class 3	
	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
Organic	1.40***	4.80	0.87***	5.76	1.60***	8.10
Fair Labor	1.17***	3.90	0.30**	2.10	1.46***	7.81
Recycled glass	1.42***	4.94	0.43***	3.10	0.97***	5.21
Wine Spectator Score	-0.01	-0.10	0.67***	7.05	0.25***	2.74
Price	-0.13***	-6.43	-0.22***	-15.18	-0.02**	-2.25
No Buy	0.49	1.11	-5.72***	-14.19	-1.29***	-3.78
Organic X Fair Labor	-0.30	-1.15	-0.11	-0.69	-0.33*	-1.76
Organic X Recycled	-0.99	-3.71	-0.66***	-3.85	-0.05	-0.27
Fair Labor X Recycled	-0.53*	-1.88	0.17	1.04	0.08	0.45
Estimated prior probabilities for class membership						
Constant	-		-0.16	-0.35	-0.77*	-1.66
Age	-		-0.01***	-3.36	-0.03***	-5.85
Male	-		-0.02	-0.18	-0.25**	-2.24
Tertiary education	-		0.14	1.37	-0.40***	-3.79
Food Values						
Appearance	-		0.08*	1.92	0.09*	1.68
Safety	-		0.16***	3.36	0.13**	2.23
Fairness	-		-0.27***	-5.07	0.26***	4.00
Taste	-		0.29***	4.36	-0.37***	-4.93
Environmental Impact	-		-0.09	-1.56	0.47***	6.54
Naturalness	-		-0.06	-1.27	0.15**	2.48
Origin	-		0.09	1.63	-0.01	-0.21
Convenience	-		0.03	0.68	-0.08	-1.51
Price value	-		-0.15***	-2.90	-0.52***	-9.03
Tradition	-		0.00	0.10	0.17***	3.10
Nutrition	-		0.17***	4.39	0.30***	6.15
Class size	0.43		0.37		0.20	
Akaike Information Criteria	6390.22					
Bayesian Information Criteria	6748.98					
Log-Likelihood	-3104.6					

Notes: (***), (**), and (*) indicate significance at a 1%, 5% and 10% respectively; Coeff.: coefficient.

Conclusions and Implications

The findings confirm that producing and marketing wine with labels addressing environmental aspects is a profitable strategy for firms as well as a promising tool to promote more sustainable production patterns (Schmit et al., 2013; Pomarici et al., 2018; Pomarici and Vecchio, 2019; Tait et al., 2019; Ruggeri et al., 2020). In addition, we provided evidence that consumers also attach significant importance to the provision of socially relevant attributes. Specifically, we outlined the potential effect of the presence of a fair working

condition label in the Italian market. Overall, our results suggest that the social attribute was valuable to wine consumers and that preferences toward sustainability labeling are complex and very heterogeneous in terms of which one of the two underlying sustainability dimensions is incorporated in the product quality.

Our findings indicate that winemakers may consider adopting fair labor production schemes as consumers exhibit a high premium for the label; thus, it is expected that including this kind of credence attribute would increase the demand for the product. This premium price could potentially foster wineries and winegrowers to engage in more socially sustainable practices as they may generate profits. One of the reasons for the exploitation of workers in the agri-food supply chain is due to the pressure by the oligopolistic downstream and upstream sectors on farmers. Their market powers bring about an iniquitous distribution of risks, costs, and profits along the supply chain (Hunt, 2014; Melossi, 2021). This imposes farmers to adopt price-cutting strategies, and, as a result, labor costs get squeezed. Therefore, to mitigate the issue, retailers should pass the premium associated to the fair labor certification to producers to alleviate the pressure on costs.

On the policy side, our results emphasize that efforts towards the achievement of sustainable consumption and production patterns should truly embrace a holistic approach to sustainability. Preeminent social concerns are often disregarded in favor of environmental aspects; instead, both dimensions should be equally weighted in the implementation of legislative acts and policy tools aimed at pursuing sustainability.

More specifically, the spread of food certification schemes involving fair working treatment would be synergic to the European and National regulatory efforts to prevent and eradicate unethical or illegal labor practices in the agri-food supply chain. The European labeling scheme on sustainability is already advocated within the European Farm to Fork strategy (European Commission, 2020). Our findings are expected to inform policymakers that such an overarching scheme should tackle unfair labor treatment in agriculture, among other sustainable aspects, as we found that this issue is of concern to wine consumers and that vineyards constitute valuable assets in the European agricultural sector. This would satisfy a potential market demand while promoting improvements in the farm laborers' protection. Furthermore, the Farm to Fork strategy should encompass the respect for agricultural workers' rights to synergistically reinforce the new CAP focus on fairer labor conditions. Indeed, for the first time since its introduction in 1962, the policy has incorporated the social

conditionality to bind the farmer income support to the respect of basic social rights and employment conditions for all agricultural workers alongside the environmental requirements (European Commission, 2021). Strenuous efforts are warranted by governments and authorities in the monitoring process to ensure that requirements on labor conditions for the label are effectively fulfilled as also that mandatory minimum standards imposed through law are in place.

At the national level, the Italian Senate has initiated the regulatory path to establish a new ethical label ("*Marchio etico del lavoro di qualità*"), which certifies respect for workers' rights. The aim is to counteract the exploitation of workers and the *caporalato* phenomenon which severely affect the agri-food system in Italy. The law proposal currently states that firms which adhere to the scheme will benefit from fiscal incentives, advantages in public calls for tenders and promotion and information campaigns about the new label (Senato della Repubblica, 2021). To this extent, our findings can effectively inform national policymakers since the stated WTP for a fictitious fair labor label may reflect Italian consumers' acceptance of the provisions of this potentially ethical label. The premium price would ultimately further encourage companies to enter the labeling scheme.

The existing international certification covering the same issue is the "S.A.8000", which actually attests the social responsibility and commitment of the enterprise toward workers. Alternatively, both the Italian voluntary wine schemes "V.I.V.A. sustainable wine" and "Equalitas" address the overarching concept of sustainability in the production process, including the corporate social commitment of the wineries toward workers, along with many other environmentally sustainable practices. Future research should concentrate on uncovering the reasons why the existing labels tackling this issue are not commonly used on food products, remaining largely unknown among consumers despite there being a considerable WTP for these. Moreover, given the hypothetical nature of our experiment, more studies should focus on this topic by applying a real experiment or an experimental auction to correct for the hypothetical bias. Consistently, our results may also suffer from social desirability bias, hence future works should try to mitigate or control for the social desirability responding behavior of participants. Lastly, we ran the choice experiment focusing on a bottle of Chianti Classico DOCG for a special occasion. This specific designation of origin was chosen since it is the most commercialized in the Italian large distribution chains (Casini et al., 2020), as also one of the most familiar and consumed wines

in the Italian supply. These characteristics were held constant across all wine alternatives to minimize the choice task complexity to participants while preserving attributes critical to the decision-making process. As a result, the conclusions can be extended to the market segment of medium-high priced wines, although not generalizable to the whole wine supply. Further studies should address the applicability of our findings to different wines and purchase occasions.

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Appendix

Figure A1. CE sample choice task.

Note: English translation of the Italian original version

Research article 3. Investigating consumer preferences for sustainable packaging through a different behavioural approach: A Random Regret Minimization application

Abstract

Plastic pollution causing the near-permanent contamination of the environment is a preeminent concern. The largest market sector for plastic resins is packaging, and the food industry plays a major role in producing plastic packaging waste. Therefore, the gradual switch of the food system towards pro-environmental packaging strategies is required to contain the plastic packaging waste issue. To this extent, this study aimed to investigate how food consumers relatively value the provision of different sustainable packaging alternatives, namely the unpackaged option and bioplastic packaging. Moreover, to shed light on the behavioural mechanism underlying the decision-making process for sustainable packaging, we considered two different decision paradigms: the traditional Random Utility Maximization and Random Regret Minimization framework. Overall, our results indicate that consumer tastes are highly heterogeneous and that preference patterns change according to the behavioural approach assumed by individuals. Policymakers and marketers of food industries need to carefully consider the differences in the decision mechanism of consumers when implementing strategies to encourage pro-environmental food choices. Notably, our findings elucidate on the importance to embrace other perspectives as well, and not simply limit to utility maximization, to fully comprehend the decision-making process of consumers for sustainable foods.

Keywords: Sustainable food choices; Bioplastic packaging; Unpackaged food; Choice experiment; Hybrid latent class; Pro-environmental behaviour.

Introduction

The irreversible intrusion of plastics in the environment is a serious threat contributing to climate change (Ford et al., 2022), biodiversity loss (Gall and Thompson, 2015) and risks to human health (Waring et al., 2018). The total amount of virgin plastics manufactured from

1950 through 2015 is 7,800 million metric tons (Geyer et al., 2017). As a consequence, plastics constitute the largest share of marine debris (between 60 and 80%) and are ingested by organisms in the marine ecosystem, thus being transferred in the food chain (Setälä et al., 2014; Gall ad Thompson, 2015). Nonetheless, the plastic global production is forecasted to double in the next 20 years (World Economic Forum, 2016).

The largest market sector for plastic resins is packaging (Jambeck et al., 2015; Barnes, 2019). In Europe, the packaging industry covers the 40% of plastic material demand (Plastics Europe, 2020), and the plastic packaging waste reached a total of 15.4 million tonnes in 2019, an increase of 26.4% compared to 2009 (Eurostat, 2019). The reuse and recycling of these materials still remain under-implemented (European Commission, 2018). As a result, the development of sustainable solutions in the packaging industry is urgently needed to mitigate the global externality of plastic pollution.

In this context, food-related packaging like drinking bottles, food wrappers, lids, take-away containers, and grocery bags are among the most common plastic waste products (UNEP, 2018). Food companies employ single-use plastic taking advantage of its durability, reduced weight, and low cost to prevent waste and guarantee food safety while ensuring high throughput (Leal Filho et al., 2019; Phelan et al., 2022). Given its major role in producing plastic packaging waste, the food industry is required to orientate towards packaging solutions alternative to plastic to improve the environmental performance of the supply chain (Phelan et al., 2022). To this end, packaging-free products and bioplastic packaging may represent convincing strategies to contrast the plastic pollution issue (Fogt Jacobsen et al., 2022). Previous research explored the consumer preferences and valuation for both bioplastic packaging (Herbes et al., 2018; Klein et al., 2019; De Marchi et al., 2020; Wensing et al., 2020) and the absence of packaging (Fernqvist, et al., 2015; van Herpen et al., 2016; Marken and Hörisch, 2019) in the food domain. However, most studies concentrate solely on one type of environmental-friendly packaging (Herbes et al., 2018). Scarce attention has been paid on the assessment and comparison of consumer acceptance for different sustainable packaging configurations (Herrmann et al., 2022). Therefore, further evidence on the interplay among multiple pro-environmental packaging solutions is needed.

Moreover, consumer pro-environmental choice behaviours have been traditionally investigated under the utility maximization decision rule, which postulates that people are rational and choose to maximize their expected utility. As a result, the vast majority of

Discrete Choice Experiment (DCE) applied in literature makes use of the associated Random Utility Maximization (RUM) models (McFadden, 1974) to analyse choice data. Nevertheless, different behavioural paradigms departing from utility maximization have been implemented so far to capture the cognitive aspects left out from this classic framework. Among the others, Chorus (2010) proposed the Random Regret Minimization (RRM) approach, the underlying assumption of which is that individuals act to minimize their anticipated regret. This mechanism relies on the anticipated emotion (i.e., regret) that may be experienced as a consequence of individual decision outcomes (Loomes and Sugden, 1982). Regret arises when a foregone option outperforms the chosen one according to one or more attributes.

RRM models have been adopted in several research fields, yet there are only few applications in the food context (Biondi et al., 2019). Furthermore, to date, RRM models have never been used in the frame of sustainable food choices. In this situation, anticipated regret is suspected to afflict individual choices in a twofold manner. On the one hand, choosing the pro-environmental alternative may arise regret from the immediate benefits waived by discarding the anti-environmental alternative, e.g., the one with more convenience features or lower price (Zhang et al., 2021). Conversely, deciding for the anti-environmental option may generate regret due to the loss in potential long-term benefits for the environment and social welfare from not engaging in an environmental-friendly choice (Zhang et al., 2021). For this reason, we hypothesized that regret minimization could play a role in consumer decision-making process for sustainable foods, along with the well-established utility maximization paradigm.

Based on these premises, the primary objective of the study was to investigate how food consumers relatively value the provision of different pro-environmental packaging alternatives, namely the bioplastic packaging and loose format. Additionally, we aimed to understand consumer choice behaviour towards pro-environmental packaging alternatives, considering two different behavioural paradigms, i.e., utility maximization and regret minimization. Drawing upon these, we also intended to explore possible sources of heterogeneity in consumer preferences according to the choice mechanism followed by consumers.

The contribution of this study to the existing literature is twofold. Firstly, it provides new evidence on consumer acceptance of pro-environmental packaging options, whose deep

knowledge is essential to achieve the market transition towards an alternative of sustainable solutions to the use of plastic packaging. A deeper understanding of the underlying decision mechanism for pro-environmental choices is expected to help the design of policy strategies aimed to address the effective reduction of plastic packaging waste. Additionally, we will derive implications for food companies that are interested in engaging in a more responsible use of plastics while remaining aligned to consumer demand to maintain profit. Secondly, this study expands food choice research by applying a behavioural paradigm different from the classic utility maximization approach to investigate consumer choices. Remarkably, our results elucidate on the need to embrace other perspectives as well, not simply limit to utility maximization, to fully comprehend the decision-making process of consumers for sustainable food attributes.

The paper is organised as follows. The next section provides the background of this study, which relies both on the literature on consumer behaviour for sustainable packaging and the strand concerning the RRM framework. Then, the following section describes the methodological approach adopted to conduct the study and the econometric analysis performed. The results are outlined in section 4 and discussed in section 5. Lastly, the closing section illustrates the conclusion and main implications stemming from this work.

Background

Consumer preferences for sustainable food packaging

The conceptualization of sustainable packaging in consumer mind is largely dominated by material-related considerations (Lindh et al., 2016) and, consequently, by biodegradability, reusability, or recyclability issues (Herbes et al., 2018). Therefore, limiting the environmental impact of food packaging can be achieved by substituting plastics with more sustainable materials, such as bioplastics, or buying free- (or reduced-) packaging products (Fogt Jacobsen et al., 2022).

The possibility of replacing plastic with bioplastic materials has recently gained attention on the market (Wensing et al., 2020). According to European Bioplastics, the association representing the interests of the thriving bioplastics industry in Europe, bioplastic can be defined as any plastic that is either bio-based, biodegradable, or a combination of both. The

term bio-based indicates that the material originates from biomass such as corn, sugarcane, or cellulose (European Bioplastics, 2022). However, stemming from this definition, it is worth noting that bioplastics still contribute to the global waste production, as they are not always biodegradable though renewable (Rujnić-Sokele and Pilipović, 2017). Consistently, many consumers perceive bioplastic materials as the least sustainable alternative option to the traditional plastic (Herrmann et al., 2022). For instance, the study by Herbes et al. (2018) pointed out that biomethane-based packaging is not positively accepted among consumers because, on the one hand, it was presented as non-biodegradable and, on the other, it suffers from the lack of knowledge of people. The authors concluded on the prominent value placed by people on the biodegradability feature compared to the material being bio-based. Moreover, they outlined the importance of increasing consumer understanding and awareness of the biomass industry. Indeed, information provision seems to trigger consumers to select environment-friendly packaging. In this regard, De Marchi et al. (2020) observed the positive effect of information on consumer likelihood to choose the bioplastic packaging. Moreover, consumers were found to be willing to pay more for bioplastic bottled water with respect to the traditional plastic format. Similarly, Wensing et al. (2020) confirmed the presence of a premium for the bioplastic packaging presence and tested the effectiveness of different types of nudging, including information, in inducing the choice of bioplastic packaging option. Responses to nudges seem to depend on consumers' cognitive style. Intuitive decision-makers are more susceptible to label information or pictures, while information text or videos are more effective in increasing consumer willingness to pay for bioplastic among rational individuals. Other studies add to this by investigating further possible drivers and barriers of consumer acceptance for bioplastics. For instance, the work by Russo et al. (2019) disclosed that individual, green self-identity mediates the relationship between the attitude and intention to purchase and switch to bio-based products. Klein et al. (2019) reported the importance of green consumer values in influencing the purchase intention for bioplastic products. Both works corroborate the positive relation between the individual ecological worldview and the preference for sustainable food attributes (see for instance, Steiner et al., 2017).

With regard to the unpackaged product strategy, less attention has been given so far to this kind of pro-environmental behaviour (Fuentes et al., 2019; Louis et al., 2021). The purchase of loose foods is a growing market trend (Rapp et al., 2017; Louis et al., 2021). Consumers

are becoming more concerned about their own waste production. Consequently, specific sections devoted to bulk product purchases are being installed in many supermarket chains (for example, Waitrose in United Kingdom, Albert Heijn in Netherlands, and Coop in Italy), along with the opening of grocery stores fully conceived for zero-packaging purchases (van Herpen et al., 2016; Rapp et al., 2017). However, a significant shift towards this specific pro-environmental behaviour requires substantial changes both from the supply- and demand-side (Marken and Hörisch, 2019). Renouncing food packaging causes logistic and operational drawbacks for retailers, for instance, the need to consider the lack of the protective function of packaging during transport and distribution (Beitzen-Heineke et al., 2017). Instead, from the consumer perspective, potential limits are the reduction in consumer convenience and more time-consuming shopping (Beitzen-Heineke et al., 2017). Marken and Hörisch (2019), drawing upon a quantitative survey, showed that the lack of awareness of the existing offer, the limited product-range available, and impracticality are the most relevant deterrents among consumers. Moreover, the study by Fuentes et al. (2019) stressed that the practice of package-free shopping is a completely different mode of shopping that requires a drastic reinvention of consumer habits. People are asked to acquire new competencies and change behaviours (e.g., reusing bags; jars and other containers that are to be brought with them to stores). However, in the context of difficult-to-break routines, materiality and norms may exert a key role in the adoption of new sustainable practices. Indeed, pro-environmental personal norms seem to be an important predictor of the packaging-free purchase behaviour (Fuentes et al., 2019). Furthermore, people perception and inclination towards this sustainable practice varies upon the food category being involved. For instance, Fernqvist et al. (2015) explored advantages and disadvantages of the presence of packaging in relation to fresh vegetable purchases by means of focus group interviews. Their qualitative analysis showed that familiar loose products, such as vegetables, hold a stronger position in consumer preferences with respect to their packaged counterpart. Respondents identified the possibility of buying only the desired amount, the lower price with respect to the packaged alternative, and the opportunity to select higher quality products as the main positive aspects favouring the purchase of bulk foods. Moreover, plastic packaging material was viewed negatively because of its environmental impact.

With regard to research on the comparison of multiple types of pro-environmental packaging alternatives, Klaiman et al. (2016) explored consumer willingness to pay for different packaging materials and their recyclability. Their findings indicated that the least sustainable option, namely plastic, was preferred over the others, i.e., aluminium, glass, and carton. Nevertheless, consumers were willing to pay the highest premium for the recyclability of plastic, maybe due to a sort of compensatory effect arising from the awareness of the negative impact of plastic on the environment. Conversely, in the study by Friedrich (2020), innovative wood plastic composites, which constitute bio-based materials, were the most preferred compared to cardboard, PET, and aluminium. This result suggests that bioplastics can be a suitable substitute for plastic applications, notwithstanding the consumers' lack of any prior experience with the material.

Narrowing down to our case study, the work by Herrmann et al. (2022) is the only one focusing on the possible substitution of plastic packaging for food with either alternative material such as bioplastic, or through the availability of unpackaged option. They conducted DCE and qualitative text analysis to evaluate consumer willingness to pay and accept these strategies, along with other alternative materials (i.e., plastic, recycled plastic, and paper). Their findings revealed that bioplastic was the least preferred packaging alternative, whereas the unpackaged option ranked as the most preferred. Moreover, their qualitative analysis pointed out that respondents are strongly uncertain about the sustainability of bioplastic packaging, and, consistently, they are unwilling to pay more for this attribute. The authors emphasized that the general disagreement at the legislative and scientific level about what kind of packaging is actually sustainable exacerbates the possible confusion in consumer minds. However, consumer behaviour towards bioplastic packaging is still a controversial issue, as outlined before. Furthermore, their application only considers utility maximization as the underlying decision rule of consumer choices.

In this regard, our work expands the existing research in a twofold manner. Firstly, we provide additional evidence on the debate concerning individual acceptance for bioplastics and, more in general, towards the interplay among multiple pro-environmental packaging solutions. We hypothesized that, in contrast to the results of Herrmann et al. (2022), consumers are not drastically adverse to this kind of innovation rather tastes for bioplastics are heterogeneously distributed among consumers. Secondly, we incorporated in the analysis of sustainable food decisions an alternative behavioural approach: the RRM. We considered

that individuals can behave by following diverse paradigms and that the application of distinct decision rules could possibly result in different preference structures. The aim is to provide insights on the preferences of different pro-environmental packaging solutions (i.e. loose and bioplastic) while simultaneously investigating the heuristics driving sustainable choices.

The Random Regret Minimization framework

The RUM paradigm has been widely applied to achieve the two main objectives of choice modelling: predicting behaviour and eliciting individual willingness to pay and welfare measures (Hess et al., 2018). The fundamental axiom of this framework is that when discriminating among goods, individuals hold perfect information about the benefits and costs of their decisions and, consequently, choose what will provide them the highest utility, informally expressed as satisfaction (Savage, 1954). However, behavioural economics and psychology drew attention on systematic deviations from purely rational behaviours (see for instance, Simon, 1955; Kahneman and Tversky, 1979; Thaler, 2015). In this direction, Loomes and Sugden (1982) proposed the regret theory as an alternative to the expected utility theory. Regret theory has been extensively applied in the field of economics for risky choices. The underlying concept is that the individual's utility is not derived from the chosen alternative per se, but from the regret or rejoice experienced by comparing the chosen alternative to the forgone one. Regret arises when the forgone option is more desirable than the chosen one, whereas rejoice, as the opposite of regret, is felt if the selected option outperforms the non-chosen. The notion of regret as a determinant of choice behaviour has gained widespread attention in many research fields (for a detailed review see Thiene et al., 2012; Biondi et al., 2019). Recently, it has been incorporated in choice modelling by Chorus (2010) through the implementation of RRM approach in discrete choice analysis. The behavioural assumption in this case is that people choose aiming to minimize their anticipated regret. Regret emerges from the process of trading off attribute-levels when making a decision (Chorus et al., 2014). According to this mechanism, a *regret minimizer* is focused on how the considered alternative compares to the competing ones in terms of every conceivable attributes, whereas a *utility maximizer* concentrates only on the performance of the considered option itself (Chorus, 2012). Moreover, the shape of the regret function (see

section 3.4 for details) implies that the regret arisen from a loss (i.e., the chosen option performing poorer than the foregone) looms larger than the rejoice generated by a gain of the same magnitude (Chorus, 2012). This asymmetry in the impact of losses and gains, along with the reference-dependency in the RRM framework, conceptually recalls prospect theory models (Kahneman and Tversky, 1979) and the notion of loss aversion (Tversky and Kahneman, 1991)[32]. Furthermore, the RRM approach enables to capture semi-compensatory behaviour (in the sense that the better performance of one attribute of an alternative not necessarily compensates an equally large decline in performance of another attribute) and choice set-composition effects (Chorus, 2010; 2012; Chorus et al., 2014).

RRM models have been adopted in several fields, such as transportation (Hensher et al., 2016; Hess et al., 2014), healthcare choices (Boeri et al., 2013; De Bekker-Grob and Chorus, 2013), environmental resources (Thiene et al., 2012), and energy programmes (Boeri and Longo, 2017). In the food choice context, Biondi et al (2019) firstly introduced the application of RRM approach by focusing on a situation of anticipated social approval about a special food choice. They provided evidence that RRM model returns estimates consistent to the RUM counterpart and is not inferior in terms of goodness of fit and predictive ability, thus suggesting the effective application of RRM models to the decision-making process for foods. Moreover, their findings indicated that, based on differences in personality traits, the choice mechanism may vary among consumers. Drawing upon this study, we decided to extend RRM applications in the field of choices for sustainable foods, specifically for pro-environmental packaging alternatives. We approached our case study through a double behavioural perspective by incorporating possible heterogeneity among consumers according to the choice mechanism adopted.

Material and Methods

The choice experiment

To assess consumer preferences for sustainable packaging under different behavioural frameworks, we conducted a hypothetical DCE. This method has been extensively applied

[32] The reference points of RRM are given by the attribute level of non-chosen options, while the reference points of prospect theory are determined by the status quo.

to elicit consumer preferences for food attributes (see, for instance, Butler and Vossler, 2018; Hilger et al., 2019; Muller et al., 2019; Boncinelli et al., 2021; Piracci et al., 2022). Data was collected by applying a cross-sectional online survey incorporating the DCE among Italian consumers. The questionnaire was delivered in March 2021 by means of a panel recruitment agency (Pollfish). The target population for the experiment comprised tomato consumers over 18 years of age, i.e., the legal age in Italy. Therefore, respondents who declared to never consume tomatoes (1%) were screened out from the survey. In total, we gathered 395 full responses.

Respondents were asked to make hypothetical buying decisions for 500 g of fresh cherry tomatoes. We choose fresh cherry tomato since vegetables can be commonly found either loose or packaged in the market. Moreover, tomato is the most consumed fresh vegetable in Italy (ISMEA, 2017).

We implemented a labelled design, as reported in Table 1, meaning that the alternatives of the product correspond to the three different packaging formats: loose, plastic packaging, and bioplastic packaging tomatoes. Additionally, the tomato alternatives were also described by two attributes. We considered the price attribute with four different levels (1.39, 1.89, 2.39, 2.89 €/500 g) that were chosen to represent the Italian market price range for fresh cherry tomatoes at the time of the study. We included the organic certification (absence, presence) in the experimental design since this attribute has been previously found to be significant in the consumer decision-making process for tomatoes (Printezis and Grebitus, 2018; Wensing et al., 2020).

Table 1. Experimental design.

Alternatives	
Loose	
Plastic packaging	
Bioplastic packaging	
Attributes	*Levels*
Organic label	Presence, Absence
Price (€/500gr)	1.39, 1.89, 2.39, 2.89

Before answering the choice tasks, respondents were provided with detailed instructions and a cheap talk script with budget constraint reminder as an ex-ante mitigation strategy to the

hypothetical bias (Cummings and Taylor, 1999). To favour the careful reading of these pieces of information, people were forced to remain in the instruction section for one minute before they were allowed to continue through the survey. Moreover, the alternatives within each choice task, as well as the choice tasks, were randomized among respondents to limit possible ordering effects.

Experimental design

The attributes and attribute levels were allocated among the three alternatives applying a Bayesian D-efficient approach (Sándor and Wedel, 2001; Scarpa et al., 2007) to reduce the number of choice tasks faced by respondents and avoid fatigue effect. The experimental design was optimised for multinomial logit models and based on a main-effects utility function.

Van Cranenburgh et al. (2018) stressed that traditional RUM efficient designs proved to perform poorly if the prevailing decision rule underlying choice behaviours is based on regret minimization. Unfortunately, the application of RRM is rare between food behaviour studies, and, thus, we have a poor empirical evidence to make any a priori assumption on the true behavioural paradigm applied by decision-makers when purchasing food. Therefore, we generated a decision-rule robust design (van Cranenburgh and Collins, 2019; van Cranenburgh et al., 2018) that simultaneously allows estimating RUM and RRM models. The chosen design is still the one minimizing the D-error as in traditional designs. However, in this case, the D-error statistics is constructed as the weighted sum of the D-errors associated with the different specifications of the model, one per behavioural rule. The resulting composite efficiency measure incorporates the probability of each decision rule being the best fitting model to describe individual choice behaviours (van Cranenburgh and Collins, 2019; van Cranenburgh et al., 2018). We set the weights for the decision rules to be equal. The Bayesian priors were generated from a pilot study conducted on a sample of 108 respondents. The design was constructed using the software Ngene (ChoiceMetrics, 2018).

The final experimental design consisted of 12 choice sets blocked in three groups. Therefore, participants faced 4 choice tasks, each including the three labelled tomato alternatives. Figure 1 shows an example of the choice task.

Figure 1. Example of choice task.

Note: Instructions and descriptions in the original choice tasks were in Italian.

We applied a forced-choice format, meaning that respondents were not provided with the opt-out option as in many previous experiments (see, among the other, Aoki et al., 2019; Costanigro et al., 2014; Gerini et al., 2016; Scarpa et al., 2021). We took this methodological decision based on the following reasons. Since the RRM approach is based on pairwise comparison between the alternatives for each of their shared attributes, the model performs poorly in discrete choice analysis in the presence of a no-choice option. This is due to the fact that such alternative is not described in terms of any relevant attribute, and it, thus, cannot be compared to other alternatives at the attribute level (Chorus, 2012; Thiene et al., 2012). Moreover, Hess et al. (2014) demonstrated that depending on the framing of the opt-out option as either "none of these" or "indifferent", the performance of RRM or RUM, respectively, are expected to deteriorate. Therefore, excluding the opt-out allowed us to prevent such risks as we were going to apply both modelling approaches simultaneously.

Even if the inclusion of an opt-out option is a common practice in DCE designs, this methodological choice should be taken in light of the objective of the study rather then set by default (Hensher et al., 2015). For instance, the presence of the no-buy alternative is required when the focus of the study is to estimate the consumer demand for the product in absolute term (Haaijer et al., 2001; Dhar and Simonson, 2003; Carlsson et al., 2007; Hensher et al., 2015)[33]. We were confident that removing the no-buy option from the experimental design as it does not affect the preference ordering (Carlsson et al., 2007), and our main

[33] For a deeper discussion on the inclusion or exclusion of the opt-out alternative, the reader can refer to Carlsson et al. (2007) and Kallas et al. (2013).

research objective was to assess the impact of the different alternatives on consumer choice and the underlying mechanism driving the decision-maker behaviour rather than eliciting the willingness to pay for the alternatives[34].

The survey instrument

The survey opened with the DCE. After completing the 4 choice tasks, respondents were asked several further questions. First, the pro-environmental orientation of consumers was measured through the 15-item version of the New Environmental Paradigm (NEP) scale developed by Dunlap et al. (2000). Participants provided their level of agreement with statements concerning the relationship between human beings and the earth and nature (e.g., "We are approaching the limit of the number of people the earth can support", "Humans have the right to modify the natural environment to suit their needs"). Responses were scored on a 5-point Likert scale from strongly disagree to strongly agree. The items are phrased such that the agreement with the eight odd-numbered items and the disagreement with the seven even-numbered ones signals a proecological worldview (Dunlap et al., 2000). Therefore, the even statements were reversed. We aggregated the answers into one single measure, following Steiner et al. (2017), and a higher total score indicated a stronger propensity towards pro-environmental attitudes and beliefs. Cronbach's alpha for the scale was 0.79, thus confirming adequate scale reliability.

Furthermore, we assessed the consumer concern for the plastic pollution issue through the items "to what extent do you think the plastic pollution is serious?" and "to what extent do you think you are worried for the plastic pollution?". Additionally, the consumer belief about the benefits of the use of bioplastic was collected through the question "to what extent do you think that bioplastic can be helpful to tackle the plastic pollution issue?". All responses were provided on a Likert scale ranging from 1 (not at all) to 5 (a lot). Lastly, we collected the socio-demographic characteristics of the sample.

[34] After each choice task we included in the survey a follow up question to ask respondents if they would have confirmed their selection or preferred not to buy anything. In 31 over 1580 choices (2%) respondents declared that they would have opted for the no-buy alternative. To test the robustness of our results we run all the analysis excluding these 31 observations and we did not detect any difference from the estimates on the whole sample. The additional results are available upon request.

Econometric Analysis

We assumed that consumers choose one of the packaging options either maximizing their own utility, i.e., following the classical RUM paradigm, or minimizing their anticipated regret, i.e., according to the RRM behavioural approach. The linear-additive utility function underlying the RUM modelling framework can be written as follows (Thurstone, 1927; Marschak, 1960):

$$U_i = V_i + \varepsilon_i = \boldsymbol{\beta}' \boldsymbol{X}_i + \varepsilon_i \quad (1)$$

where U_i is the utility the decision-maker *n* gains from alternative *i*, V_i is the deterministic portion of utility, ε is the stochastic component, *X* is the vector of attributes describing the alternative *i* and β is the vector of the associated estimated parameters. As per McFadden (1974), assuming that the errors are independent and identically distributed (i.i.d.) Extreme value type I distributed, the choice probability is derived through a Multinomial Logit (MNL) specification (RUM-MNL):

$$P_i^{RU} = \frac{e^{V_i}}{\sum_{j=1}^{J} e^{V_j}} \quad (2)$$

Likewise, the overall regret postulated in the RRM modelling approach Ψ is made up of a systematic portion of the regret *R* and a random error component δ. Van Cranenburgh et al. (2015) proposed the μRRM model as a generalization of the classical RRM model first introduced by Chorus (2010). This model allows the μ parameter to be estimated along with the preference weights ϑ_m. The regret function of the μRRM model is given by (van Cranenburgh et al., 2015):

$$\Psi_i = R_i + \delta_i = \sum_{j \neq i} \sum_{m=1}^{M} \mu \ln(1 + \exp \frac{\vartheta_m}{\mu} [x_{jm} - x_{im}]) + \delta_i \quad (3)$$

The observed part of the regret is conceived as the sum of all so-called binary regrets associated with the pairwise comparison between the considered alternative *i* and each competitor alternative *j* for all attributes *M*. R_i maps the differences between the attribute

levels of the different alternatives ($x_{jm} - x_{im}$) onto the regret. ϑ_m captures the slope of the regret function for attribute *m* and reflects its relative contribution to the regret. Moreover, μ determines the shape of the regret function and indicates the profundity of the regret, which refers to the degree of regret aversion in choice behaviour. It gives information about the extent to which the choice is driven by the relative importance between losses (regret) and gains (rejoice). In case μ equals one, the µRRM model shrinks to the classical RRM model. Estimating μ larger than one implies a mild profundity of the regret; specifically, when μ approaches infinity, the model provides the same choice probabilities as its RUM counterpart: regret and rejoice are equivalent. Conversely, if μ is smaller than one, the individual degree of the regret aversion is higher than that ascribed to the classical RRM. Lastly, if μ tends to zero, only regret matters and rejoice is irrelevant; in this case, the model collapses into the Pure RRM model (van Cranenburgh et al., 2015)[35].

With the assumption that the negative of the error component is i.i.d. extreme value type I distributed and the consideration that minimizing the random regret is mathematically equivalent to maximizing its negative, the choice probability can be estimated as a Multinomial Logit (µRRM-MNL):

$$P_i^{RR} = \frac{e^{(-R_i)}}{\sum_{j=1}^{J} e^{(-R_j)}} \tag{4}$$

The MNL models were specified to recognize the panel structure of the data by multiplying the probabilities across individual choice observations for the same individual. However, MNL models still assume homogeneity in preferences across respondents. To relax this assumption, we applied two different approaches, accounting for the different sources of heterogeneity, as proposed by Boeri and Longo (2017). First, we specified a Random Parameter Logit (RPL) model. This model allows to investigate how taste variability affects consumer choices. Specifically, the coefficients of the attributes and alternatives are allowed to vary randomly across the individuals according to continuous probability distribution functions and to correlate within themselves. RUM-RPL is derived by integrating the logit probabilities over the distribution of β (Train, 2009). Consistently, we implemented the

[35] As underlined by Boeri and Longo (2017) and Geržinič et al. (2021), the μ parameter in the µRRM model should not be confounded with the μ scale parameter related to the variance of the error term in RUM models.

equivalent model, µRRM-RPL, within the RRM framework, as described by Boeri and Masiero (2014). In both cases, all the taste parameters were specified as normally distributed, except for the price, which was kept fixed.

In addition, to accommodate for the heterogeneity in the decision rule applied within the sample, we assumed to observe a mixture of RUM-driven choices and RRM behaviours rather than treat all the choices as based on either utility or regret. To this end, we estimated a two-class Latent Class (LC) model where the class embeds the behavioural approach underlying the choices of the respondents, following Hess et al. (2012). The LC model is the semi-parametric version of a mixed model in which the heterogeneity is modelled as discrete in C mass points, with C being the number of classes. In this case, each class represents a group of consumers, categorized in a way that the decision rule is homogeneous within the segment, whilst heterogeneous between the segments. Therefore, one class consists of RUM decision-makers, whilst the other is made up of people behaving consistently with the RRM paradigm. Conditional on being in one of the two classes, the choice probabilities are defined according to an MNL process, see (2) and (4) for RUM and RRM, respectively. Likewise, the probability that individual *n* belongs to class *c* can be modelled as MNL (Greene and Hensher, 2003), as follows:

$$\pi_{nc} = \frac{e^{(\alpha_c + \boldsymbol{Z_n}'\boldsymbol{\theta_c})}}{\sum_{c=1}^{C} e^{(\alpha_c + \boldsymbol{Z_n}'\boldsymbol{\theta_c})}} \tag{5}$$

where Z_n is a vector of the observed respondent's characteristics, $\boldsymbol{\theta}_c$ is a vector of the associated parameters elicited for each class, and α_c is the class-specific constant. For identification purposes only the C-1 set of coefficients can be independently identified, one needs to be normalized to zero and act as the reference level.

In a LC model incorporating only the traditional RUM setting, the probability, P_i, that individual *n* chooses alternative *i*, unconditionally on the class he belongs to, is obtained as the product of the two probabilities:

$$P_i = \sum_{c=1}^{C} \pi_{nc} \; P_i^{RU} \tag{6}$$

In our specification, to account for the RRM contribution, equation (6) needs to be extended as:

$$P_i = \pi_v P_i^{RU} + \pi_r P_i^{RR} \quad (7)$$

where $\pi_r = (1 - \pi_v)$ and π_v and π_r are the membership probabilities for the RUM class and the RRM class, respectively[36].

Two versions of the LC model were then estimated. Model 1 is the base model, where the class allocation probability is only function of the settings of the choice task, i.e., no respondent characteristics are included in (5). As a robustness check, we estimated Model 2 by adding socio-demographic information and the pro-environmental attitude of the respondents as predictors in the membership probability function.

All the analyses were performed using the Apollo package in R (Hess and Palma, 2019) by means of maximum simulated likelihood. The RPLs were then estimated, specifying 500 Halton draws.

Results

Description of the sample's characteristics

The sample's characterization in terms of socio-demographic information and personal features is reported in Table 2. Females were slightly predominant in the sample (56.96%), while the median age of the respondents was 38. Regarding education, 54.43% of the sample held a university degree or a higher education degree, 37% held a high-school diploma, and the remaining had completed middle school. Considering the income, about 50% of the sample stated to have a low income, 26% reported a medium income, 4% declared they had a high-income level, and 20% preferred not to disclose this information. Furthermore, concerning their consumption habits, more than half of respondents (66.33%) stated to consume cherry tomatoes at least once a week or more, whilst 26.33% stated they consume the product once or twice per month. On the other hand, only a few respondents (7.34%)

[36] For a deeper econometric description of the Latent Class model, the readers can refer to the works of Hess et al. (2012) and Boeri et al. (2014).

stated to consume cherry tomatoes less than once a month or rarely. A small proportion of the respondents (18.48%) were on vegan or vegetarian diet regimes, and the vast majority of the sample (89.87%) were responsible for the grocery shopping in the household. Moreover, the respondents were highly concerned about plastic pollution and believed in the positive contribution of bioplastics in tackling this issue.

Table 2. Socio-demographic characteristics and personal traits and habits of the sample (n = 395).

Variable	n	%
Gender		
Female	225	56.96
Male	170	43.04
Class age		
18-24	62	15.7
25-34	108	27.34
35-44	96	24.3
45-54	84	21.27
> 54	45	11.39
Education		
Middle school	33	8.35
High school	147	37.22
Bachelor degree or higher	215	54.43
Income		
Low income	197	49.87
Medium income	101	25.57
High income	18	4.56
Not disclosed	79	20.00
Consumption frequency of cherry tomatoes		
Once per week or more	262	66.33
Once or twice per month	104	26.33
Less than once per month	14	3.54
Rarely	15	3.80
Vegan or vegetarian diet	73	18.48
Responsible for food purchase	355	89.87
Concern for plastic pollution issue – mean, SD	4.34	0.73
Belief in the benefits of the use of bioplastic – mean, SD	3.73	0.93

Note: SD = Standard Deviation.

Discrete Choice Experiment results

The majority of the previous studies applying the RRM framework have focused on the MNL form. Therefore, to present our findings, we aligned to the traditional literature approach, starting from the MNL outcomes. In all the models, the alternative specific constant for the plastic option is normalized to zero due to identification purposes.

Table 3 reports the model estimates for RUM-MNL and RRM-MNL. As expected, the coefficient signs are persistent in both RUM and RRM specifications, confirming the consistency of the results. In terms of goodness of fit, the RUM version fits the data slightly better than its RRM counterpart, as indicated by the Log-Likelihood, Akaike Information Criterion, and Bayesian Information Criterion. Nonetheless, the difference between the two models can be considered negligible, as suggested by the rho-squared values (0.14 for RUM-MNL and 0.14 for RRM-MNL). Since the models were estimated assuming two different paradigms, the coefficients cannot be compared, as the interpretation differs.

Under the traditional RUM setting, the alternative specific constants indicate the utility of each packaging alternative relative to the plastic option. The coefficients for the loose and the bioplastic attribute are both statistically significant and positive, meaning that the consumers' utility increases when they buy products wrapped in pro-environmental packaging alternatives instead of products wrapped in plastic packaging, *ceteris paribus*. The coefficient of organic is not statistically significant, suggesting that the presence of the label does not affect consumer choices for tomatoes. Conversely, the price coefficient is statistically significant and negative. This reflects a decrease in utility with increasing price, which is consistent with the economic theory.

On the other hand, the RRM estimates signal the potential contribution of the alternatives and the attributes to regret. The regret parameter is significant and smaller than one signalling a high degree of regret aversion in the sample. The alternative specific constants capture the average of the unobserved regret associated with that alternative compared to the reference level, namely the tomatoes packaged in plastic. Therefore, the positive and statistically significant coefficient of the two sustainable packaging alternatives indicates that not choosing them will lead to significantly higher anticipated regret than the regret associated with the plastic packaging option. A positive and significant coefficient of the organic attribute means that the regret increases as the attribute is present in a non-chosen

competing alternative but absent in the chosen option. Moreover, the negative and significant coefficient of the price attribute means that regret decreases as the non-considered alternative becomes more expensive than the selected option. Practically, the two models provide similar qualitative descriptions of the consumers' preferences. Under both paradigms, the loose alternative ranks higher than the bioplastic one, and the plastic tends to be discarded.

Table 3. RUM-MNL and μRRM-MNL model estimates.

	RUM-MNL		μRRM-MNL	
	Coeff.	Std. err.	Coeff.	Std. err.
Loose	1.03***	0.07	0.73***	0.05
Bioplastic	0.80***	0.08	0.21**	0.09
Organic	0.05	0.05	0.08**	0.04
Price	-0.68***	0.04	-0.56***	0.04
μ			0.74**	0.38
Log-Likelihood	-1488.04		-1488.94	
Adjusted Rho-squared	0.14		0.14	
Akaike Information Criterion	2984.08		2987.88	
Bayesian Information Criterion	3005.54		3014.71	
Parameters	4		5	
Observations	1580		1580	

Notes: (***) and (**) indicate significance at a 1% and 5%, respectively. Coeff. denotes coefficient, and Std. err. means standard error.

We estimated the RPL models to account for the heterogeneity in tastes among the consumers. Results are presented in Table 4. The preference structure for the alternatives is the same as that found through the MNL specifications, except for the organic attribute, which is significant and positive in this case. The loose tomatoes are the most valuable format for the consumers, followed by the bioplastic option, whereas the plastic alternative is the least preferred. The standard deviations of the constants are highly significant, indicating high variability in preferences for sustainable packaging formats, namely the loose and the bioplastic. Nonetheless, in the RRM-RPL model, the mean of the bioplastic coefficient is not significant, suggesting that the distribution of the tastes is so heterogeneous that capturing the contribution of that parameter among the sample through the mean estimate is not informative. Furthermore, under both paradigms, the mean of the organic

coefficient is positive and statistically significant, whilst the standard deviation is not statistically significant. This reflects that the attribute positively affects buying decisions for cherry tomatoes and that the preference for the organic alternative is homogeneous within the sample.

Table 4. RUM-RPL and μRRM-RPL model estimates.

	RUM-RPL		μRRM-RPL	
	Coeff.	Std. err.	Coeff.	Std. err.
Loose	1.30***	0.16	0.99***	0.11
Bioplastic	1.02***	0.15	0.15	0.14
Organic	0.09*	0.07	0.12**	0.05
Price	-0.98***	0.06	-0.84***	0.05
μ			1.37***	0.46
Standard deviation of random parameters				
Loose	1.85***	0.18	1.49***	0.14
Bioplastic	1.30***	0.15	0.82***	0.10
Organic	0.00	0.02	0.00	0.11
Log-Likelihood	-1375.11		-1375.01	
Adjusted Rho-squared	0.20		0.20	
Akaike Information Criterion	2770.23		2772.03	
Bayesian Information Criterion	2823.88		2831.04	
Parameters	10		11	
Choices	1580		1580	

Notes: (***), (**) and (*) indicate significance at 1%, 5% and 10% respectively; Coeff. denotes coefficient, and Std. err. refers to standard error.

To consider further sources of heterogeneity, we allowed for the coexistence of different decision processes within the sample. To this end, we applied an LC-modelling approach with one class per behavioural rule. Table 5 displays the results. We estimated Model 1, the base model, and specified Model 2 by adding sociodemographic characteristics and the pro-environmental attitude of the respondents as class membership predictors. In Model 1, the coefficient estimates for the RUM class are consistent with the findings from the MNL and RPL models. Both the loose and the bioplastic options are preferred over the plastic option, with the loose being the most valuable alternative among the respondents. In contrast, in the

RRM class, the preference ranking for the sustainable alternatives is reversed, and notably, the bioplastic option is slightly preferred over the loose option. This indicates that for the consumers who choose by minimizing their regret, the loose alternative is not as important as it is for those driven by the maximization of their utility. Another difference is that the organic alternative is not influential in the decision-making process of the RRM respondents, whilst it significantly affects the preferences in the RUM context. In addition, the price attribute emerges as a remarkable factor in buying decisions for the RRM consumers, as seen in the magnitude and significance of the estimated coefficient. Therefore, the LC model provided evidence for several discrepancies in individual behaviours that would have not been captured by considering homogeneity in the decision rule underlying their choices, as assumed in the MNL and RPL approaches. The class allocation probabilities show that the largest share of choices (72%) for the cherry tomatoes is explained by the regret minimization paradigm, whereas the remaining share (28%) is characterized by the utility maximization tendency. Furthermore, the regret parameter of the RRM class is significant and smaller than the parameter reflecting a high degree of regret aversion among the individuals included in this group.

Model 2 corroborates the outcomes from Model 1. The RUM class is the baseline for defining the effect of individual characteristics on the consumers' preferences. Respondents are more likely to follow the regret minimization paradigm if they have university-level education and low income. On the other hand, having a pro-ecological worldview is negatively associated with the probability of belonging to the RRM model. This implies that individuals are more likely to behave according to utility maximization when they have a strong pro-environmental attitude.

Table 5. LC model estimates.

	Model 1				Model 2			
	Class 1		Class 2		Class 1		Class 2	
	RUM Class		µRRM Class		RUM Class		µRRM Class	
	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
Loose	2.92***	0.35	0.18**	0.08	3.20***	0.41	0.19**	0.08
Bioplastic	0.59*	0.39	0.23**	0.12	0.88**	0.45	0.21**	0.12
Organic	0.36*	0.23	0.04	0.05	0.32*	0.22	0.05	0.04
Price	-0.34*	0.21	-0.83***	0.06	-0.35**	0.20	-0.81***	0.06
μ			0.74**	0.30			0.74**	0.29
Intercept	-		0.94***	0.19	-		2.55**	1.07
Female					-		0.08	0.21
Age					-		0.00	0.01
University education					-		0.71**	0.38
Low income					-		0.41*	0.27
Medium income					-		-0.05	0.13
High income					-		3.30	4.53
Pro-environmental attitude					-		-0.03**	0.02
Class Membership probability	0.28		0.72		0.27		0.73	
Log-Likelihood	-1399.26				-1391.82			
Adjusted Rho-squared	0.19				0.19			
Akaike Information Criterion	2818.51				2817.63			
Bayesian Information Criterion	2883.15				2927.52			
Parameters	10				17			
Choices	1580				1580			

Notes: (***), (**) and (*) indicate significance at a 1%, 5% and 10% respectively. Coeff. denotes coefficient, and std. err. denotes standard error.

Discussion

In evidence, this study introduces the RRM framework in the context of sustainable food choices. The outcomes from the RRM models (MNL and RPL specifications) proved to be consistent from an empirical perspective, as they provide the same preference structure as the RUM models, coherently with previous applications (see, for instance, De Bekker-Grob and Chorus, 2013; Boeri and Longo, 2017; Mao et al., 2020). This can be seen as a sign of robustness for the resulting managerial and political implications (Thiene et al., 2012; Boeri and Masiero, 2014).

Our findings indicate that the pro-environmental packaging options in the food context, namely the absence of the packaging and the presence of bioplastic packaging, are valuable among consumers. These alternatives were always preferred to the plastic option, and both the investigated behavioural paradigms confirmed this. Furthermore, the observed preferences for the sustainable packaging alternatives were considerably heterogeneous across the sample. These outcomes are corroborated by van Herpen et al. (2016), De Salvo et al. (2020), and Kocak Yanik et al. (2020), who previously observed the positive inclination of consumers towards unpackaged vegetables. In line with our results, De Marchi et al. (2020) and Wensing et al. (2020) pointed out that consumers are willing to pay premium prices for bioplastic-packaged products. However, our results are partially in contrast with Herrmann et al. (2022), who reported that consumers need an incentive to accept buying bio-based packaged foods since they elicit a negative willingness to pay for the attribute. A reason for this can be that their consumer sample was found to be strongly uncertain about the sustainability of bioplastic packaging and declared to perceive it as the least sustainable packaging format alternative to plastic packaging. Conversely, our sample, on average, exhibits a positive perception of this material and its beneficial contribution to mitigating the plastic pollution issue.

Accounting for the heterogeneity in the consumers' decision-making processes allowed us to capture two different behavioural patterns among the respondents. On one hand, the loose format was highly important among those who choose to maximize their utility. A plausible motivation for this behaviour can be rooted in the consumer prerogative of quality control during the purchasing phase. Unpackaged vegetables allow consumers to discriminate and choose according to search attributes (e.g., colour, size, appearance, physical defects, and

degree of ripeness), which are considered extremely relevant during the buying stage (Ragaert, et al., 2004). This seems to justify why the loose option is strongly preferred by those driven by the utility they can directly gain from their chosen alternatives rather than by the regret of making a poor choice. Moreover, the loose alternative implies no packaging disposal and is perceived by the consumers as the more sustainable option (Herrmann et al., 2022). Accordingly, the class of utility maximization decision-makers was found to include environmentally conscious respondents. This supports the findings of Boeri and Longo (2017), illustrating that being involved in environmental organizations makes a respondent more likely to behave according to the utility maximization paradigm rather than the regret minimization rule. In line with this result, we found that the presence of the organic certification was appreciated by the class focused on utility maximization. In contrast, the class of the respondents following the regret minimization approach was indifferent to the attribute. This seems to strengthen the view that the individuals adopting the utility maximization process may be more ecologically oriented, since organic food consumption is positively correlated to the consumers' environmental concerns (Aertsens et al., 2009).

On the other hand, the regret minimization class appreciated both sustainable packaging alternatives, and the loose format was not prevalent. It appears that the consumers belonging to this group placed particular emphasis on the price attribute, which was found to be remarkably influential in driving their choice behaviours. We would conclude that the RRM decision-makers consider the economic outcomes related to their food choices as significant. These empirical findings are consistent with the general notion that the minimization of the anticipated regret is a pivotal driver when the choice is perceived by the individual as important or difficult (Zeelenberg and Pieters, 2007), such as the choice concerning budget evaluations for food expenditure.

Regarding socio-demographic determinants, we found that the well-educated individuals with low income were more likely to behave according to the regret minimization, whereas gender and age were not important in influencing the decision rule of the respondents. Boeri et al. (2013) obtained similar evidence regarding the non-significant effect of gender and the significant contribution of education as predictors of RRM behaviours on personal healthcare decisions.

Without the consideration of the heterogeneity in the decision rule within the sample, our results would have not captured the differences in the choice patterns among the consumers.

Most notably, when allowing for the co-existence of multiple behavioural paradigms, we found that the consumer choice behaviour for food packaging is better described under the regret minimization framework, as 72% of the choices are consistent with this mechanism. The predominance of the RRM decision-makers over the RUM decision-makers has been previously observed in the context of choices for air quality improvement policies (Mao et al., 2020) and renewable energy programmes (Boeri and Longo, 2017), whilst the opposite has been detected for decisions related to traffic calming projects (Boeri et al., 2014). Therefore, our findings corroborate the idea that the utility maximization rule should not be regarded as the only driver of consumer choices in all possible choice contexts.

Conclusion

The transition of the food industry towards more sustainable patterns has been increasingly advocated in political and academic debates (Phelan et al., 2022). Tackling the plastic pollution issue, this study investigated consumer acceptance of multiple pro-environmental packaging strategies under different behavioural rules by conducting a DCE. Overall, our findings reveal that consumer tastes are variable and that preference patterns change, depending on the behavioural paradigm assumed by an individual. In other words, we found that the heterogeneity in consumer choices lies in at least two different dimensions: taste and decision rule.

Consumers following the utility maximization mechanism attach great importance to the possibility of buying loose vegetables instead of plastic-packaged products. Moreover, they also exhibit a positive, albeit less pronounced, orientation towards the use of bioplastic packaging. Rather, individuals choosing according to the regret minimization process similarly value the provision of both sustainable packaging options. Surprisingly, 72% of the sample adopted the RRM decision rule in the context of sustainable food choices.

Our results provide practical and policy implications. First, the study supports the idea that promoting pro-environmental packaging strategies as substitutes for plastic applications can contribute to limiting the environmental impact of the food system, since consumers were positively prone to their application. Several food companies tend to ignore plastic pollution in their sustainability agenda (Beitzen-Heineke et al., 2017). Moreover, they mention only waste management and recycling in their corporate sustainability reports, whilst neglecting

sustainable packaging solutions aimed at systemic change (Beitzen-Heineke et al., 2017). Consumers' acceptance of sustainable packaging solutions can trigger firms to gradually orientate towards the use of bioplastic applications. As consumer demand for sustainable products grows rapidly, this orientation can be a potential reward strategy for food industries. In addition, marketers should consider that according to the different behavioural paradigms consumers follow, multiple market segments can be identified. These, in turn, present heterogeneous preference structures. Therefore, specific marketing strategies should be conceived for each target group. For instance, since utility maximizers were found to be environmentally conscious and attracted to the loose alternative, companies could benefit from the choice of supplying their products unpackaged to this group. In this case, the companies' promotion and advertising campaigns should emphasize the advantages of the packaging-free format for both the consumers (i.e., the possibility to select only high-quality products and in the desired amount) and the environment (i.e., no plastic packaging to dispose of after the purchase). On the other hand, as regret minimizers appreciated both sustainable packaging formats and did not favour one over the other, either bioplastic packaging or the unpackaged strategy can be profitably achieved. However, communication with the consumers should highlight the benefits of these products in comparison to the available competing alternatives. Furthermore, the price should be carefully set, as this group of consumers exhibited a high sensitivity to this attribute. In line with the previous considerations, policy interventions and tools aimed at encouraging sustainable consumption, specifically a reduction in plastic packaging waste, should also be tailored to the consumers, taking into account the heterogeneity in the behavioural approaches they apply when making choices. For instance, nudging strategies or information tools leveraging loss aversion principles may be influential on the individuals following the RRM mechanism. Conversely, policy instruments based on environmental information or aimed to stimulate the individual's ecological worldview can prompt the individuals who take decisions through the RUM process. Future studies may test these considerations by exploring the effectiveness of different kinds of nudges, as per the decision rule adopted by consumers.

Lastly, our findings are relevant to scholars in the field of food consumer behaviour. We demonstrated that choices for sustainability attributes are driven by regret feelings. *Ceteris paribus*, we observed that the eco-friendly packaging strategies were preferred among

people driven by regret minimization principles, indicating that sustainable consumption behaviour should be considered under the regret lens. Considering that the packaging format influences only the product's environmental footprint and not the food quality characteristics, a large share of consumers opt for the pro-environmental packaging strategies to avoid the regret of having chosen an identical product with packaging that promotes pollution.

Moreover, combined with the solid and well-established RUM, the RRM framework enabled to achieve a broader overview of the consumers' decision-making process for sustainable foods, as it allows them to take into account the choice phenomena that diverge from the classical RUM assumptions. We provided evidence that the behavioural patterns in the context of pro-environmental choices do not seem to be described solely by utility maximization mechanisms, rather regret minimization underlies most of the decisions. Therefore, heterogeneity in consumers' choices relies also on the decision rule applied by the consumers, and not only on their tastes. Evaluating all decision-makers and their choices as driven by utility maximization considerations can lead to incomplete conclusions. Thus, expanding the theoretical foundation in modelling the choices is required, and further studies should test the regret framework on different applications or, alternatively, should consider the integration of RUM in other behavioural approaches.

Notwithstanding the contributions of the current study, the following limitations should also be considered. First, we relied on a hypothetical stated preference method. Hypothetical DCEs are known to suffer from hypothetical biases, which may lead to misrepresented results. Therefore, further studies may apply incentive-compatible methods (e.g., real choice experiments and experimental auctions) or scanner data to corroborate our results and elicit the consumers' willingness to pay and the market shares for sustainable packaging formats. In addition, to investigate preferences for different pro-environmental packaging options, we centred the experiment on tomatoes. This methodological choice derives from the evidence that consumers are used to the presence of fruits and vegetables without packaging since these items are commonly available in the market in bulk. Therefore, our results need to be interpreted as behaviours towards the absence or presence of packaging in the context of learned preferences (van Herpen et al., 2016). People might have reacted differently if they had been asked to make purchase decisions for other less common, unpackaged foods. The next step in research might be to understand the effect of the absence of packaging,

considering other food categories that were only recently introduced as loose (e.g., pasta, cereals, and beans). Furthermore, in our study, we concentrated on preferences for the bioplastic packaging without incorporating how this should be signalled to the consumers to make it recognizable. Possible research directions could be addressing the effectiveness of labelling and information provision in increasing consumer acceptance of this new alternative to plastic. Lastly, to what extent the packaging strategies considered in this experiment should be actually acknowledged as more sustainable than plastic is still a controversial debate. For instance, in the case of loose food, the literature is not concordant on whether it is more important to reduce packaging production or minimize the risk of food spoilage (Beitzen-Heineke et al., 2017). Nevertheless, the broad array of bioplastics gives rise to a conspicuous list of adverse effects threatening sustainability, such as competition with food production, hygienic issues, or problems in waste management, depending on the renewable sources they originate from (European Commission, 2018; Rujnić-Sokele and Pilipović, 2017). Although these considerations are positioned far beyond our research's scopes, further evidence from Life Cycle Assessment studies on food packaging is required to investigate the "degree of sustainability" of the different packaging options available that can be alternatively utilised to gradually substitute plastics.

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Research article 4. Which attribute is the most important in sustainable food choices? An analysis using the food value framework

Abstract

The notion of sustainable food is still ambiguous or abstract to most people. The food values proposed by Lusk and Briggeman (2009) represent a comprehensive set of attributes inherent to food consumption that are effective in explaining choices between food products. This study aims to assess what consumers value in sustainable food products in terms of food values and their relative importance in the product purchase decision. Consumers were segmented based on their preferred attributes and profiled according to multiple individual self-identities. It was found that the drivers of sustainable food choices relate more to self-centred values rather than society-centred values. Three consumer segments prioritising different food values were identified: "private benefit seekers," "sustainability focused," and "naturalness and health driven." Consumers interested in health and those caring for sustainable aspects shared the same identity profile. The results of the study provide behavioural insights that can be useful to design sustainable policy and marketing strategies.

Keywords: Sustainable food choices, Ethical consumption, Best-Worst Scaling, Self-Identity, Food values.

Introduction

Consumers play a pivotal role in fostering the transition towards a sustainable food system.[37] Switching towards more sustainable eating patterns can trigger changes on the supply side as well as contribute to policy efforts aimed to pursue sustainable development. The achievement of sustainability in the food domain is of preeminent concern from a global and European policy perspective, as advocated, respectively, by the 2030 Agenda (United

[37] A food system can be deemed as sustainable if it "delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised" (FAO, 2018).

Nations, 2015) and the European Green Deal, in the form of the Farm to Fork strategy (European Commission, 2020a).

On the one hand, consumers show a strong interest in sustainability. However, on the other, they have difficulty defining this multifaceted and overarching concept (van Bussel et al., 2022). The term remains ambiguous or abstract in people's minds (Mastroberardino et al., 2019) and is primarily associated with issues involving only the environmental dimension of the phenomenon, such as ecosystem protection and climate change (Barone et al., 2020; Simpson & Radford, 2012). An analogous situation occurs when the concept is narrowed down to the food context. Consumers are unable to describe sustainable food in their own words and the term is frequently associated to carbon footprint, climate-friendly, or environmental impact (van Bussel et al., 2022), which neglects the other important areas, i.e., the social and economic pillars of food sustainability.

Peri (2006) defined the fuzzy concept of food quality through a list of requirements necessary to satisfy consumers' needs and expectations (e.g., nutritional, sensory, functional, aesthetic, etc.). Moving one step further, Lusk and Briggeman (2009) identified 11 abstract attributes of food, namely, the food values, representing a comprehensive set of aspects inherent to food consumption that can effectively explain choices made between food products (Lusk, 2011). Therefore, exploring the perception of sustainable food through the lens of the food values may be informative of the consumer decision-making process for sustainable food products.

So far, the conceptualisation of sustainable food in consumers' minds has been studied by investigating people's stated meanings (Stancu et al., 2020) or their priorities among different already-given definitions (Peano et al., 2019). However, what individuals conceive as a sustainable food product in terms of food attributes has never yet been assessed. Generic food is primarily considered by consumers in terms of taste and price (Lusk & Briggeman, 2009), whereas, in the case of sustainable food products, it is expected that the environmental outcomes and social or ethical impacts of food production would be the most relevant attributes for consideration. Conversely, in the literature, individuals were found to associate sustainability with healthy eating, traditional foods, and nourishment (Barone et al., 2020). In the study by Stancu et al. (2020), taste was found to be one of the most important external motivations in driving sustainable food behaviour in the buying phase. Moreover, previous research underlined the existence of a close connection between consumer perceptions of

health issues and sustainability when it comes to diets (Van Loo et al., 2017). Nonetheless, scarce attention has been paid to other food characteristics. Moreover, how the consumer trades off between the different attributes in his/her idea of sustainable food remains unexplored.

Previous research points out the role of individual self-identities as an important driver of sustainable consumption behaviours (Whitmarsh & O'Neill, 2010; Gatersleben et al., 2019; Stancu & Lahteenmaki, 2022). According to identity theory, people engage in behaviours that are consistent with the concept that they have of themselves, the so-called self-identity (Stryker & Burke, 2000; Reed et al., 2012). The influence of self-identity also extends to preferences and consumption since individuals generally tend to focus on goods that act as "reminders and confirmers" of their perceived identity (Belk, 1988). For instance, consumer environmental identity is positively associated with the intention to purchase organic food (Qasim et al., 2019) and the purchase of fairtrade products (Gatersleben et al., 2014). Arguably, different kinds of self-identities might be effective in explaining consumer preferences for sustainable food in terms of various food attributes. However, as far as can be determined, these relationships have never been investigated.

To promote sustainable consumption patterns, there is a need to address what consumers effectively consider sustainable food, including the identification of the attributes people seek when purchasing such products. Moreover, exploring which individual self-identities drive different preferences can contribute substantially to tailoring policy and marketing strategies aimed at encouraging sustainable food choices. Based on these premises, the first objective of this study was to assess which food values are important to consumers when it comes to sustainable food and their relative importance in the product purchase decision. Additionally, to explore the heterogeneity among individuals, the study aimed to segment consumers based on their consideration of sustainable food and profile them according to multiple individual self-identities.

To this end, a cross-national investigation was conducted by means of an online survey incorporating a Best–Worst Scaling (BWS) instrument. Italy and Denmark were selected for the research since these two countries show different patterns in regard to sustainable food consumption. Assuming organic products as a reliable proxy for sustainable foods, Denmark has the highest market share of organic products at the global level (13.4%) and the highest per capita consumption in Europe, € 344 (FiBL & IFOAM – Organics International, 2019).

Italy, however, holds a per capita consumption of € 60, below even the overall European average level of € 84 (FiBL & IFOAM – Organics International, 2019). Nonetheless, Italian eating patterns are more influenced by traditional and local products (Boncinelli et al., 2017) than the Danish dietary style, and these attributes can be seen as a means of environmental and economic sustainability.

Conceptual Background

Food Values

Consumer food preferences and habits may not be static, rather, they often change according to the consumers' interests, concerns, needs, or knowledge. Nonetheless, the underlying set of values that orientate food choices are deemed to be relatively stable (Ellison et al., 2021; Cerroni et al., 2022). The pioneering research on food values conducted by Lusk and Briggeman (2009) proposed an initial set of 11 food values, comprising naturalness, safety, environmental impact, origin, fairness, nutrition, taste, appearance, convenience, price, and tradition.[38] According to the authors, these can be seen as intermediary values or end-states of existence[39] associated with food purchase and consumption. American consumers were found to prioritise the values of safety, nutrition, taste, and price (Lusk & Briggeman, 2009). On the European side, Norwegians were seen to favour safety, naturalness, taste, and animal welfare[40] (Bazzani et al., 2018), whereas Italian consumers were found to attribute higher importance to taste, origin, safety, and naturalness (Piracci et al., 2022).

The food values were found to significantly relate to actual grocery store purchases; hence, they can effectively explain consumer food preferences and guide marketing decisions (Lusk, 2011). Furthermore, the food values can be used to investigate food choices regardless of the specific category or context under investigation since they are general constructs that capture the multiple dimensions of food consumption and embrace more specific product attributes (Lusk & Briggeman, 2009; Bazzani et al., 2018). Indeed, the scale

[38] The food value scale (Lusk & Briggeman, 2009) is made up of the set of values plus each value's definition.
[39] The idea of intermediary values is grounded in the means-end chain theory (Gutman, 1982). The means-end chain technique links product attributes to end-states of existence. Since end-states were considered too abstract to be of practical relevance to food policy or marketing communication strategies, Lusk and Briggeman (2009) conceived the set of food values as the intermediary values of the chain to the final end-states of existence.
[40] Bazzani et al. (2018) modified the original version by adding the animal welfare and novelty values.

has been applied to explain and predict consumer demand for organic food (Lusk, 2011), functional food (Pappalardo & Lusk, 2016), and food nanotechnology (Yang & Hobbs, 2020), as well as to observe changes in food preferences during the COVID-19 pandemic (Ellison et al., 2021; Cerroni et al., 2022).

To investigate the sustainable food concept, the animal welfare value that was recently added to the initial scale by Bazzani et al. (2018) was included, as it can be considered an essential facet of sustainability in the food domain and consumers are increasingly interested in this issue (Van Loo et al., 2014; Bangsa & Schlegelmilch, 2020). The seasonality value was also added since this element considerably affects the environmental impact of food production (Macdiarmid, 2014) and is an important attribute of a sustainable diet according to consumers (Stancu et al., 2020). Furthermore, the nutrition value was interpreted in a broader dimension, acknowledging not only the type and amount of nutrients taken in through the food, but also the overall positive role the food exerts on individual health. Therefore, the overarching value of healthiness was taken into consideration in this study. Additionally, the taste and appearance values were merged as these values leverage the same sphere, namely, sensory appeal. Lastly, the safety value, which is defined as "the extent to which consumption of food will not cause illness," was excluded since it can be regarded as a necessary criterion for the food to be marketed in first place, that is, it is an essential consumer right rather than an attribute that can be traded off for another.

Consumer Self-Identities

Self-identities refer to the "category labels" that represent the subjective view of the self (Reed et al., 2012). People tend to think and behave in coherence with their cognition of themselves (Stryker & Burke, 2000); hence, self-identities can affect all aspects of the individual, such as values, personal goals, everyday behaviour, consumption habits, or food preferences (Gatersleben et al., 2014; Qasim et al., 2019). In the current research, it was hypothesised that self-identity might have an impact on the consideration of sustainable food in terms of attributes. Recently, Gatersleben et al. (2019) argued that since consumers simultaneously manage multiple self-identities, an action can be the result of several types of identities. Therefore, to explain the variability in consumer preferences for the different

food values, multiple individual self-identities relevant to sustainable consumption were taken into account.

We focused on the role of pro-environmental and moral self-identities, considering the environmental and ethical components of sustainable consumption. Previous literature captured the importance of pro-environmental self-identity as a driver of several pro-environmental behaviours, such as recycling, energy saving, carbon offsetting, and food waste aversion (Whitmarsh & O'Neill, 2010; Van der Werff et al., 2013; Stancu & Lähteenmäki, 2022). Similarly, moral self-identity was found to drive socially sustainable behaviours like buying fairtrade products (Gatersleben et al., 2019) or partaking in civic engagement activities (Sunil & Verma, 2018). Although the social facet of sustainability is often neglected, the literature indicates that consumers are becoming more sensitive towards the ethical sphere of consumption (Piracci et al., 2022). Therefore, the pro-environmental and moral self-identities were expected to describe individuals prioritising environmental impact, fairness, and animal welfare values in their sustainable food choices.

Given the strong relationship between health and sustainability diets from the consumer perspective (Aschemann-Witzel, 2015; Van Loo et al., 2017), healthy self-identity was included in this study. It was hypothesised that this self-identity would characterise consumers interested in the healthiness value when considering sustainable products.

Frugal and thrifty self-identities have been studied as possible drivers of sustainable behaviours (Gatersleben et al., 2019; Stancu, 2021), as they refer to people's tendency to restrain consumption or expenditure. However, frugality centres around avoiding wasting resources and resisting overconsumption, whilst thriftiness encompasses the skills of getting the best value for the money spent and preserving economic having (Evans, 2011). Hence, it was expected that these self-identities describe consumers who favour the price value, as both self-identities are associated with saving money, although the frugal self-identity is more likely to be linked to proper sustainable consumption than the thrifty self-identity (Gatersleben et al., 2019; Stancu, 2021).

The Schwartz's value category of self-transcendence entails concerns for the wellbeing of others (either persons or entities) and the need to prioritise society's interests rather than one's own. Therefore, self-transcendence is closely aligned with sustainability principles and, accordingly, was found to positively predict sustainable behaviours (Vermeir & Verbeke, 2008; Lee & Cho, 2019). For this reason, the self-transcendent identity was

included in the study based on the assumption that it belongs to individuals that value the attributes strongly consistent with the concept of sustainability: environmental impact, fairness, and animal welfare.

Methods

Data Collection and Sample

Data were collected via an online survey delivered to consumers from Italy and Denmark through two professional panel recruitment agencies, Toluna and Userneeds, between May and July 2022. The study received ethical approval from the Research Ethics Committee of the Aarhus University (approval registration number BSS-2022-029). Informed consent was obtained from all individuals involved in the study.

The two samples were representative of the respective country population according to age and gender. Individuals under 18 or above 70 years old were excluded from the study. The questionnaire was distributed in the participants' native languages, i.e., Danish and Italian. Twenty-two respondents identified as straight-liners (i.e., no variance in response behaviour) were removed from the data analysis. As a result, the final sample size consisted of 1000 participants: 487 Italian and 513 Danish. The sociodemographic composition of the sample is reported in Table 1.

Table 1. Socio-demographic composition of the sample.

	Denmark (N = 513)		Italy (N = 487)		Total (N = 1000)	
	N	%	N	%	N	%
Gender						
Male	257	50.10	234	48.05	491	49.10
Female	255	49.71	252	51.75	507	50.70
Other	1	0.19	1	0.21	2	0.20
Age Category						
18–34	166	32.36	89	18.28	255	25.50
35–50	149	29.04	209	42.92	358	35.80
51–75	198	38.6	189	38.81	387	38.70
Education						
No high school diploma	36	7.02	37	7.6	73	7
High school diploma	231	45.03	270	55.44	501	50.1
Higher education (bachelor's degree or higher)	246	47.95	180	36.96	426	42.6
*Budget available for grocery shopping**						
High	262	51.07	211	43.33	473	47.30
Medium	183	35.67	229	47.02	412	41.20
Low	68	13.26	47	9.65	115	11.50
Role in grocery shopping						
Responsible or co-responsible	442	86.16	439	90.14	881	88.10
Occasionally doing the grocery shopping	58	11.31	44	9.03	102	10.20
Never doing the grocery shopping	13	2.53	4	0.82	17	1.70

Notes. SD = Standard Deviation. *High refers to the statement "there is enough money to buy the foods I want"; medium refers to the statement "There is some need to consider prices, which limits some choices when buying food"; and low refers to the statement "There is a need to consider prices carefully, which limits many choices when purchasing food". These options could be selected in response to the question "If you think about the amount of money available for grocery shopping in your household, which of these statements best suits you."

Best-worst scaling

To gain an understanding of the relative importance of the food values in consumers' choice of sustainable foods, a BWS approach was implemented (Finn & Louviere, 1992). The BWS method is widely adopted in food economics and marketing research (see, for instance, Pappalardo & Lusk, 2016; Bazzani et al., 2018; Peano et al., 2019; Cerroni et al., 2022) and specifically for cross-cultural applications (Lockshin & Cohen, 2011; Chrysochou et al., 2022). This method consists of a series of choice tasks where participants are asked to

indicate which items, among a specific set, they prefer the most and the least. The underlying assumption is that the selected pair maximize the difference on a priority scale of preferences, which is the reason BWS is also known as "maximum difference scaling." The aim of the approach is to elicit the extent to which each attribute of choice has prior importance or is preferred when describing a concept/product/service (Peano et al., 2019).

The main advantage of BWS is that it overcomes the limits affecting common rating scales (e.g., Likert scales). Rating scales allow individuals to state that multiple items are of similar priority without having to discriminate across them. As a result, people tend to answer that all issues are important to them (Lusk & Briggeman, 2009). Conversely, BWS forces respondents to make trade-offs between the different items as they can only pick one choice as the most preferred and one as the least preferred (Bazzani et al., 2018). The second advantage is that of scale invariance. It is known that personal interpretations of rating scale values vary between individuals, and this scalar inequivalence issue is exacerbated in cross-country studies (Beuthner et al., 2018). BWS, however, can be seen as an invariant measurement method since it is based on choices rather than ratings; thus, it overcomes this problem. Consequently, the BWS method is considered the appropriate tool for cross-national segmentation studies (Mueller Loose & Lockshin, 2013). The third advantage of a BWS approach is that it allows for the measurement of individual-level scales (Lusk & Briggeman, 2009) and is recommended over other stated preference approaches, for example, choice experiments, that require choosing only the best option as those provide information on what is more preferred (Louviere et al., 2015).

Following previous research assessing the relevance of food values (Lusk & Briggeman, 2009; Bazzani et al., 2018; Cerroni et al., 2022), this study makes use of the BWS case 1 mechanism (for an exhaustive treatment of the different BWS approaches, see Flynn & Marley, 2014; Louviere et al, 2015). This is because the BWS case 1 mechanism is best-suited to a situation where the analyst aims to determine the relative importance associated with each item in a set of items (Flynn & Marley, 2014).

Accordingly, respondents were asked to indicate which food attributes are the most and least important to them when choosing to buy sustainable foods instead of their conventional counterparts.[41] A best-worst (BW) choice task sample is show in Figure 1.

Figure 1. An example of best-worst choice task included in the survey.

Which of the following attributes is the most important and which is least important when you decide to buy the sustainable food option instead of the conventional alternative? Please note that you can select ***only one attribute as the most important and only one attribute as the least important****.*

Most important	Attribute	Least important
□	Environmental impact (effects of food production on the environment)	□
□	Fairness (farmers, processors and retailers get a fair share of the price)	□
□	Healthiness (the food is good for the health)	□
□	Taste and Appearance (sensory appeal: the food looks and tastes good)	□
□	Tradition (the food preserves traditional consumption patterns)	□

As outlined in Section 2.1, the full set of food attributes included in the BWS was adapted from the original food value scale by Lusk and Briggeman (2009) and the modified version of Bazzani et al. (2018). The final list is provided in Table 2.

[41] If participants stated in a previous question to have never purchased sustainable foods before, they were asked to indicate which food values are the most and least important if they were to consider buying sustainable food rather than the conventional alternative.

Table 2. List of the food values (adapted from Lusk & Briggeman, 2009; Bazzani et al., 2018).

Food value	Description
Naturalness	Made without additives or modern food technologies like genetic engineering, hormone treatment, and food irradiation
Seasonality	The food is produced during its own natural production period
Environmental impact	Effects of food production on the environment
Origin	Whether the food is produced locally in Denmark/Italy
Fairness	Farmers, processors, and retailers get a fair share of the price
Healthiness	The food is good for the health
Taste and appearance	Sensory appeal: the food looks and tastes good
Animal welfare	Well-being of farm animals
Convenience	How easy and fast the food is to cook
Price	Price you pay for the food
Tradition	The food preserves traditional consumption patterns

The 11 food attributes were allocated in 11 BW choice tasks, each covering five items, following a Balanced Incomplete Block Design (BIBD). The design is balanced since each attribute appears the same number of times, in this case, five times. The BIBD also ensures orthogonality meaning that each pairwise comparison of items occurs an equal number of times, which in this design, was twice, to avoid context effect. The order of the choice sets and items within each choice set was randomised across respondents to prevent ordering effect. The design was generated using the software R (package bwsTools).

Survey Design

The first section of the questionnaire was devoted to implementing the BWS instrument. The second section was aimed at collecting multiple measures. The scales applied are reported in Appendix A. First, six different consumer self-identities with relevance to sustainable consumption were evaluated: pro-environmental, moral, healthy, frugal, thrifty, and self-transcendent. The pro-environmental self-identity was measured through the items developed in Van der Werff et al.'s (2013) work. The remaining self-identities were assessed by adapting the Van der Werff et al. (2013) and Gatersleben et al. (2019) scales.[42]

The need for information on sustainable food was measured using the four-item scale adapted from Hung et al. (2017). Following Brucks (1985), consumer knowledge about sustainable food was assessed at two levels: subjective and objective knowledge. Subjective

[42] The scales used to measure the healthy, frugal, and thrifty self-identities were previously validated in Stancu (2021).

knowledge was collected through a reduced version of the scale proposed by Flynn and Goldsmith (1999). However, to gather objective knowledge, participants were provided with a set of eight statements on sustainable food and were asked to indicate whether the statement was true or false or whether they did not know. The participants' self-identities, need for information, and subjective knowledge were measured on a 7-point scale ranging from 1 (totally disagree) to 7 (totally agree). The corresponding variables included in the analyses were constructed as the average of the items for each scale. However, the objective knowledge measure was computed as the percentage of correct answers.

Lastly, in the third section of the questionnaire, participants were asked about their socio-demographic information.

Before the data collection, a pilot study was conducted to assess the clarity and validity of the measurement instruments included in the survey.

Data analyses

The rankings of preference for the values of sustainable food were obtained by applying the counting method (Mueller Loose & Lockshin, 2013) to calculate the average individual BW score. The measure was computed as the difference between the number of times each item was chosen as the best and the number of times each item was chosen as the worst, averaged across the sample. Since each food value was repeated a total of five times in the full experimental design, the individual BW scores ranged between +5 and –5. This measure indicated the food values' importance. However, a negative BW score did not imply dislike, rather a low, i.e., below average, preference level (Mueller Loose & Lockshin, 2013).

To investigate the heterogeneity within the sample, a latent class cluster analysis was applied based on the individual BW scores (Cohen & Neira, 2003). This procedure allowed for the segmentation of consumers such that the preferences were homogeneous within the class while being diverse between the classes. The analysis was built on the whole consumer sample, in line with previous recommendations suggesting the investigation of cross-cultural segments rather than determining country-specific classes (Bech-larsen & Grunert, 2003; Lockshin & Cohen, 2011; Mueller Loose & Lockshin, 2013). The clusters were profiled according to the multiple individual self-identities and the socio-demographic information gathered from the survey.

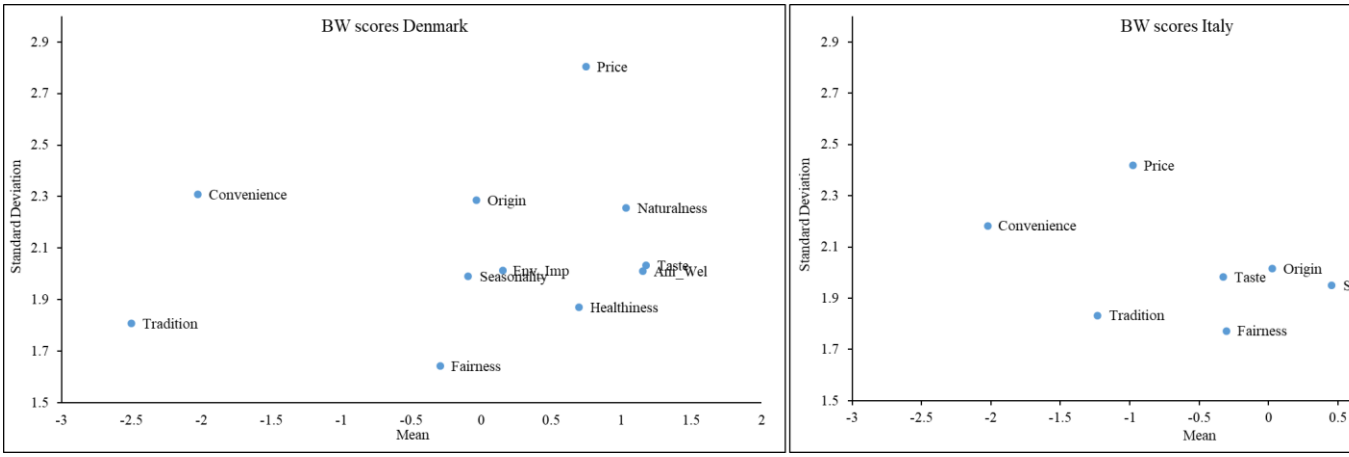
The counting analysis was performed in R, whereas the latent class model was run in Latent Gold 5.1.

Results

Relative Importance of the Food Values in Sustainable Food

The scatter diagram (Figure 2) reports the mean BWS scores against the standard deviations of the BW scores, illustrating the ranked order of the preferences for the food values in the two countries. In the Danish sample, the most important food value driving sustainable food choices was taste and appearance (1.17), followed by animal welfare (1.16), naturalness (1.03), and price (0.75). The least considered values were tradition (-2.50), convenience (-2.03), and fairness (-0.29). In the Italian sample, consumers were found to prioritise naturalness (1.53), healthiness (1.43), animal welfare (0.74), and environmental impact (0.69) in their sustainable food purchase choices, while convenience (-2.02), tradition (-1.23), and price (-0.98) were the least relevant values to their decisions. It is worth pointing out that the BW scores tended to be more concentrated for the Italian respondents (Figure 2), whereas among the Danish respondents, there was a higher degree of variability, as denoted by the more pronounced dispersion of the scores and the higher variation range of the standard deviations. Furthermore, on average in both countries, respondents agreed on the importance assigned to the values of fairness and tradition, which reported the lowest standard deviations. In contrast, preferences for price and convenience tended to be heterogeneous, regardless of the country. The analysis of variance provided in Appendix B indicates that the BW scores significantly differed across the two countries, excluding the values of origin, fairness, and convenience. Nonetheless, as shown by the two plots, the overall positioning of the food values tended to be consistent between Denmark and Italy, with the only exceptions being the values of price and taste and appearance. This corroborates the use of a cross-national segmentation approach.

Figure 2. Average individual BW scores and relative standard deviations in Denmark and Italy.



Notes. Ani_Wel represents the Animal Welfare value; Env_Imp represents the Environmental Impact value; and Taste represents the Taste and Appearance value.

Segmentation Analysis

To identify consumer groups with similar patterns of preference ratings, a latent class cluster procedure based on the individual BW scores was implemented. The optimal number of classes was determined as follows. First, the goodness of fit of the model specifications ranging from one to nine clusters was considered. The results are reported in Appendix C. The log-likelihood (LL), Bayesian information criterion (BIC) and Akaike information criterion (AIC) improve continuously by adding a further cluster until the 8-class model is reached, which is the turning point of the three theoretical criteria. Since only a smaller marginal improvement was observed when switching from three to four classes and so on, as compared to the shift from two to three, the most parsimonious model was opted for, as suggested in Ruto et al. (2008). Therefore, the 3-cluster model was chosen, as the other specifications did not add to the understanding of the underlying behavioural process, following Swait (1994)[43].

Table 4 reports the average BW scores of the food values for each cluster. The first consumer segment accounted for 35% of the sample. Compared to the other two groups, this one scored the highest on the values of price (2.49) and taste and appearance (1.58). Likewise, the

[43] An analogous modelling approach was previously used by other authors. See, for instance, Boncinelli et al., 2021 and Chrysochou et al., 2022.

healthiness value was considered an important driver (0.66) for this cluster. Since this class prioritised the strictly utilitarian values when purchasing sustainable products, these consumers were labelled as "private benefit seekers." According to the first group's preferences, the scores for the environmental and ethical dimensions were all negative, and the least preferred value was tradition (-1.68). The second cluster accounted for 32.3% of the sample. Consumers in this segment attached great importance to the traditional sustainability values, namely, animal welfare (2.74), environmental impact (1.91), and fairness (0.61), which had the highest scores with respect to the other two classes. For this reason, this cluster was labelled as "sustainability focused". Also, this group considered the values of naturalness (1.70) and healthiness (0.61) to be relevant, whereas the values of convenience (-2.98) and tradition (-1.86) were given the lowest attention. Additionally, the values of price (-1.76) and taste and appearance (-0.75) scored the lowest in this group compared to the other two segments. Lastly, the third consumer class, which accounted for 32.6% of the participants, primarily sought the values of naturalness (2.52), healthiness (1.88), and seasonality (1.26) when choosing sustainable food products. These values, along with the value of origin, scored the highest compared to the other two clusters. Therefore, consumers in the third class were labelled as "naturalness and health driven". Furthermore, the least preferred values in this segment were convenience (-3.01) and tradition (-2.12), as in the second segment.

Table 4. Average BW scores for the three clusters.

Food value	Class 1 Private benefit seekers	Class 2 Sustainability focused	Class 3 Naturalness and health driven	*F*	*p*-value
Naturalness	-0.29 [a]	1.70 [b]	2.52 [c]	217.19	< 0.001
Seasonality	-0.62 [a]	-0.07 [b]	1.26 [c]	93.15	< 0.001
Environmental impact	-0.66 [a]	1.91 [b]	0.08 [c]	211.32	< 0.001
Origin	-0.44 [a]	-0.18 [a]	0.63 [b]	23.29	< 0.001
Fairness	-0.91 [a]	0.61 [b]	-0.54 [c]	83.11	< 0.001
Healthiness	0.66 [a]	0.64 [a]	1.88 [b]	50.08	< 0.001
Taste and appearance	1.58 [a]	-0.75 [b]	0.40 [c]	123.3	< 0.001
Convenience	-0.23 [a]	-2.98 [b]	-3.01 [b]	263.12	< 0.001
Price	2.49 [a]	-1.76 [b]	-1.21 [c]	459.78	< 0.001
Animal welfare	0.10 [a]	2.74 [b]	0.11 [a]	302.27	< 0.001
Tradition	-1.68 [a]	-1.86 [a,b]	-2.12 [b]	4.45	0.012
Class size (%)	35	32.3	32.7		
Danish (%)	43.47	28.65	27.88	$\chi^2(2) = 33.42$	< 0.001
Italian (%)	26.08	36.14	37.78		

Notes. The superscripts [a–c] indicate significantly different means in each row following ANOVA post hoc Tukey tests ($p < 0.05$).

Cluster Profiling

The descriptions of the clusters according to the consumer self-identities, need for information, and objective and subjective knowledge are reported in Table 5. Considering the self-identities, consumers in the second and third segments scored highest on the environmental, moral, healthy, and self-transcendent self-identities. On the other hand, the "private benefit seekers" were more prone to see themselves as thrifty individuals with respect to the other two groups. Regarding the need for information, the "sustainability focused" segment showed a higher interest in receiving and seeking sustainability-related information than the other segments. In terms of knowledge levels, the "private benefit seekers" exhibited a lower degree of both subjective and objective knowledge about sustainable foods. Overall, the "sustainability focused" consumer profile was not significantly different from the "naturalness and health driven" consumer profile, with the only exception being the need for information.

Table 5. Cluster profiling on self-identities, knowledge, and need for information.

	Class 1	Class 2	Class 3		
	Private benefit seekers	Sustainability focused	Naturalness and health driven	*F*	*p*-value
Pro-environmental SI	4.45 [a]	5.70 [b]	5.52 [b]	118.00	< 0.001
Moral SI	5.33 [a]	5.84 [b]	5.79 [b]	29.00	< 0.001
Healthy SI	4.61 [a]	5.41 [b]	5.51 [b]	62.12	< 0.001
Frugal SI	4.89 [a]	5.43 [b]	5.44 [b]	27.98	< 0.001
Thrifty SI	5.47 [a]	5.08 [b]	5.17 [b]	12.29	< 0.001
Self-transcendent SI	5.15 [a]	5.76 [b]	5.62 [b]	43.02	< 0.001
Need for information	3.62 [a]	5.23 [b]	4.71 [c]	120.97	< 0.001
Subjective knowledge	3.25 [a]	4.27 [b]	4.09 [b]	50.24	< 0.001
Objective knowledge	0.65 [a]	0.70 [b]	0.70 [b]	5.34	0.005

Notes. The superscripts [a–c] indicate significantly different means in each row following ANOVA post hoc Tukey tests ($p < 0.05$). SI: Self-identity.

Table 6 presents the socio-demographic composition, consumption behaviour for sustainable food, and diet characterisation of the three clusters. The "private benefit seekers" cluster consisted of more male, younger, and less educated consumers. The "sustainability focused" and "naturalness and health driven" clusters had a slightly higher proportion of female respondents. Moreover, older consumers with a higher level of education were more likely to belong to these segments. The available household budget for grocery shopping did not discriminate between the classes, whereas the role in grocery shopping differed among the segments. Indeed, the second and third classes had a higher proportion of responsible or co-responsible figures. In addition, the "sustainability focused" consumers had a higher frequency of consumption of sustainable food products compared to the rest of the sample. Furthermore, this class comprised the highest proportion of flexitarian and the lowest share of omnivore consumers. Conversely, the "private benefit seekers" class tended to consume less sustainable foods and included the highest share of omnivore respondents.

Table 6. Cluster composition (%) in terms of socio-demographic characteristic, consumption frequency of sustainable food, and diet characterisation.

	Class 1 Private benefit seekers	Class 2 Sustainability focused	Class 3 Naturalness and health driven	χ^2	*p*-value
Gender				13.26	0.01
Male	56.57	45.82	44.34		
Female	43.14	54.18	55.35		
Other	0.29	0	0.31		
Age category				43.19	< 0.001
18–34	33.71	24.15	18.04		
35–50	40.29	32.82	33.94		
51–75	26	43.03	48.01		
Education				9.90	0.042
No high school diploma	8	9.29	4.59		
High school diploma	53.14	44.89	51.99		
Higher education (bachelor's degree or higher)	38.86	45.82	43.43		
*Budget available for grocery shopping**				7.76	0.101
High	42	49.54	50.76		
Medium	43.71	40.25	39.45		
Low	14.29	10.22	9.79		
Role in grocery shopping				24.60	< 0.001
Responsible or co-responsible	81.43	90.09	93.27		
Occasionally doing the grocery shopping	15.71	8.67	5.81		
Never doing the grocery shopping	2.86	1.24	0.92		
Frequency of sustainable food consumption				134.83	< 0.001
Never or rarely	24.57	6.19	7.95		
Sometimes	50.29	28.17	40.37		
Often or always	24.14	65.63	51.68		
Diet				37.21	< 0.001
Omnivore	86.29	71.52	78.29		
Flexitarian	8.57	20.43	15.9		
Pescetarian	3.43	1.55	2.75		
Vegetarian	1.14	2.79	1.22		
Vegan	0	1.55	0.31		
Other	0.57	2.17	1.53		

Discussion

The first objective of this study was to investigate which food values are the most important in the choice of sustainable foods and to classify and profile the consumers according to their preferences and multiple individual self-identities. To this end, a BWS approach was followed, which was implemented by means of a cross-national online survey among a Danish and Italian sample.

The results indicate that the overall preferences for the food values were fairly similar in many aspects across Denmark and Italy. The respondents' most sought values in sustainable products were taste and appearance (Denmark) and naturalness (Italy), which is in line with the work of Hemmerling et al. (2016) and Stancu et al. (2020); these values provide individual private benefits. Likewise, in both countries, other utilitarian values, such as healthiness and price, were considered among the most important drivers for sustainable food choices, as previously observed in other studies (Verain et al., 2015; Petrescu et al., 2020). This is at odds with the core principles of sustainability implying the production of positive externalities for the whole society, such as environmental benefits or ethical and social gains. The findings support the idea that consumers favour food values related to their direct use of the food (private attributes) over those concerning non-use characteristics (public attributes), such as those related to sustainability, confirming the results from prior studies (Verain et al., 2016; Grunert et al., 2018). Indeed, the values of environmental impact and fairness, which can be considered values consistent with the sustainability concept, ranked only as sixth and ninth, respectively, in terms of preference for the Danish sample, and as fourth and seventh, for the Italian sample. Lusk (2011), in assessing the effect of food values on consumer willingness to pay for organic foods, also found that the value of fairness was not positively correlated with preferences for organic foods, which is in line with this study's findings. However, Lusk (2011) reported that the value of environmental impact was the most important determinant in organic food demand, which is in contrast to this study's findings. One plausible motivation to explain this difference could be rooted in the fact that the current study was focused on the umbrella concept of sustainable food, which is a multi-faceted notion that remains abstract and complex among consumers (Mastroberardino et al., 2019; van Bussel et al., 2022). However, the study by Lusk (2011) concentrated on a

delimited and well-known category, namely, organic food, the environmental virtues of which are renown among consumers (Aertsens et al., 2011).

Notwithstanding this, the animal welfare value was an exception since it was found to be highly considered for sustainable purchases, ranking second and third in terms of preference in Denmark and Italy, respectively. The considerable importance of animal welfare for Danish consumers was expected, since the country has a strong regulatory regime and monitoring systems for the respect of animal welfare standards and is regarded as one of the most proactive countries in the world in this field (World Animal Protection, 2022). Interestingly, the findings show that the issue of animal welfare is also becoming a preeminent concern among Italian consumers, as outlined by Rubini et al. (2021) reporting that 69% of Italian consumers stated that they pay attention to animal welfare during their grocery shopping.

The variance in consumer responses reflects the different degrees of development for the market of sustainable foods in these two countries. In Denmark, which holds one of the biggest shares of organic consumption in the world (Jensen et al., 2019; Organic Denmark, 2022) and the second-largest share of environmentally labelled products in Europe (Koos, 2011), consumers have awareness, knowledge, and considerable experience of these products. This explains the higher variability in the Danish respondents' personal opinions and perceptions of sustainable food. However, in Italy, where the sustainable food market is far less consolidated, consumers have minor experience of organic consumption. Thus, slightly less variability in the relative importance placed on the food values by the Italian respondents for sustainable purchases can be seen. Nonetheless, a relevant degree of heterogeneity was detected in both countries.

To cope with this underlying variability, a cross-national segmentation approach was applied. By doing so, this study contributed to the discussion on sustainable food consumption by identifying three distinct consumer segments based on different preferred food values for their purchase decisions: "private benefit seekers," "sustainability focused," and "naturalness and health driven." The derived cluster solution is comparable to the segmentation of sustainable food consumers described in the literature review by Verain et al. (2012), thus substantiating the validity and persistence of this pattern. The segment uninterested in sustainability, i.e., the "private benefit seekers," were strongly price-oriented and exhibited less preference towards the traditional sustainability-related attributes.

Conversely, the "sustainability focused" cluster preferred the food values fully consistent with sustainability, that is, the animal welfare, environmental, and ethical values. This result suggests that the concept of sustainable food in the consumer mind adheres, even if to different extents, to multiple aspects and dimensions, not only to the environmental sphere; the environmental, ethical, and animal welfare values can be cognitively distinguished by consumers. When it comes to motivations for sustainable food purchases, they merge into a unidimensional abstract driver, i.e., generic sustainability (Van Dam and van Trijp, 2011; Verain et al., 2021).

The third group consisted of "naturalness and health driven" consumers, who attached importance to the absence of "artificialness" and the positive benefits of the food products on personal health. Such evidence points out the close connection between food naturalness and healthy eating, as outlined in Román et al. (2017), and is consistent with the study by the European Commission (2020), which reported that 40% of consumers mention "nutritious and healthy" as the main characteristic of sustainable food. Moreover, this study's findings agree with those of Verain et al. (2012), which addressed individuals more involved with a balanced and healthy diet as "potential green" consumers. Indeed, the "naturalness and health driven" segment was found to also be interested in sustainability-related aspects such as the origin and seasonality of the foods. Concern about the proximity and proper season of foods is a means of remunerating territorial producers, supporting the local economy, and reducing carbon emissions. Nonetheless, while sustainability is seen as something distant from the self, the origin and seasonality values can be perceived as something more concrete (Verain et al., 2021) as they are linked to the individual's private sphere. This is in line with this class being primarily interested in healthiness and naturalness and is the motivation behind local and seasonal attributes forming a unidimensional driver of sustainable consumption that is distinct from the other traditional sustainability aspects, namely, environmental, ethical, and animal welfare issues (Sautron et al., 2015).

In terms of how consumers see themselves, it was expected that the self-identities mapping onto morality or biospheric and altruistic values, namely, the environmental, moral, frugal, and self-transcendent self-identities, would have discriminated between people more involved in sustainability attributes and those who were not. On one hand, it was found that this was not the case for the "naturalness and health driven" consumers, who were described by the same identities as the "sustainability focused" consumers. Indeed, healthy eating can

be seen as a form of conscious and responsible behaviour towards the self that relates to the ethical and moral sphere of individuals as well. This would also justify why, in turn, the healthy identity characterises the "sustainablility focused" consumer class. Therefore, this study's findings corroborate the strong connection between health and sustainability from the food consumer's perspective, in line with those of Aschemann-Witzel (2015) and Van Loo et al. (2017). On the other hand, the self-identities differentiated the sustainability involved and hedonic segments, consistent with Gatersleben et al. (2019), as they related to the distinction between pro-environmental and wasteful consumers. The "private benefit seekers" were thriftier than the other consumer groups, which indicates a remarked attention to cost, value, and economic worth. Since sustainable products are generally higher-priced than their conventional counterparts (the organic example can be seen as a reliable proxy), the thriftiness of consumers in the first cluster justifies their negative attitude towards the sustainable attributes and their strongly price-oriented preferences, which is in line with the findings of Stancu (2021).

Furthermore, the "naturalness and health driven" and the "sustainability focused" classes consisted of consumers that were more knowledgeable about sustainable food, both in terms of the subjective and objective dimensions, as compared to the price-driven group. Consistently, these consumers showed a higher level of consumption frequency of sustainable foods and need for sustainability-related information. Indeed, knowledge can be gained through past experience with the product and information acquisition (Brucks, 1985), whereas a higher demand for information leads to a stronger motivation to process food labels (Hung et al., 2017).

Socio-demographic characteristics contributed to the profiling of the identified consumer segments. Women and well-educated consumers were more likely than men and less-educated individuals to show interest in sustainability-related issues and sustainable attributes. However, in contrast with previous literature (see, for instance, Lee & Cho, 2019), it was found that younger adults were more likely to belong to the price-oriented group. Arguably, this segment comprised students or unemployed consumers who needed to consider their budgets first and foremost, even if they were sensitive to sustainability principles.

Conclusion

As far as can be determined, this study is the first exploring the concept of sustainable food in terms of food values and their relative importance across consumer segments. Considering the whole sample, it was found that the drivers of sustainable food choices relate more to self-centred values than society-centred values. Three consumer segments prioritising different values for their choices were identified: "private benefit seekers," "sustainability focused," and "naturalness and health driven." The pro-environmental, moral, frugal, healthy, and self-transcendent self-identities described both the "sustainability focused" and "naturalness and health driven" consumers. Conversely, the thrifty self-identity was more pronounced in the segment of "private benefit seekers," who preferred price and taste and appearance values.

The results of this study provide behavioural insights that can be useful to the design of sustainable policy and marketing strategies. Since private values, namely, healthiness, price, and sensory aspects, seem to be the core elements in sustainable food choices, marketers and policymakers are encouraged to build upon such aspects in their strategies in order to favour more sustainable food choices. Furthermore, policy and marketing instruments must be tailored according to the different consumer segments and their respective identity profiles to be complementary rather than selective in their coordinated contribution aimed to encourage sustainable consumption patterns. Considering the "private benefit seekers" segment, one strategy to increase sustainable food product purchase could be to ensure the affordability of the sustainable food alternative. In that way, consumers would not have to trade off the price being paid for the sustainability of the food. This class of consumers would also need to be assured of the sensory properties of sustainable products as they highly consider taste and appearance food values. Regarding the "naturalness and health driven" segment, emphasising the origin and seasonality of sustainable foods would trigger these consumers' sustainable purchase choices, as long as the healthiness and naturalness of the product are granted. The results further highlighted that information and education campaigns aimed at promoting healthy and sustainable dietary habits can be combined to strengthen their effectiveness since consumers interested in these aspects share the same identity profile. Arguably, the synergies between these two trends should be enhanced to emphasise that healthy habits, such as reducing meat consumption, increasing plant-based

food intake, and preferring less-processed products, have positive environmental spill-over effects, and vice versa. Information-based instruments should leverage consumer self-identities to encourage sustainable and healthy consumption. As an example, relying on the self-transcendence, moral, and pro-environmental self-identities, communication strategies should emphasise the importance of everyday individual food choices from environmental and societal perspectives. On the other hand, drawing upon the healthy self-image, information tools should highlight the key contribution of food to maintain and preserve individual healthiness.

Some limitations should be acknowledged in the interpretation of this study's results. First, although BWS overcomes the limits inherent within common rating scales (see Section 3.2), it may be prone to attribute non-attendance due to the complexity of the choice tasks, i.e., too many items or too many choice tasks, resulting in misinterpreted discrimination among the values. Second, since the focus of the survey was on sustainable food choices, results may have been affected by the social desirability response behaviour of the participants. However, the complete anonymity of the answers could have limited this particular bias. Third, the BW choice tasks were built addressing the food concept in general. The importance of food values in the context of sustainability may be contingent upon the specific food category; thus, they vary. Nonetheless, the study remained with the scope of its primary research objective, namely, investigating the idea of sustainable foods at a broader level.

Future research could explore the relative importance of food values for precise food categories and validate the findings of this research. Moreover, as it was found that the "sustainability focused" and "naturalness and health driven" segments were not different in terms of their identity profiles, it is probable that other possible sources of heterogeneity between these two classes are yet to be found. For instance, the personal values of consumers or other types of individual self-identities could be investigated. Lastly, since the food values of origin and seasonality are usually ignored when focusing on sustainable consumption or choices, further research on these topics is needed, as the current findings indicate that a relevant segment of consumers consider them in making sustainable choices.

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Appendix

Appendix A

Table A1. Self-identity scales used in the survey.

Self-identity	Items	Mean	SD	α
Pro-environmental		5.21	1.27	0.91
	Acting environmentally friendly is an important part of who I am	5.15	1.48	
	I am the type of person who acts environmentally friendly	5.20	1.34	
	I see myself as an environmentally friendly person	5.27	1.33	
Moral		5.64	1.00	0.82
	Doing the right thing is an important part of who I am	5.57	1.18	
	I am the type of person who always tries to do the right thing	5.50	1.23	
	I see myself as a responsible person	5.86	1.07	
Healthy		5.16	1.22	0.90
	Choosing products that are good for my health is an important part of who I am	5.21	1.34	
	I think of myself as a health-oriented person	5.12	1.35	
	I see myself as a person who is trying to be healthy	5.17	1.33	
Frugal		5.24	1.13	0.84
	I am the type of person who would first use what I already own before purchasing something new	5.36	1.36	
	Avoiding unnecessary consumption is an important part of who I am	5.31	1.36	
	I am the type of consumer who buys only what I need and doesn't replace unless necessary	5.17	1.42	
	I see myself as someone who would limit my consumption whenever possible	5.14	1.33	
Thrifty		5.24	1.09	0.77
	I am the type of person that looks for bargains	5.07	1.52	
	Getting the best value for money is an important part of who I am	5.28	1.33	
	I see myself as a person who is looking for products on discount	5.43	1.42	
	I see myself as a person who is thrifty	5.19	1.36	
Self-transcendent		5.50	0.93	0.75
	Caring for the welfare of others is an important part of who I am	5.49	1.22	
	I am the type of person who always tries to correct injustice	5.19	1.26	
	I see myself as a person tolerant of different ideas and beliefs	5.50	1.28	
	I am the type of person who thinks that everyone deserves equal rights and opportunities	5.82	1.20	

Notes: SD means Standard Deviation. α indicates the Cronbach's alpha value.

Table A2. Scales included in the survey and related sources.

Scale and items	Mean	SD	α
The need for information (adapted from Hung et al., 2017)	4.50	1.53	0.74
R. I am happy with general labels about sustainability (e.g. sustainable food) without the need to know in what sense the food is sustainable [D]	3.98	1.46	
It is important to me to know the environmental and social impacts of food products	4.43	1.65	
It bothers me if sustainability-related information is not available on food products	4.39	1.74	
It is important to me to receive information on food products stating that the food has been produced respecting ethical and environmental standards	4.67	1.63	
Subjective knowledge	3.86	1.49	0.91
In comparison with an average person I know a lot about sustainable foods	4.11	1.55	
I know a lot about how to judge the quality of sustainable foods	4.03	1.59	
People who know me, consider me as an expert in the field of sustainable foods	3.42	1.68	
Objective knowledge (adapted from Aertsens et al., 2011; Grunert et al. 2014; Peschel et al., 2016)[*]	0.68	0.26	0.71
Climate friendly products are those products that are high in carbon emissions	0.75	0.43	
Fairtrade products ensure better prices, decent working conditions and good terms in food production	0.76	0.43	
Organic food production requires that products are locally/regionally produced	0.57	0.49	
Animal welfare certifications signal foods with no animal-based ingredients	0.56	0.50	
A carbon footprint measures the amount of CO2 emitted in producing, distributing and marketing the product	0.73	0.44	
Fairtrade label works to achieve lower prices for consumers	0.56	0.50	
Organic farmers do not use synthetic pesticides	0.67	0.47	
Animal welfare products are obtained under improved conditions for and protection of animals	0.85	0.35	

Notes: SD means Standard Deviation. α indicates the Cronbach's alpha value. [D] Denotes the items removed from further analyses. * The means and standard deviations refer to the percentage of correct answers.

Appendix B

Table B1. Average individual Best-Worst scores by country and analysis of variance.

	Denmark			Italy				
Food Value	Rank	BW score	SD	Rank	BW score	SD	*t*-test	*p*-value
Naturalness	3	1.03	2.26	1	1.53	2.05	3.63	<0.001
Seasonality	8	-0.10	1.99	5	0.45	1.95	4.41	<0.001
Environmental Impact	6	0.15	2.01	4	0.69	1.90	4.34	<0.001
Origin	7	-0.04	2.28	6	0.02	2.02	0.47	0.64
Fairness	9	-0.29	1.64	7	-0.30	1.77	-0.09	0.93
Healthiness	5	0.70	1.87	2	1.43	1.90	6.15	<0.001
Taste	1	1.17	2.03	8	-0.33	1.98	-11.82	<0.001
Convenience	10	-2.03	2.31	11	-2.02	2.18	0.00	1.00
Price	4	0.75	2.81	9	-0.98	2.42	-10.38	<0.001
Animal Welfare	2	1.16	2.03	3	0.74	1.97	-3.25	<0.05
Tradition	11	-2.50	1.81	10	-1.23	1.83	11.02	<0.001

Note: SD: Standard Deviation.

Appendix C

Table C1. Comparison of the goodness of fits for the cluster models.

Model	LL	BIC	AIC
1-Cluster	-23643.91	47439.78	47331.81
2-Cluster	-23123.35	46557.54	46336.69
3-Cluster	-22940.64	46351.00	46017.28
4-Cluster	-22779.74	46188.08	45741.48
5-Cluster	-22665.11	46117.70	45558.22
6-Cluster	-22553.68	46053.73	45381.36
7-Cluster	-22404.31	45913.86	45128.62
8-Cluster	-21811.03	44886.17	43988.05
9-Cluster	-21983.05	45389.10	44378.10

Notes: LL: log-likelihood. BIC: Bayesian information criterion. AIC: Akaike information criterion.

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III CONCLUSIONS

General discussion

Favouring the transition towards a sustainable food system requires a deeper understanding of the role of sustainability attributes in triggering sustainable food choices among consumers. This thesis aimed to study the effect of environmental and social sustainability attributes on consumer food choices and investigate the decision-making process for sustainability attributes.

The main contribution of Research article 1 is to synthesise and systematise findings collected so far in the literature on the WTP for sustainability labelling and to gather generalisable evidence on the contribution of the different types of labels in terms of the breadth of formulation, underlying sustainability dimension and specific category. It is the first attempt to provide a taxonomy for sustainability labelling as well as the most extensive meta-analysis on WTP for sustainability attributes. Regarding the importance of sustainability dimensions, the study revealed that social and ethical aspects are considered less than environmental-related issues in public opinion. Label information concerning production methods and environmental outcomes is the most impactful on the premium price for sustainability attributes. Any significant difference in the premium price of the generic *versus* specific formulations was detected. Additionally, the study indicates that sustainability labels signalling the environmental impact of the product, the production methods, or animal welfare improvements achieve higher premiums when provided on expensive foods rather than low-priced products, substantiating that consumers' interest in food sustainability varies depending not only on the type of label but also on the price range of the carrier product.

Research article 2 hinges upon the findings of Research article 1, aiming to elucidate further on consumer preferences for social labelling. Specifically, the study investigates a case where the ethical issue recalled by the label is well-known among consumers: the treatment of workers in Italy, where the exploitation of migrant labour in the agricultural sector has become a preeminent social plague. The findings outlined the existence of a premium for the fair labour label in the Italian market, indicating that social labelling can be valuable among consumers when the underlying ethical issue is familiar and close to them. Moreover, the research outlined that possible competition effects may occur between different sustainability labels when simultaneously present on the product packaging, suggesting that

combining these certifications, such as the organic with other environmental labels, may provide consumers with interrelated and overlapping utilities and may cause a detrimental effect on the choice probability of the product.

Research article 3 primarily introduces the RRM framework in the context of sustainable food choices. The contribution of the study to the current debate on sustainable consumption is twofold. Firstly, the study reveals that preference patterns for pro-environmental packaging options change depending on the behavioural paradigm assumed by an individual. Consumers following the utility maximization mechanism attach the greatest importance to the possibility of buying the loose product, whereas individuals choosing according to the regret minimization process similarly value the provision of both the sustainable packaging options (loose and bioplastics). Secondly, the study indicates that in the context of sustainability attributes most of the decisions are driven by regret minimization feelings rather than utility maximization matters. Therefore, evaluating all decision-makers and their choices as only driven by utility considerations can lead to a partial understanding of the phenomenon. Rather, sustainable consumption behaviours should be investigated by combining the utility maximization and the regret minimization perspectives.

Research article 4 explains how the overall product attributes asset influences the purchase decision for sustainable food, specifically, which are the most important attributes driving sustainable choices. It has been shown that self-centred values (private attributes) rather than society-centred values (public attributes) are more important in determining sustainable food behaviours. Three distinct consumer segments are based on different preference patterns for their purchase decisions: the first group favouring Price, Taste and Appearance values (the "private benefit seekers"); the second prioritising sustainability-related values, namely Environmental Impact, Fairness and Animal Welfare (the "sustainability focused"); and the third attaching higher importance to Naturalness and Healthiness (the "naturalness and health driven"). The second and third consumer segments were found to share the same profile in terms of sustainability-related self-identities. This emphasised the strong synergy between healthy and sustainable eating patterns from the consumer's perspective.

Conclusion and implications

The thesis presents an integrative perspective concerning the role of social and environmental labelling in food choices, the behavioural mechanisms underlying sustainable purchase decisions, and the trade-off between sustainability attributes and other food attributes. The work provides behavioural insights that can be useful to design policies aimed to encourage sustainable consumption as well as marketing strategies.

Labelling was found to promote informed choices and strengthen the demand for more sustainable alternatives in the case of already established preferences, such as the case of environmental labels, or in the case of proximity and familiarity with the issue underlying the label, like the fair labour claim in the Italian context. Moreover, preferences for ethical and environmental labels were seen to be strongly heterogeneous among consumers. From a policy perspective, this indicates that food labelling should be addressed as a part of the policy tool belt rather than the main instrument to drive the sustainable transition as not all sustainability facets are considered equally important among consumers at the point of purchase. An integrated policy approach, encompassing diverse measures, is needed to achieve a "completely sustainable" food system, namely an agri-food chain that contributes to all the different pillars, namely the environmental, social and economic, in a balanced manner. Social and ethical issues tend to be considered less than the environmental-related aspects in public opinion, probably because they are perceived as something distant and not directly relevant to the self in time and space. Therefore, public authorities and institutions should address and manage the growing gap between the citizens and the social policy agendas. Awareness-raising campaigns should be utilised to emphasise that ethical priorities are a core component of the path to a more sustainable society, as has been recently done with the climate change and environmental crises issues.

On these premises, the development of a comprehensive and overarching sustainability label, as advocated by the European F2F Strategy, could be an effective strategy to prompt sustainable food choices. A generic label would rule out the competitive effects and information overload caused by the plethora of existing single-sustainability-issue labels, guaranteeing transparency and increasing consumer trust in food sustainability attributes. The literature review emphasised the need for more scientific evidence on this topic, to

corroborate the effectiveness of generic labelling indications in promoting sustainable food purchases.

Moreover, policy strategies aimed to promote sustainable consumption patterns should be tailored to consumers taking into account, on the one hand, the heterogeneity in their behavioural approaches when making purchasing choices, while, on the other, the privileged food attributes they consider when purchasing sustainable products. As per the decision rule adopted by consumers, nudging strategies or information tools leveraging loss aversion principles may be influential on the individuals following the regret minimization mechanism. On the other hand, policy instruments focusing on the advantages of sustainable alternatives can prompt consumers who decide through the utility maximization process. In regards to consumer priorities in terms of food attributes, one strategy to address the price-oriented individuals could be to ensure the affordability of sustainable choice alternatives. In that way, there is no need for the consumers to trade off the price for the sustainable reformulation of the product. Moreover, considering the similarities between the health-conscious segment and the sustainability-driven consumers, policymakers could harness the synergies between these two important consumption trends. Education campaigns aimed at promoting healthy and sustainable dietary habits can be combined to strengthen their effectiveness since consumers interested in these aspects share the same identity profile.

To producers and retailers interested in increasing their market shares, labels addressing environmental and ethical aspects could be profitable tools. However, the current thesis provides evidence that consumer willingness to pay for sustainability labels considerably varies depending on the information disclosed and on the products' price range. The adoption of environmental labels and animal welfare certifications should be promoted in high-end food categories, whereas the generic claim of "sustainable product" is more appropriate for low-end products. As per the Italian context, the sustainability scheme tackling unfair labour treatment in agriculture would satisfy a potential market demand as this issue was found to be of concern to wine consumers and they were willing to pay more for this certification.

Firms should consider that according to the diversity in the importance that consumers attach to food attributes when making sustainable choices, multiple market segments can be identified. Therefore, specific marketing strategies could be conceived for each target group. Sustainability labelling can be effective in triggering sustainable choices among those

valuing environmental impact, fairness and animal welfare values. However, when consumers highly consider the taste and appearance of food values, they would need to be assured of the sensory properties of sustainable products. The healthiness and naturalness of the foods, instead, need to be granted and emphasised for individuals who are primarily interested in healthy properties and reduced food processing.

The thesis findings are also relevant to scholars in the field of food economics in a twofold manner. Firstly, the work advances the scientific debate on food labelling stressing that it is not informative to generally refer to or conclude on "sustainability labels". Results concerning the overall sustainability labelling may be misleading as the field is extremely complex, heterogeneous and multifaceted. As such, it is not possible to gather considerations effectively fitting the whole *sustainability labelling landscape*. Secondly, the thesis provides one of the very few applications of discrete choice analysis through the RRM framework, the first in the sustainable food context. Combined with the solid and well-established RUM, the RRM approach enabled the achievement of a broader overview of the consumer's decision-making process for sustainable food allowing to capture the choice phenomena that diverge from the classical utility maximization assumptions. Regret minimization underlies most of the purchase decisions in the context of sustainable food choices. Therefore, other perspectives, not simply limited to utility maximization, should be considered to fully comprehend the decision-making process of consumers.

Future research

Some limitations associated with this doctoral research need to be acknowledged, thus providing recommendations for opportunities for further research.

Given the hypothetical nature of the discrete choice experiment considered for study 1 and implemented in studies 2 and 3, the results may suffer from hypothetical bias. Future studies should apply incentive-compatible methods, such as real choice experiments or experimental auctions, to correct for the hypothetical bias and validate these findings.

Similarly, all the studies rely on self-reported measures. Although very common in this field, it was not possible to control for data accuracy. As a consequence, all the studies may also suffer from social desirability bias, namely the respondents' tendency to deliberately alter their responses to create a positive self-image and to present themselves in a socially

acceptable manner. Self-reported measures are prone to this phenomenon and also the topic, of sustainable food choices, is more likely to induce this behaviour. To overcome these limitations, more experimental and observational data are recommended to assess actual behaviour or revealed preferences.

The literature review pointed out the existence of a research gap as very few studies have attempted to address the effect of labelling based on generic information as compared to a specific one. Therefore, future studies should research whether a generic labelling scheme could prompt consumers to switch towards more sustainable purchasing patterns since the information provided to them would be more easily interpretable and identifiable or, conversely, if retaining the single-sustainability-issue indication is more effective in drawing individuals' attention in the buying phase.

More recently, green identity labels (e.g. "this product is for green shoppers") have been proposed to nudge consumers towards sustainable consumption by leveraging individual self-identities. However, this aspect was not taken into account for the current research project. The effectiveness of this innovative labelling strategy in promoting sustainable food choices should be deepened in future studies. Additionally, the effect of identity labels hinging upon the social self-identity (e.g. "this product is for the ethical consumer") on prompting choices for social-labelled products should be investigated.