Are university students really hungry for sustainability? A choice experiment on new food products from circular economy

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Abstract

Consumers are demonstrating increasing awareness towards initiatives promoting sustainable practices in the food sector. This is particularly pronounced among university students, a segment known for its receptivity to sustainability initiatives. Utilizing a choice experiment, this study examines the Italian students' preferences for fruit juice produced by a hypothetical company. Specifically, the research explicitly assesses the premium price attributable to a circular economy certification—a relatively new standard—in comparison with the widely recognized and appreciated organic certification. Furthermore, the study evaluates the potential additive value of possessing both certifications jointly. Results indicate that consumers are willing to pay a premium for products labelled with circular economy attributes. However, in the presence of an organic certification, the additive value of the circular economy certification is diminished by more than half. Finally, consumers who have received environmental training demonstrate a higher premium for such products, highlighting the role of education in promoting sustainable choices. These findings suggest that a potential market exists for circular economy-certified products, providing an incentive for businesses to adopt circular economy practices. Environmental training plays a relevant role in fostering sustainable transitions, thereby underscoring the significance of education in shaping conscious consumer behaviour.

Keywords: Choice experiment, Fruit juice, Circular economy, Consumer preference, Food labelling

Key points

1. It is important to investigate whether there is a potential market for circular economy-certified products.
2. The paper analyses Italian university students' willingness to pay a premium price for circular economy-certified products.
3. Circular economy-certified products earn a premium price.
4. Attending specific training courses increases the premium price for circular economy-certified products.

> 5. Encouraging specialized training can promote conscious behaviours supporting sustainable transition.

Introduction

Global concerns surrounding sustainability and the adoption of a Circular Economy (CE) approach have gained paramount importance on both national and international agendas. Commencing in 2015, the United Nations incorporated this thematic focus into its array of 17 Sustainable Development Goals[1] (SDGs). Within the European context, the European Commission (EC) has promulgated specialized guidelines to foster a sustainable vision.[2] Further reinforcing these initiatives is the European Green Deal, which envisages a prosperous and inclusive transition towards an equitable society that robustly embraces CE principles (Bieroza et al. 2021; Filipović et al. 2022). Accordingly, a diverse consortium of stakeholders—encompassing governments, commercial enterprises, research institutes, and non-governmental organizations—is collaboratively exploring innovative pathways for actualizing a CE-oriented production model (Muscio and Sisto 2020). Within this overarching framework, the agrifood sector emerges as fundamental in the transition to CE. The importance arises from the undeniable fact that both livestock and agriculture are important contributors to CO_2 emissions (Despotović et al. 2021).

Nonetheless, several scholars have identified various barriers that could limit the transition to a sustainability perspective, encompassing economic, social, institutional, and market-related obstacles (de Jesus and Mendonça, 2018; Salmenperä et al. 2021; Salminen et al. 2022). Among them, the market barrier is considered particularly influential, encompassing an underdeveloped market demand for CE-aligned products and services, uninformed consumer choices, minimum prices of virgin material, and long payback periods for investments (Vermunt et al. 2019; Salminen et al. 2022).

Turning attention to market-specific barriers, existing literature accentuates the limited consumer understanding of "green" product claims as well as a prevalent knowledge deficit concerning the implications of the CE (Raimondo et al. 2024; Blengini and Shields 2010). Moreover, prior empirical studies corroborate that elevated educational level is positively associated with pro-environmental behaviours (Meyer 2015). Additionally, Deliens et al. (2014) suggest that individuals typically set their lifestyle and dietary choices between the ages of 18 and 30 and that the critical thinking developed during this formative period has a consequential impact on their purchasing and consumption patterns.

As substantiated by empirical evidence, university students appear to be more actively engaged in pro-environmental behaviour (Omisakin and Kularatne 2022), thus representing a promising prospective target demographic for "green" food products. Moreover, non-compulsory university courses related to sustainability and the

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[1] Notably, the exigency for effectuating a sustainable transition is explicitly articulated in Goal 8, which pertains to "Decent Work and Economic Growth," as well as in Goal 12, which addresses "Sustainable Consumption and Production."

[2] One relevant document in this regard is the EC 2015 publication, "Closing the Loop—An EU Action Plan for the Circular Economy," which delineates a comprehensive monitoring framework for CE implementation.

CE have been shown to positively impact students' propensities towards sustainable consumption (Prieto-Sandoval et al. 2022). Given that students are often seen as early adopters of change and potential future leaders, producers could strategically target their offerings to this group, thereby overcoming existing market barriers and facilitating a sustainable transition.

Focusing on this specific market segment, the present study aims to quantify the Willingness To Pay (WTP) attributable to a CE certification––a relatively new standard––in comparison with the widely recognized and appreciated organic certification. Furthermore, the study evaluates the potential additive value of possessing both certifications jointly. Finally, the research investigates whether specific training on environmental issues positively influences premium prices for organic and CE certifications.

To achieve these objectives, a choice experiment was designed. An online survey targeting Italian university students was conducted, and fruit juice was selected as the product for study. Fruit juice is widespread consumed among young people making it a pertinent subject for a study targeting university students. Secondly, as demonstrated by Lerro et al. (2018), fruit juice emerges as an advantageous product for conveying green labels. Owing to its relatively unprocessed nature in comparison with other food products, fruit juice serves as an efficacious carrier, facilitating a more unambiguous analysis of the roles assumed by labels and certifications. This occurs in the absence of confounding variables attributable to attributes typically present in more highly processed foods. The choice experiments investigate the preferences towards three specific attributes of the product: price, organic and CE certifications. For the latter, the recent AFNOR XP X30-901 standard, launched at the end of 2018, served as the reference (AFNOR 2020).

This study makes significant empirical contributions to the literature on market readiness to support sustainability and the CE adoption for food products, considering: (i) a specific focus on the CE certification. While many scholars analysed consumer preferences regarding a specific sustainability attribute, such as organic label (Gracia and de Magistris 2008), geographical indications (Stiletto and Trestini 2022) and animal welfare (Gorton et al. 2023), further investigations are needed for CE certification; (ii) an exploration of the agri-food sector. While CE certification has been studied in other literature strands, such as mobile phones (Boyer et al. 2021), its application in the agri-food sector is relatively underexplored; (iii) an investigation of market barriers, with a specific focus on consumer choices, identifying and understanding the barriers that could hinder the CE adoption is a useful strategy. The study results can encourage businesses to adopt sustainable practices, increasing competitive advantage in the market; (iv) a specific focus on university students. The focus on this specific consumer segment allows evaluating the effectiveness of recent sustainability policies, particularly those centred on green education, in shaping new and more sustainable consumer patterns. In this specific regard, results could be useful to producers for orienting their offerings to specific consumer targets, and, on the other hand, they could support policymakers in introducing appropriate certifications to reduce information asymmetry and facilitate consumers' purchasing choices. In fact, as organic certification, ecological labels by CE could be useful as green marketing tools, and they could serve as incentives for businesses to adopt sustainable environmental strategies (Donato and D'Aniello, 2022).

The paper is structured as follows: Sect. "Study background" presents the study background, Sect. "Data and methods" includes the study's methodology, specifically focusing on the survey design and the empirical model used. Section "Results" shows the results obtained from the choice experiment. Section "Discussion" and Sect. "Concluding remarks" will focus on the main conclusions and implications of the present study.

Study background

Several scholars have analysed barriers in various literature strands that could limit the transition to more sustainable patterns (de Jesus and Mendonça, 2018; Salmenperä et al. 2021; Salminen et al. 2022). The study of Vermunt et al. (2019) explored barriers to designing several circular business models by categorizing them into internal and external barriers. Among the internal barriers related to enterprises, they mentioned financial barriers, such as high investment costs not supported by the company, organizational aspects, such as complex planning processes, and the level of knowledge and technology. Among the external barriers, they mentioned the supply chain, where material availability is a significant incentive to support the adoption of circular business models, institutional barriers, such as the level of social awareness, and market barriers, including minimum prices of virgin material, lack of interest from consumers, and resistance from stakeholders with high interests in the linear economy.

Similarly, studies by Salminen et al. (2022) have contributed to exploring market barriers for a CE from a water-use perspective. In this study, the barriers were based on their topic: cultural barriers, such as the common use of mineral fertilizers in agriculture; regulatory barriers, such as variation in technical requirements from country to country; technological barriers related to personal skills; and finally, market barriers, which encompass the high price of recovered fertilizer products or low competitiveness of secondary material prices, and long payback periods for investments. In addition, other studies focused on the diffusion of organic dairy farming (Verburg et al. 2022), and cited market barriers such as lack of demand, expensive and low-quality products, and lack of supply retailers. Other scholars have included market barriers in other categories, such as Salmenperä's study (2021), which encloses them in economic barriers and are functionalities of the recyclable materials market, market uncertainty, technological, and information aspects lack data, supply chain optimization tools, regional waste data. In addition, many scholars (Grafström & Aasma 2021; Mehmood et al. 2021) have explored potential obstacles to the adoption of the CE as a quality standard, including uncertainties in the supply chain and a lack of economic incentives or authorization to expand, low perceived benefits, low prices of virgin materials, high initial investment costs, supply chain reversal, contract renegotiation, technology adaptation to meet new inputs, or high development costs for designing new products are just a few examples.

As previously highlighted, in the present study the focus will specifically fall on market barriers, and to this aim two perspectives will be considered: the demand and the supply side. From the supply side, the CE is increasingly developing interest in the public debate (Lahti et al. 2018; Santa-Maria et al. 2021; Urbinati et al. 2017). The growing pressure on resources and increased awareness of the Earth's vulnerability make the widespread take-make-dispose model no longer sustainable. The main goal of EC is to promote sustainable production and consumption patterns that close the resource cycle (Ghisellini

et al. 2016; Gusmerotti et al. 2019). Therefore, there is a need for a shift from the current linear system to a CE approach (Goyal et al. 2016). The agricultural sector is the only one that has already begun a sustainable transition, reducing 20 per cent of greenhouse gas emissions since 1994 (Peters and Hertwich 2008). Despite this, agricultural activities remain among the main climate change drivers. As highlighted by many scholars (Beckman et al. 2020; Thyberg and Tonjes 2016), the agri-food system is responsible for around the 30 per cent of the total greenhouse gas emissions. In addition, the agri-food system involves the overuse of natural resources and contributes to a very high percentage of wasted food (Gallagher et al. 2022). Moreover, food production contributes significantly to atmospheric pollution, soil degradation and biodiversity loss. Promoting responsible consumer behaviour, informed purchasing choices and label information could increase awareness among consumers who are increasingly concerned about the environmental impact of food production and consumption (Sala et al. 2017; Stiletto and Trestini 2022). In this scenario, businesses, universities, research centres, institutions and citizens are all called upon to contribute to the transition to circular production, distribution, and consumption systems (Sisto et al. 2020; Del Vecchio et al. 2021).

In such a situation, one of the many challenges that consumers must face is asymmetric information. Certification is recognized as one of the key mechanisms for addressing this problem. With certification, producers can employ labels as voluntary signals of quality, thereby informing the market about otherwise unobservable and unverifiable attributes of the product or process.

Considering the growing consumer concern for sustainability, several studies in the literature have focused on exploring the key factors influencing the purchase of foods with sustainable certifications. For example, beliefs regarding the negative effects of dairy consumption on the environment and animal welfare, along with health concerns associated with their consumption, can have a significant impact on the market for dairy products (Siraj et al. 2022). Additionally, research suggests the existence of generational differences in consumer sustainable consumption patterns, with millennials considered one of the most interested generations in this regard (Molinillo et al. 2020).

Moreover, consumers are more likely to purchase products labelled as sustainable if they perceive themselves to be effectively contributing to solving environmental issues (Siraj et al. 2022). However, consumer innovativeness (i.e. the inclination to purchase new products) can negatively influence purchase intention; consumers with higher levels of innovativeness are less inclined to purchase products labelled as sustainable, while hedonistic or functional values may be less influenced by environmental values (Testa et al. 2020).

Furthermore, trust in labelling plays a key role in the impact of environmental, social, or animal welfare labelling: with the increasing recognition of greenwashing practices, scepticism towards sustainability information may increase (Cook et al. 2023). According to Rossi and Rivetti (2023), scepticism is a precursor to purchase behaviour that has a negative impact and makes consumers less likely to purchase products with sustainability labels. Moreover, individuals with higher levels of education, such as participants in this study, have all the tools to gather additional information and interpret hidden clues and meanings, using them to dispel doubts and support their decision-making process (Rossi and Rivetti 2023).

However, in the context of the CE, further progresses in implementing certifications for food products are required (Pretner et al. 2021). In fact, although the EC is already studying the introduction of product labels to certify the production process's circularity, currently more process certifications for food products, proving the use of this approach are required. Indeed, to date, there are only private certifications indicating the CE, such as (i) BS 8001:2017 is a standard published by the British Standards Institute to implement CE guidelines and (ii) AFNOR XP X30-901, the French standard for defining the circular management of a company (Urain et al. 2022). However, from a business perspective, for the long-term implementation of CE principles, the costs incurred by companies must be offset by a premium price for products bearing CE labels. If these costs outweigh the benefits, a market failure is likely to occur (Del Giudice et al. 2018). This underscores the importance, as our study also does, of investigating the existence of such a premium in a market context crowded with various certifications.

Furthermore, society at large, which includes consumers, remains far from possessing a comprehensive understanding of the concept and implications of the CE, as indicated by Vargas-Merino et al. (2022). Consequently, this study aims to examine whether students with varying levels of knowledge on sustainability manifest different price premiums for products bearing CE certification. The pivotal role of education is increasingly scrutinized in the literature, yielding two essential findings: (i) the university period is often considered a time of significant life changes for most students, particularly in terms of autonomy in food choices. Research suggests that young adulthood is a critical phase for establishing eating behaviours that persist throughout life (Deliens et al. 2014); (ii) a positive correlation exists between education and pro-environmental behaviour (Meyer 2015).

In this study, we examine consumer preferences for fruit juice produced by a food company that is hypothetically certified under AFNOR XP X30-901. In particular, the certification attests that the organization efficiently utilizes resources in a manner that maximizes the retention of the economic value of products, materials, and resources for an extended period (de Arroyabe et al. 2021; Urain et al. 2022). This approach is evaluated in the context of the seven key action areas of the CE: sustainable procurement, eco-design, industrial symbiosis, functional economy, responsible consumption, extension of service life, and the effective management of materials and products at the end of their life cycle. These action areas are, in turn, aligned with the three principal dimensions of sustainability: environmental, economic, and social (AFNOR 2020). Moreover, this study aims to compare CE certification to the organic certification. Specifically, it explores the effects of introducing such a CE certification in contexts where other labels already exist on the market, namely the organic ones. As discussed by Borrello et al. (2022), the mere presence of multiple labels does not inherently signal an advantage to consumers (Barreiro-Hurle et al. 2010). Interactions between these various certifications—whether they conflict, are redundant, or complement each other—can result in unpredictable pricing premiums. It should be noted that the choices presented in this study are hypothetical; to the best of our knowledge, although rare cases exist among food processors, no fruit juice companies in Italy have yet attained this particular certification, given its novelty. Nevertheless, the absence of such certified entities in Italy

Table 1 Attributes and levels considered

Attributes	Levels definition
Organic label	Absence
	Presence
CE certification	Absence
	Presence
Price	€2.50
	€4.25
	€5.65

renders the investigation particularly pertinent, especially considering the scarcity of scholarly attention devoted to this subject in the existing literature.

Data and methods

Choice experiment

Research increasingly utilizes discrete choice models to analyse individuals' decision-making processes (Grunert 2005). Several studies in the literature employ this approach to evaluate how product attributes can influence consumers' purchasing or preference choices (Gracia and de Magistris 2008; Kamphuis et al. 2015; Lizin et al. 2022). Specifically, individuals' choices are assessed using an experimental design. This approach is advantageous in cases where evaluations need to be made on attributes of a product or products that still need to be made available or present in the market. The underlying idea of this method is that a product is a combination of attributes, and each consumer decides among alternatives during various stages of the purchase process (Lancaster 1966).

As mentioned earlier, since the objective was to examine the impact of CE certifications and its complementarity or substitution to other "green" labels, three essential attributes for this purpose were selected. Specifically, two attributes were dichotomous, indicating the presence or absence of organic and CE labels. While consumers are familiar with organic labelling, CE labels interpretation may still be confusing (Kuchler et al. 2020). The third attribute was the price, which was divided into three levels. We opted for a lower price level (€2.50 for 750 ml of product), a medium price level (€4.25 for 750 ml of product), and a higher price level (€5.65 for 750 ml of product). The average price of juices in different supermarkets and hypermarkets was considered to determine the price levels.[3] On the other hand, the existing literature that has used prices as an attribute for fruit juices was consulted (see Luckow and Delahunty 2004 or Otieno and Nyikal 2017). Table 1 provides an overview of the chosen attributes and levels for the choice set.

A pilot questionnaire was constructed before distributing the final version. This decision was driven by the limited knowledge of the coefficient to be included in the efficient design regarding the CE certification attribute. After administering the pre-test to 30 respondents, initial analyses were conducted, which allowed the determination of the efficient design for the choice sets.

The D-optimal design employed in this study comprised 12 possible combinations. The design was generated using the modified Fedorov algorithm (Carlsson and Martinsson
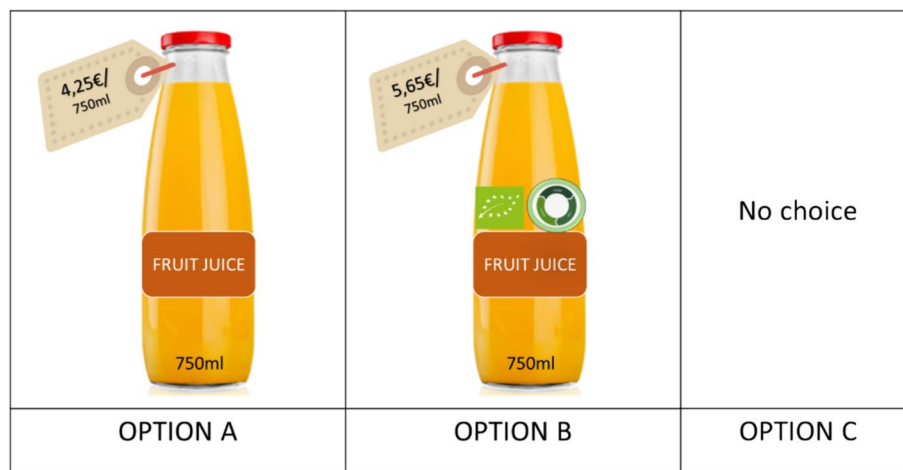
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[3] https://www.trovaprezzi.it

Fig. 1 Example of a choice set used in the present study. The survey included choice sets in Italian, while terms in the figure are translated to English to increase readers' comprehension

2003; Zwerina et al. 1996) which maximizes the D-efficiency of the design based on the covariance matrix of the conditional logit model, using the estimates from the pre-test as priors. The design with the highest D-efficiency value (1.03) was chosen after several iterations. These combinations were organized into three blocks, and each participant was presented with four choice sets. In each choice set, participants were asked to express their preference between two multi-attribute alternatives (options A and B) and a "no-buy" option (C) (Hensher et al. 2015). Options A and B differed in the levels of each attribute, allowing participants to compare and evaluate their preferences. The "no-buy" option allowed for a realistic purchase scenario, wherein participants could opt not to purchase the product if its characteristics did not align with their preferences (Stiletto and Trestini 2022). Figure 1 provides an illustrative example of a choice set used.

Empirical model

When participating in choice experiments, respondents evaluate and compare the available alternatives to choose the option that provides the highest utility (Gracia and de Magistris 2008). It is assumed that individuals derive utility from the characteristics that describe a product rather than the product itself (Lancaster 1966).

Consumers' preferences for product options were examined using the theoretical framework of the random utility model (RUM) developed by McFadden (2001) and the Conditional Logit technique for estimating model parameters (Train 2009). To illustrate, considering a set of C juice alternatives presented to each i-th consumer, the utility associated with option c can be expressed as a linear function of all $\boldsymbol{h}$ attributes and levels specific to product option c:

$$U_c^i = h_{c\prime}\Omega + v_c^i \tag{1}$$

where h_c represents the vector of product attributes, $\boldsymbol{\Omega}$ stands for a parameter vector, and the term v_c^i accounts for the stochastic error element. The model assumes that a consumer selects product alternative c over k if it maximizes their expected utility: $U_c^i \geq U_k^i$, where c and k are alternatives within the set C, and $k \neq c$.

In the present model, the observed choice can be translated into probabilities. Mathematically, the probability that the i-th consumer selects a specific product alternative c out of all the available alternatives in set C is determined by the probability that the utility of alternative c is greater than or equal to the utilities of other proposed options: $p(U_c^i) = p\{U_c^i > U_k^i, \ldots, U_C^i\}$. Consequently, the parameter estimates denoted by $\boldsymbol{\Omega}$ reveal how the product attributes influence the likelihood of a certain option being chosen. This enables the identification of how the three product attributes affect consumers' decisions. The model parameters were estimated using the maximum likelihood estimator under the assumption of fixed parameter specifications for conditional logit (Amemiya, 1985).

The study employed two models: a conditional logit model considering only main effects with the interaction of both certifications, and another conditional logit model incorporating interaction effects of attending training or university courses focused on environmental sustainability. The primary aim of the initial conditional logit model was to assess how the chosen attributes impact decision-making within the experiment.

After estimating both models, the marginal willingness to pay (MWTP) was calculated. This involved determining the ratio of the parameter for non-monetary attributes to the price parameter, which was then multiplied by negative one.

Survey design

To implement the analysis, a questionnaire targeting Italian university students, between 18 and 30 years, was constructed. The selected sample was chosen because it could represent the potential marketing target for interested green food producers. Also, it is homogeneous in other important characteristics such as age, income, and purchasing behaviour and consequently, it allowed to isolate the effect of education on consumers' WTP.

Firstly, the questionnaire provided information on privacy and an explanation of the research objectives, preparing the respondent for the compilation. Subsequently, it included one screening question to select only the eligible sample. The following sections included questions regarding the respondent's sociodemographic characteristics and their knowledge about organic certifications and CE concepts, with these latter evaluated using multiple-choice questions, with one correct answer out of three options (Table 7, Appendix). General food purchasing habits were assessed in a specific section. The participants were then presented with the attributes (and their levels) to evaluate during the choice experiment (see Table 1), while the core of the questionnaire was dedicated to the choice experiment itself. Finally, the last sections of the questionnaire investigated the specific purchasing habits related to fruit juices.

It is important to highlight that no questionnaire section included additional information or a definition of environmental sustainability and CE. This choice aimed to capture potential consumers' awareness of the sustainability issues without giving any other information and to simulate a typical situation during the purchasing process. The survey was conducted online via Google Forms between March and June 2023, using a mix of convenience and snowball sampling approaches. Specifically, the participation link was first shared through Italian university student groups on social media, in this way the participants were selected based on

their accessibility and availability. Furthermore, they were also invited to disseminate the link among their other university colleagues.

Although, in general, the convenience sampling might not accurately represent the entire population since participants are chosen for convenience rather than randomly, nevertheless in this study, considering the difficulty in reaching the target population, the homogeneous convenience sampling, specifically tailored for Italian university students, has been shown to be more reliable than conventional convenience sampling (Jager et al. 2017).

Results

Descriptive statistics of the sample

A total of 415 respondents participated in the survey; nevertheless, 62 of them were excluded for the following reasons: (i) not being university students, (ii) not providing informed consent for the questionnaire, and (iii) being above the age of 30 years.

Consequently, the results refer to 353 valid questionnaires. Descriptive statistics of the sample are presented in Table 2, while additional details regarding the administered survey questions can be found in Table 7 (Appendix). Most respondents were women, accounting for 71.1% of the sample, while a significant portion (37.1%) fell within the age range of 21 to 23 years. Concerning the geographical distribution of the sample, it was evenly divided across all parts of Italy, with a slightly higher percentage for the south and islands (45.3%). Regarding educational attainment, 47.3% reported having a bachelor's degree, 42.8% a master's degree and only around 10% reported a higher level of education. Approximately half of the respondents reported a monthly family income of around €2,550. About engagement in seminars, university courses, and training programmes on environmental sustainability and the CE, 65.2% of the sample reported participating in at least one of them. In comparison, 34.8% had not taken specialized courses on these topics. Finally, one of the main findings is that 80% of the sample exhibited a good level of knowledge regarding organic certification (83%) and the CE (81.6%).

Conditional logit estimates

Based on the described variables, a conditional logit model was implemented. Table 3 shows the estimated coefficients, all of which are highly significant. Considering that the coefficients obtained can be meaningfully interpreted by considering their signs, it is possible to highlight significant results. Specifically, the price coefficient and the no-buy option have negative coefficients, while the attributes related to the organic and CE certifications have positive coefficients, showing their positive influence on purchase decisions. Furthermore, the interaction between organic and CE certifications exhibited a negative coefficient, suggesting that when these labels are presented together, their combined effect is less than additive.

Additionally, it was observed that there is a positive correlation between consumers with good knowledge of CE and sustainable topics and those who attended training courses or seminars on these subjects (Table 4). Therefore, two subgroups were created, and a new conditional logit model was implemented to measure the marginal utilities for students who have attended environmental sustainability training courses and students who have not. The results of the second model are presented in Table 5.

Table 2 Descriptive statistics of the sample

Variable	Item	Frequency	Percentage (%)
Gender	Female	251	71.1
	Male	98	27.8
	Other	4	1.1
Age	18–20 years	117	33.1
	21–23 years	131	37.1
	24–26 years	72	20.4
	27–29 years	33	9.4
Region	North	72	20.4
	Centre	121	34.3
	South and islands	160	45.3
Education	Bachelor's degree	167	47.3
	Master's degree	151	42.8
	Other	35	9.9
Household income	Below €2,500/month	103	29.2
	About €2,500/month	178	50.4
	Above €2,500/month	72	20.4
Courses/seminars/lessons about sustainability	Yes	230	65.2
	No	123	34.8
Grocery shopping per week	Below €50	142	40.2
	€51-€100	160	45.3
	€101-€150	40	11.3
	Above 150	11	3.2
Healthy product	1–2 times a week	174	49.3
	>3 times a week	51	14.4
	Never	28	7.9
	<1 times a month	100	28.4
Packaging preference	Unconcerned	87	24.6
	Plastic	11	3.1
	Tetra Pak	130	36.9
	Glass	125	35.4
Consumer knowledge of organic product	Yes	293	83
	No	41	11.6
	I don't know	19	5.4
Consumer knowledge of CE	Yes	288	81.6
	No	22	6.2
	I don't know	43	12.2

Table 3 Conditional logit model

	Estimate	*SE*	z	*p*-value
Price	-0.773	0.060	-12.79	<.001
Organic label	1.310	0.137	9.58	<.001
CE certification	0.746	0.130	5.73	<.001
Organic label × CE label	-0.527	0.183	-2.88	.004
No-buy option	-1.466	0.143	-10.24	<.001

Table 4 Pearson's correlation

	Training	Knowledge of CE	Knowledge of Organic
Training	1.000		
Knowledge of CE	0.103*	1.000	
Knowledge of Organic	0.112**	0.192***	1.000

Training = students who have attended environmental sustainability training courses

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Table 5 Conditional logit model with interactions

	Estimate	*SE*	z	*p*-value
Price	− 0.779	0.060	− 12.98	<.001
Organic label	1.312	0.201	6.54	<.001
CE label	0.247	0.201	1.23	.220
Organic label × CE label	0.161	0.286	0.56	.574
No-buy option	− 1.466	0.143	− 10.27	<.001
Organic label × Training	0.023	0.241	0.10	.922
CE label × Training	0.762	0.244	3.12	.002
Organic label × CE label × Training	− 1.058	0.377	− 2.81	.005

Training = students who have attended environmental sustainability training courses

Table 6 MWTP for organic and CE certification

	Whole sample	Trained students	Untrained students
Organic label	1.69€[a1]	1.71€[a1]	1.68€[a1]
CE certification	0.96€[b1]	1.30€[b2]	0.32€[b3]
Both labels	1.97€[c1]	1.86€[a1]	2.21€[a1]

Different superscript letters/numbers indicate significant differences within a column/row at the 5% level

The results indicate that both trained and untrained students are equally willing to pay the same amount for a product with organic certification. However, it is noteworthy that only respondents who have participated in an environmental sustainability training course are willing to pay a premium for products with CE certification. While both labels, when presented individually, positively influence product choice for trained students, it is interesting to observe that when presented together, the impact of the CE certification does not significantly surpass the effect of the organic label alone ($\chi^2_{(1)} = 0.63$; $p > 0.10$).

As concerns the estimate of the MWTP, the hypothetical nature of choice experiments often leads to inflated estimates of MWTP (Menapace and Raffaelli 2020). However, the emphasis of the analysis should focus less on these absolute figures and more on the relative values across different attributes. Such comparative measures are invaluable for understanding consumer preferences and market segmentation, especially when variations across different consumer groups are considered.

As indicated in Table 6, respondents were willing to pay an additional 1.69€ for a certified organic juice compared with an identical product without certification. The most interesting output of the analysis is that respondents are willing to pay a premium price of 0.96€

for a product labelled with CE attributes compared to the same product without certification. Moreover, the estimates revealed that the combined effect of the two labels was slightly greater, but statistically significant (+0.28€ in MWTP), than that of the organic certification when presented alone ($\chi^2_{(1)} = 4.17$; $p < 0.05$). Finally, the results indicate that solely students who have engaged in environmental sustainability training courses were willing to pay a premium price for CE-certified juice, while there was no discernible difference in MWTP for organic certification between trained and untrained respondents.

Discussion

The conditional logit results consistently shed light on consumer readiness to CE-certified products. Specifically, the findings in Table 3 align with existing literature, as the negative coefficients associated with the variables "price" and "no-buy options" indicate, respectively, that higher prices decrease the likelihood of selecting a specific product (Krovetz 2016), and that a decrease in individual utility occurs when the preference is not to purchase a product within a choice set (Barreiro-Hurle et al. 2010). Furthermore, the positive effect of the "organic label" variable confirms respondents' awareness and the impact of this labelling on consumers, consistent with previous research on organic certification (Aprile and Punzo 2022; Rousseau and Vranken 2013).

Notably, labelling a product as originating from the CE also has a positive coefficient, signifying consumers' awareness of the need for companies to adapt and preserve resources. This positive influence supports sustainable transitions and reduces market barriers' impact (Kirchherr et al. 2018; Vermunt et al. 2019). These outcomes are in line with the findings of Franco and Cicatiello (2018), who argue that sustainability branding can positively influence consumer attitudes towards a product, increase their willingness to pay, and foster greater satisfaction and loyalty among customers, particularly in the case of food products.

Furthermore, only students who have participated in environmental sustainability training courses were willing to pay a premium price for CE-certified juice, with a MWTP of 1.30€. This result highlights the significance of specific sustainability-related education in shaping pro-environmental behaviours (Meyer 2015). The findings are consistent with the literature, suggesting that only a small number of people view labelling as the most crucial factor in making sustainable choices. This highlights the significance of implementing additional initiatives to effectively influence consumer behaviour (Cook et al. 2023).

These findings underscore several important points. Firstly, the study establishes a preference for organic certification over CE certification due to consumers' familiarity, enabling them to readily recognize and associate it with products. Secondly, the consumer's WTP a premium price for products from the CE suggests promising market potential, even without current certification. However, our results reveal the presence of an 'embedding effect' of CE certification within the organic one. In simpler terms, we observe a situation where the concurrent presentation of both labels, which theoretically convey distinct information, results in the same premium as using only the organic label. As stated by Borrello et al. (2022), this could suggest that students derive utility from the concept of "sustainability," which they perceive as already encompassed by the organic certification, thereby assigning no additional value to the CE label, even when it may technically represent a higher degree of sustainability. In addition, according to

Valentine and Powers (2013), younger generations exhibit a positive inclination towards addressing social and environmental issues, and they can act as drivers compared to other generations in promoting sustainable behaviours, significantly influencing the purchasing behaviour of other generations.

These findings could have theoretical, managerial, and policy implications. Concerning theoretical implications, the initial step is to move beyond the mere numerical outcomes of our analysis for different reasons. Firstly, the sample includes university students within a narrow age range (18–29 years). Existing literature underscores that within these demographic groups, incomes typically lean towards modest levels or are frequently dependent on familial financial support. In such circumstances, the budget constraint significantly influences sustainable food purchasing decisions. (Greaney et al. 2009). Given the homogeneity of our respondents and the restrictive budget constraint, our findings are tainted by revealed preference bias, indicating a highly different MWTP for CE certification between trained and untrained students (€1.30 versus €0.32, respectively). Furthermore, as we deal with revealed preferences, it is helpful not to discuss only the numerical values but to interpret the result's implications.

The investigation reveals that sensitivity towards CE certification is more evident among students who have attended specific training in sustainability and CE principles. This behaviour is aligned with previous studies made during the introduction of organic certification, where despite initially low WTP, significant shifts in consumer behaviour and awareness were observed because of time, communication efforts, and specialized training courses attended by respondents (Aprile et al. 2012; Piracci et al. 2024). These insights followed our findings indicating a marginal deviation of only €0.03 between trained and untrained students concerning organic certification, already integrated into consumer purchasing habits.

Moving on to managerial implications, our results could serve as a significant incentive for producers oriented towards food having sustainable attributes. As highlighted earlier, market barriers pose substantial challenges for the agri-food sector. The adoption of CE certification may entail considerable costs for producers and retailers, including compliance expenses and regulatory standards. However, the opportunity to obtain a premium price from consumers for products bearing such labels could incentivize and justify these investments. Although this study was conducted on a simulated market, results, highlighting the positive response from consumers and the presence of a potential segment willing to pay a premium price for CE certification, encourage food producers to embrace CE practices.

Finally, from a political point of view, the implications of this study emphasis the crucial role of universities as increasingly important actors in sustainable transition, either for their educational and institutional role or giving their scientific support to the innovation adoption processes. Thus, the direction taken by various policy documents, as well as the SDGs, of focusing on the critical role of universities and incentivizing specialized training can be a suitable strategy to stimulate conscious behaviours to support a sustainable transition.

Concluding remarks

Considering the need to investigate barriers to sustainable transition, this study is the first step in analysing the existence of market barriers by analysing the WTP for products with CE certification for food products. The analysis focused on university students for the following reasons: i) the university years represent a susceptible period because environmental awareness and future purchasing and consumption behaviours are formed; ii) the increasingly recognized role of training courses in fostering the sustainable transition; iii) the desire to have a homogeneous group of respondents that did not differ either by income or other sociodemographic characteristics. Thanks to the implementation of two conditional logit models, achieving the study's objective of recording positive MWTP for CE products was possible. Furthermore, when considering two groups of respondents, those who attended specialized courses and those who were never trained on environmental sustainability or CE, there are very different MWTPs between the groups. Results are significant from several perspectives and suggested important insights. Even if the choice experiment was only hypothetical, the positive MWTP associated with CE label indicates that there could be a potential market ready to buy which recognizes certification from the CE for food products.

However, the study presents some limitations. Responses can be influenced by significant biases caused by the lack of realism in the study scenario (Hensher et al. 2015). In such cases, actual future behaviour may differ from the responses and choices the respondent makes. Future steps will involve implementing these considerations and including other attributes in the analysis. For example, brand influence could play a significant role in consumer choices, as certification on a product with a recognized brand may have a different relevance than certification imposed on a lesser-known brand. Additional limitations include the reliance on computer-assisted web interviewing. Despite its advantages, such as cost-effectiveness, wide geographic reach, and efficient data collection, there are notable drawbacks. These include self-selection bias, wherein individuals who choose to participate may not be completely representative of the larger population being studied. Linked to investigation based on declared preferences, another bias is represented by response bias because participants may provide inaccurate or skewed responses, influenced by factors like social desirability or misunderstanding of questions. Moreover, there is limited control over the interview environment, which may introduce unintended variables that could impact data quality and reliability.

Despite these limitations, this study can be considered as an interesting starting point for analysing market barriers and as well as strategic opportunities for implementation of an effective sustainable transition that addresses economic, environmental, and social aspects.

Future research, aimed at delving deeper into this field and confirming the hypothesis that young generations in Italy are the driving force behind sustainable transition, could involve conducting surveys across different consumer segments. The findings from these surveys could corroborate the positive impact of policies and education on shaping sustainable consumption patterns, while also shedding light on additional market barriers. As a result, different policies and strategies could be identified and properly designed to also target other consumer groups.

Appendix

See Tables 7, 8.

Table 7 Additional details regarding the administered questions

Variable	Question	Options
Courses/seminars/lessons about sustainability	During your studies, have you ever attended courses/seminars/lectures on the topic of sustainability?	Yes
		No
Knowledge of organic product	A food with "Organic" certification:	*It is a food produced by a production system that does not involve the use of chemical substances, such as herbicides, pesticides, or fungicides, at any stage of its production*
		It is a typical high-quality Italian food, whose origin area and traditions still used to create it make it so unique that it must be safeguarded from counterfeiting
		I don't know
Knowledge of circular economy	Could you indicate among these proposed definitions what is meant when a company adopts a circular economy process?	The company adheres to a process that involves the extraction of raw materials, mass production and consumption, and the disposal of waste once the product reaches the end of its lifecycle
		The company internally reutilizes material and energy resources already employed, thus eliminating the concept of "waste" and replacing it with terms such as "recovery," "recycling," and "sharing."
		I don't know

Table 8 Estimates including differences between university and PhD/postgraduate students

	Estimate	SE	z	*p*-value
Price	− 0.787	0.063	− 12.35	<.001
Organic label	1.325	0.144	9.23	<.001
CE label	0.724	0.135	5.37	<.001
Organic label × CE label	− 0.531	0.191	− 2.78	.005
No-buy option	− 1.487	0.148	− 10.01	<.001
Price × PhD/postgrad student	0.146	0.201	0.73	.468
Organic label × PhD/postgrad student	− 0.143	0.474	− 0.30	.763
CE label × PhD/postgrad student	0.276	0.517	0.53	.593
Organic label × CE label × PhD/postgrad student	0.073	0.692	0.11	.916
No-buy option × PhD/postgrad student	0.218	0.556	0.39	.695

Estimates on interaction terms "× PhD/post grade student" do not support the hypothesis of the existence of significant differences between University and PhD/postgraduate students

CE circular economy

Abbreviations
CE   Circular economy
EC   European commission
WTP   Willingness to pay
MWTP   Marginal willingness to pay

Author contributions
NdS: Conceptualization, Methodology, Investigation, Writing—Original Draft. GC: Formal analysis, Methodology, Investigation, Data Curation, Writing—Original Draft. RS: Resources, Conceptualization, Methodology, Writing—Review & Editing. FC: Methodology, Data Curation, Writing—Review & Editing. VP: Supervision, Conceptualization, Methodology, Writing—Review & Editing.

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Availability of data and materials
The datasets utilized in the present study are accessible upon a reasonable request from the corresponding author.

Declarations

Ethics approval and consent to participate
The participants provided informed consent to participate in the survey after reading important information in the introduction section, including details about privacy protection, their rights, and what they could do in the stress situation, during the survey. Moreover, the questionnaire was accompanied by the following presentation "The data collected will be processed in accordance with Law No. 219 of December 22, 2017, guaranteeing the anonymity of participants. Specifically: personal data collected will not be transmitted to individuals not directly involved in the research and will be processed in an anonymous form; results will be presented in an aggregated form with all necessary precautions taken to avoid participant identification. The processing of data collected for research purposes, their communication to third parties, and/or publication for scientific purposes are allowed but can only occur after the data have been anonymized, under the direct responsibility of the research coordinator. The data will be stored, using technological means, by the research coordinator, in compliance with the principles outlined in Article 5 of EU Regulation 2016/679, for a period not exceeding the achievement of the research objectives, with specific regard to the principle of limitation of storage pursuant to Article 5 letter e) of EU Regulation 2016/679. The research is conducted in accordance with the Declaration of Helsinki."

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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