





# How about choosing environmentally friendly beef? Exploring purchase intentions among Italian consumers

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## Research Paper

**Cite this article:** Stranieri S, Ricci EC, Stiletto A, Trestini S (2023). How about choosing environmentally friendly beef? Exploring purchase intentions among Italian consumers. *Renewable Agriculture and Food Systems* **38**, e2, 1–11. <https://doi.org/10.1017/S1742170522000357>

Received: 21 September 2021

Revised: 21 September 2022

Accepted: 17 October 2022

### Key words:

Climate change; consumer preferences; ecolabeling; environmentally friendly beef; food; sustainable production and consumption; trust

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### Abstract

The increasing global demand for livestock products and its large environmental impact ask for urgent policy and managerial strategies. With regard to meat consumption, feasible actions relate to its reduction and orienting consumers toward more sustainable meat choices. The aim of the study is to investigate the determinants affecting meat consumers in their intention to buy beef whose label clearly expresses environmentally friendly characteristics. To do so, we hypothesized to apply an institutional system of ecological labeling on beef products. An extended framework based on the Theory of Planned Behavior was applied to understand the factors affecting the consumer decision-making process toward eco-labeled beef. A survey was conducted with 1139 consumers in Italy. Data were analyzed by means of confirmatory factor analysis and structural equation models. Results highlight that beef consumers are likely to change their habits, in favor of more sustainable beef choices. The analysis highlights that, together with consumer attitudes, social norms and perceived behavioral control, institutional trust and food shopping habits play an important role in activating the consumer's cognitive decision-making process toward more sustainable beef. Results add to the literature on the determinants of green food-choices and introduce new insights on the role of institutional trust in the intention to buy beef labeled with a public standard. Findings highlight that particular attention should be devoted to build trust for public institutions in order to promote sustainable food consumption behavior. Moreover, results validate previous studies on the effectiveness of information-based policies in fostering more sustainable consumption choices.

## Introduction

The expected increasing global demand for livestock products and the great environmental impact induced by the activities conducted within the related supply chains ask for urgent policy and managerial adaptation strategies (EU, 2006; Herrero *et al.*, 2016). Indeed, climate change is one of the greatest challenges that human society is facing and mitigation measures need to be identified in all sectors and at all levels (Chakravarty *et al.*, 2009; Massetti and Ricci, 2013; IPCC, 2014). According to Rojas-Downing *et al.* (2017) and Hyland *et al.* (2017), the demand for livestock products will double by 2050 and the contribution of the related sector toward anthropogenic greenhouse gas (GHG) emissions counts for 14.5% of global emissions. Also, Leach *et al.* (2016) highlight that livestock production has the largest carbon, nitrogen and water footprints in the food sector. By looking at the livestock supply chain, such emissions relate to most of the activities conducted within the chain, like for example, feed production, animal rearing, processing methods and transportation of all the related raw materials (Röös *et al.*, 2013). The European Commission is putting much effort in identifying reliable methodologies for assessing the environmental performance of products and organizations as a mean to communicate trustworthy information to final consumers (European Commission, 2019). More in detail, the goal is to develop by 2024 a voluntary public standard in relation to food environmental sustainability (EC, 2020).

The negative environmental impact of livestock production can be reduced through; technological innovations to increase nitrogen use efficiency; new lower environmental impact breeding strategies; an improved management of land based on GHG mitigation strategies; and through variations in consumption patterns (Smith *et al.*, 2013). With regard to meat consumption, possible feasible actions relate to a reduction of meat consumption in the western world and to orienting consumers toward more sustainable meat choices (Röös *et al.*, 2014). Coherently with this, the European Commission launched in 2020 the Farm to Fork Strategy, as part of the European Green Deal, to fully address the challenges of sustainable food systems.

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This strategy pays particular attention to the livestock sector to reduce its environmental impact and promote environmentally friendly production and consumption patterns (EC, 2020).

Considerable literature has focused on ecolabeling of food products (Grunert, 2011; Grunert *et al.*, 2014; Yadav and Pathak, 2017; Prieto-Sandoval *et al.*, 2020), with some studies focusing on meat consumption (de Barcellos *et al.*, 2010; de Boer *et al.*, 2014; Caracciolo *et al.*, 2016; Henchion *et al.*, 2017; Hoeksma *et al.*, 2017). However, considering the many aspects that the meat consumer has to take into consideration while shopping, it is still not clear which are the determinants affecting consumer decision to buy more environmentally friendly meat, i.e., meat whose production characteristics reflect environmental protection. To fill this gap, the aim of the present study is to investigate the determinants affecting meat consumers in their intention to buy beef meat whose label clearly expresses to consumers its greater environmentally friendly characteristics. The choice of beef is related to the fact that it is considered as the type of meat with the highest environmental impact (Bellarby *et al.*, 2013). To achieve our goal, in our study we hypothesized to apply an institutional system of ecological labeling on beef products, the EU Ecolabel (Reg. 66/2010). The EU Ecolabel was established in 1992 and it is a public certification scheme adopted by agri-food firms on a voluntary basis (i.e., without any legal obligation) to promote products which have a reduced environmental impact during their entire lifecycle and to provide consumers with accurate information on the environmental impact of products within the European territory. To achieve such a goal this certification scheme takes into consideration the European ISO Type I Ecolabel, which clearly defines criteria on the basis of the latest scientific and technological outcomes for products (ISO 14024:2001, 2001). The European Commission is responsible for the certified criteria and it assures that the EU Ecolabel Regulation is implemented correctly.

The reason behind the choice of EU Ecolabel is twofold. First, such label is widely recognized by the market as a purely green label. Second, taking into consideration a non-existing product, i.e., EU eco-labeled beef, we could exclude several factors influencing consumer attitudes, such as past experience or accessibility (Vermeir and Verbeke, 2008). To carry out the research question, we implemented a survey based on the Theory of Planned Behavior (TPB) (Ajzen, 1991) to understand the factors affecting the intention to buy eco-labeled beef products. Our survey was conducted throughout a questionnaire to 1139 beef consumers in Italy.

We choose Italy as case study for our analysis for different reasons. First, from an economic point of view, the meat sector has a relevant impact in terms of GDP and employment. Indeed, in Italy the turnover of the meat industry is about 32 billion euros each year and it employs about 180,000 workers (Golini *et al.*, 2017), with beef being one of the dominant products. Second, at the EU level, the Italian cattle sector represents about 10% of European production (Golini *et al.*, 2017). However, the livestock sector, especially beef production, in Italy has often been criticized for its high environmental impact particularly related to its generally intensive production systems. This has led to a penalization of Italian farmers in terms of EU CAP subsidies compared to those of other countries, like for example France and Ireland (Cozzi and Ragno, 2003). Third, Italian beef consumer preferences can be considered as a good example to analyze consumer preferences of a mature market with an interest and awareness toward meat labeled quality attributes like origin,

traceability, animal welfare and environmentally sustainable characteristics (Merlino *et al.*, 2018).

Given the importance of the sector in economic terms, the relevance of its environmental impact and GHG-emission potential, and the existing room for improvement in the Italian system from a supply and demand side (Bragaglio *et al.*, 2018), it is important to identify feasible strategies to promote more sustainable pathways. In this direction, this paper aims at investigating if from the consumer side there is a potential appreciation for more environmentally sustainable meat products.

The results add to the existing literature on the determinants leading to green choices of beef and introduce new insights on the role of institutional trust toward the intention to buy beef labeled with a public standard.

The background on the existing research on environmentally sustainable meat labels is presented in the next section. The theoretical framework upon which the paper is based is described in section 'Conceptual framework'. Methods and data collection are described in section 'Materials and methods'. Results and discussion of findings are presented in section 'Results'. The paper ends with limitation of the study and future research directions in section 'Conclusions'.

### Beef environmental-sustainability labeling

In order to promote more sustainable beef choices, consumers need to be made aware of the differences in the impacts of choosing between differently bred cattle. Thus, a system should be introduced to signal to consumers the differences in the production processes. With regard to this latter aspect, it should be considered that environmental sustainability related to production processes represents a credence attribute for consumers (Nelson, 1970) and cannot be verified either before or after consumption. Therefore, more sustainable food choices need to be guided by a reliable labeling system (i.e., ecological labeling or eco-labeling) able to fill the environmental information gap of consumers by communicating the environmental impact of a single product (Mackey and Metz, 2009) and reducing the related information costs (Teisl *et al.*, 2002). Consumer interest toward sustainability labels has strongly increased in the last years due to a general increase in awareness toward environmentally related food challenges and an increased concern toward the negative effects of food production on climate change (Napolitano *et al.*, 2010; Banterle and Ricci, 2013). Therefore, consumer choices of environmentally friendly labeled meat products may play an important role in promoting more sustainable consumption (Koos, 2011).

Despite the positive consumer attitudes toward green products, the understanding of the factors leading consumers to make environmentally sustainable choices is still controversial. The reasons behind this difficulty in conceptualizing sustainable consumer behavior in relation to environmentally friendly labeled quality attributes are mostly due to the high variety of existing labels on the market used to express the sustainability-related food properties and the cognitive associations made by consumers when they take into consideration a green label during food purchases (Angulo and Gil, 2007; Van Loo *et al.*, 2014).

For example, in Europe, the environmentally friendly characteristics of beef products can be communicated both through a variety of private standards set up both by food processors and retailers and through the European public voluntary organic label. Such labels differ in terms of type of certification, information labeled, and features of logo presentation (Pouta *et al.*, 2010;

Vanhonacker and Verbeke, 2014; Samant and Seo, 2016). For example, for beef products most of the labels relate to private or national initiatives and most of them certify the production characteristics of products, for example animal welfare, carbon footprint information, the avoidance of genetically modified organism (GMO) use, and the origin of raw materials (Apostolidis and McLeay, 2016).

Moreover, most of the existing sustainability labels investigated by the literature are considered by consumers not exclusively for their environmentally friendly characteristics (Schuldt and Schwarz, 2010; Schuldt *et al.*, 2012). Consumers often associate such green labels with other sustainability-related concepts. For example, animal welfare labels involve also ethical considerations related to the protection of animal life and better health-related characteristics may be perceived due to pro-environmental perceived characteristics (Lazzarini *et al.*, 2016; Richetin *et al.*, 2021). Also, the organic label is often perceived by consumers not only as a tool to communicate environmentally sustainable practices but it is considered as a logo also signaling products with improved quality characteristics related to food safety, health-related aspects, taste and the absence of GMOs in production processes (Van Loo *et al.*, 2011; Demartini *et al.*, 2018). This variety of aspects that can be associated with existing meat labels represents a gap in the literature that needs to be addressed.

## Conceptual framework

### *The theory of planned behavior*

In our paper we referred to the TPB model because it has been considered as a suitable framework of analysis to study a wide range consumer analysis related to environmentally friendly behavior (Vermeir and Verbeke, 2008; Guillaumie *et al.* 2010; Costanigro *et al.*, 2015; Chen, 2016). According to Yazdanpanah and Forouzani (2015), the TPB has been applied successfully to investigate green food purchasing intention and it has been recently used to predict consumer choices of meat with specific quality characteristics (Hoeksma *et al.*, 2017).

The TPB assumes that consumer decision-making processes are determined by the assessment on the possible consequences of a certain behavior, the expectation of reference individuals and the potential resources or impediments related to that behavior. According to the TPB model, these considerations lead to independent determinants of consumer intention to perform a certain behavior: attitude toward the behavior, subjective norms and perceived behavioral control (Ajzen, 1985).

Attitudes relate to the degree of consumer evaluation toward a certain behavior. More precisely, it refers to the type of assessment a consumer has with regard to a certain behavior. Such evaluation can be both positive or negative. According to the TPB theory, the more positive consumers assess a certain product, the higher is the likelihood to buy it.

Subjective norms describe consumer perceived social pressure to perform or not to perform the behavior. In other words, such determinant aims at evaluating the importance of social influences on consumer decision-making process. Current literature on consumer environmentally friendly behavior has acknowledged the important role of this variable as a predictor of consumer intention rather than a predictor of behavior (Honkanen *et al.*, 2005; Blanchard *et al.*, 2009; de Bruijn, 2010). This 'intention-behavior gap' is probably due to the social desirability bias which affects sustainable food choices.

Finally, perceived behavioral control relates to consumer ability to perform a certain behavior. More precisely, it relates to the perceived level of difficulty in performing a certain behavior. With regard to food-related literature, Sillani and Nassivera (2015) highlight that such determinant is among the main factors which help to explain the choice of environmentally friendly food choices.

According to the TPB theory, the antecedent of behavior is the intention to perform the behavior. In general, the stronger the intention to engage in the behavior, the more likely should be its implementation. In our analysis we did not consider the behavioral outcome because our investigation relates to the analysis of a labeled information which has not been introduced in the market yet. Indeed, in this case consumer behavior cannot be measured.

### *An extended model for eco-labeled meat*

Several authors have pointed out that the analysis of food consumer behavior often calls for other variables in addition to those used by the basic TPB theoretical framework, due to the peculiarities surrounding food choices (Menozzi *et al.*, 2015). Indeed, the use of an extended TPB model could increase the understanding of consumer decision-making process for food products (Steg and Vlek, 2009).

For this reason, we propose an extended TPB framework by considering the following variables which have been recognized to significantly affect food pro-environmental behavior in the literature: consumer trust, food shopping habits, environmental concern. We also control for consumer individual characteristics, including socio-demographic variables and beef consumption frequency (Fig. 1).

In the context of environmentally friendly products, trust is conceptualized as consumer belief about the environmental outcome of certain kind of green products (Chen and Chai, 2010). According to Henschion *et al.* (2017), consumer trust in food characteristics plays an important role to activate positive psychological consequences related to product consumption. Food-related literature is discussing the role of trust in explaining also green behavior. Giampietri *et al.* (2018) highlighted that trust affects consumer propensity to choose short supply chains for the purchase of food products. Ricci *et al.* (2018) investigated the role of trust in the intention to buy a more environmentally sustainable salad.

Their findings revealed a significant role of trust on consumer attitudes. Also, the findings from Yip and Janssen (2015) suggest that the lack of trust in food producers is the main barrier for the purchasing of organic food. Furthermore, Janssen and Hamm (2014) discussed the positive influence of consumer confidence toward certifications on consumer intention to buy green food products. On the basis of the existing research highlighting the primary role of trust in encouraging consumer environmental behavior, we expect this variable to have an effect also on consumer intention antecedents to buy meat with environmentally friendly characteristics, in particular on attitudes and on shopping habits.

Indeed, also shopping habits have been found to significantly affect food choices because of the characteristics of such behavior. First, food shopping is often performed on a daily basis or, at least, frequently. This implies that food shopping refers to repeated actions. In such conditions, past behavior and the way consumers are used to make food choices plays an important

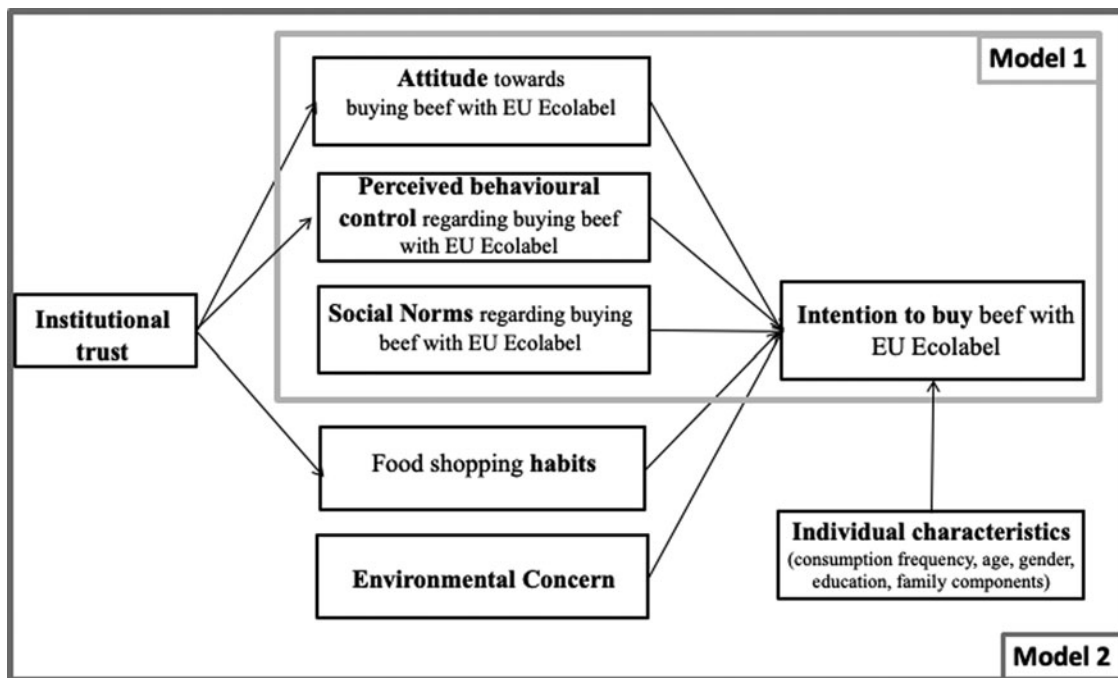


Fig. 1. Modelled variable relations.

role to guide consumer behavior in addition to their attitudes. For example, Menozzi *et al.* (2015) found that habits of looking for labeled information related to product's origin and processes were strong determinants of consumer intention to buy traced chicken among French consumers. Moreover, Stranieri *et al.* (2017) highlighted that food shopping habits significantly affected consumer intention to buy pre-packed salad with environmentally friendly characteristics. Also, Elseidi (2018) stressed how the presence of a halal logo plays an important role to moderate the halal purchasing intention. In general, the meta-analysis conducted by Massey *et al.* (2018) points out that labeled product credence attributes play an important role in explaining green food purchasing behavior.

Food-related literature has also stressed consumer environmental concern as an important factor affecting the intention to perform environmentally sustainable food choices. For example, De Groot and Steg (2007) stressed that environmental concern plays a significant role in explaining consumer intention to purchase green products. Honkanen *et al.* (2006) also highlighted that such factor can be considered among the determinants for choosing organic food. Moreover, Dowd and Burke (2013) suggested that environmental concern is an important predictor of environmentally friendly food choices. Such factor seems to affect mostly consumer choices in western countries. A recent analysis of Yadav and Pathak (2016) highlighted that environmental concern does not seem to impact purchasing intentions in developing countries.

Although this is not always the case, consumer individual characteristics may have an influence on the purchase of green products. It has been suggested that people of female gender and with a high income are more likely to purchase such products (Gracia and De Magistris, 2008; Stranieri *et al.*, 2017). Age has also been shown to sometimes be a determinant of green product choices, however, its effect is not always present or in the same direction.

## Materials and methods

### Construction of the variables

On the basis of the conceptual framework highlighted in the previous section, a set of latent variables that could be relevant to the research question were identified. Figure 1 highlights the variables considered, their relations and the models analyzed in this study. Indeed, we test both the basic TPB model and an extended framework with additional variables that have been shown to be relevant in the food domain.

A measurement model was then built identifying, for each of the latent variables, a set of measures attempting to capture such variables. An ad hoc questionnaire was built including a question for each of the measures selected. Table 1 reports the details of all the single questions included in the questionnaire for each of the latent constructs and for the other stand-alone variables tested in the models.

More in general, the focus is on the intention to purchase beef characterized by the EU Ecolabel certification. Given that this type of label is not already available on food products, we stop our analysis at intentions, as actual behavior cannot be measured yet. To measure intentions, we included in the questionnaire six questions related to the intention to buy EU eco-labeled beef, meat and food (variables  $i_1$  to  $i_6$ ). Then, we collected data on consumer attitudes toward such products (variables  $a_1$  to  $a_9$ ), perceived behavior control (variables  $c_1$  to  $c_5$ ) and subjective norms (variables  $sn_1$  to  $sn_4$ ). The questions related to such constructs were built referring to the TPB questionnaire. The above variables are those included in Model 1, that more closely resembles the basic TPB model.

As highlighted in Figure 1, we also test an additional—extended—model (Model 2) including the other variables discussed in section 'Beef environmental-sustainability labeling'. More in detail, food shopping habits questions (variables  $h_1$  to  $h_6$ ) were adapted from Grankvist and Biel (2001) and Menozzi

**Table 1.** Variable description

Variable name (short name)	Scale	Description of variables
Intention to buy meat with the EU Ecolabel (Intention)		
INT <sub>1</sub>	Scale (1–7)	I would buy fresh beef with the EU Ecolabel if it was to become available <sup>1</sup>
INT <sub>2</sub>	Scale (1–7)	I would buy fresh beef with the EU Ecolabel if it was available on the market <sup>1</sup>
INT <sub>3</sub>	Scale (1–7)	It would be important for me to find the EU Ecolabel on fresh beef products <sup>1</sup>
INT <sub>4</sub>	Scale (1–7)	It would be important for me to consume fresh beef products with the EU Ecolabel <sup>1</sup>
INT <sub>5</sub>	Scale (1–7)	I would buy food products with the EU Ecolabel <sup>1</sup>
INT <sub>6</sub>	Scale (1–7)	I would buy fresh beef products with the EU Ecolabel <sup>1</sup>
Attitude toward meat with the EU Ecolabel (Attitude)		
ATT <sub>1</sub>	Scale (1–7)	If fresh beef had the EU Ecolabel it would be healthier <sup>1</sup>
ATT <sub>2</sub>	Scale (1–7)	If fresh beef had the EU Ecolabel it would be only a marketing move <sup>1</sup>
ATT <sub>3</sub>	Scale (1–7)	If fresh beef had the EU Ecolabel it would be better <sup>1</sup>
ATT <sub>4</sub>	Scale (1–7)	If fresh beef had the EU Ecolabel it would be more expensive <sup>1</sup>
ATT <sub>5</sub>	Scale (1–7)	If fresh beef had the EU Ecolabel it would be of higher quality <sup>1</sup>
ATT <sub>6</sub>	Scale (1–7)	If fresh beef had the EU Ecolabel it would be more controlled <sup>1</sup>
ATT <sub>7</sub>	Scale (1–7)	If fresh beef had the EU Ecolabel it would create confusion among consumers <sup>1</sup>
ATT <sub>8</sub>	Scale (1–7)	If fresh beef had the EU Ecolabel it's production would be more environmentally sustainable <sup>1</sup>
ATT <sub>9</sub>	Scale (1–7)	If fresh beef had the EU Ecolabel it would help consumers make more conscious choices <sup>1</sup>
Perceived behavioral control (PBC)		
PBC <sub>1</sub>	Scale (1–7)	Buying fresh beef with the EU ecolabel would be very expensive <sup>1</sup>
PBC <sub>2</sub>	Scale (1–7)	Buying fresh beef with the EU ecolabel would not differ from buying organic beef <sup>1</sup>
PBC <sub>3</sub>	Scale (1–7)	Fresh beef with the EU ecolabel would be available only in a few specialized shops <sup>1</sup>
PBC <sub>4</sub>	Scale (1–7)	The use of the EU label would be a clear and effective way to identify ecolabeled beef <sup>1</sup>
PBC <sub>5</sub>	Scale (1–7)	It will be easy to understand the information associated with the EU ecolabel on beef as it is already used for other products <sup>1</sup>
Subjective norms		
SN <sub>1</sub>	Scale (1–7)	My friends would approve my purchase of beef with the EU Ecolabel <sup>1</sup>
SN <sub>2</sub>	Scale (1–7)	My family would approve my purchase of beef with the EU Ecolabel <sup>1</sup>
SN <sub>3</sub>	Scale (1–7)	My colleagues would approve my purchase of beef with the EU Ecolabel <sup>1</sup>
SN <sub>4</sub>	Scale (1–7)	Doctors and nutritionists would approve my purchase of beef with the EU Ecolabel <sup>1</sup>
Food shopping habits (Habits)		
HAB <sub>1</sub>	Scale (1–7)	When selecting beef, I regularly check the brand of the products <sup>1</sup>
HAB <sub>2</sub>	Scale (1–7)	When selecting beef, I regularly check the price of the products <sup>1</sup>
HAB <sub>3</sub>	Scale (1–7)	When selecting beef, I regularly check the expiry date of the products <sup>1</sup>
HAB <sub>4</sub>	Scale (1–7)	When selecting beef, I regularly check for animal welfare indications <sup>1</sup>
HAB <sub>5</sub>	Scale (1–7)	When selecting beef, I regularly check the presence of the organic logo on products <sup>1</sup>
HAB <sub>6</sub>	Scale (1–7)	When selecting beef, I regularly check traceability information <sup>1</sup>
Environmental concern (Concern)		
EC <sub>1</sub>	Scale (1–7)	Environmentally-friendly agricultural practices imply a benefit for human health <sup>1</sup>
EC <sub>2</sub>	Scale (1–7)	Agricultural practices have a strong impact on water pollution <sup>1</sup>
EC <sub>3</sub>	Scale (1–7)	Agricultural practices have a negative impact on human health <sup>1</sup>
Institutional trust (Trust)		
TR <sub>1</sub>	Scale (1–7)	Level of trust in firms operating in the beef sector <sup>2</sup>

(Continued)

**Table 1.** (Continued.)

Variable name (short name)	Scale	Description of variables
TR <sub>2</sub>	Scale (1–7)	Level of trust in institutions providing beef safety and quality assurance <sup>2</sup>
TR <sub>3</sub>	Scale (1–7)	Environmentally-friendly certifications for beef imply a benefit for the environment <sup>2</sup>
Individual characteristics		
Purchase frequency	Scale (0–5)	Beef purchase frequency <sup>3</sup>
Age	Scale (18–80)	Respondent's age in years
Gender	Dummy (0–1)	Gender dummy <sup>4</sup>
Education	Scale (1–3)	Level of completed education <sup>5</sup>
Income	Scale (1–3)	This variable measure income, given an national monthly average of 2500 euro <sup>6</sup>
Fam_comp	Discrete (1+)	Number of family components

Note: 1 (totally disagree = 0; totally agree = 7); 2 (1 = very low trust; 7 = very high trust); 3 (0 = none, I consumer other types of meat; 1 = less than once a week; 2 = once a week; 3 = twice a week; 4 = three times a week; 5 = more than three times a week); 4 (0 = male; 1 = female); 5 (1 = compulsory education; 2 = high school; 3 = university or above); 6 (1 = below average; 2 = about the average; 3 = above average).

*et al.* (2015). Environmental concern (variables  $ec_1$  to  $ec_3$ ) questions were also adapted from previous literature (Govindasamy *et al.*, 2001; Cranfield and Magnusson, 2003; Koenig-Lewis *et al.*, 2014). Trust-related questions (variables  $t_1$  to  $t_3$ ) concerned institutional trust relating to the EU ecolabel. The last set of questions included in Model 2 refer to individual characteristics of the respondents: gender, age, education, income, number of family components and beef consumption frequency.

### Data collection

Data were collected via an online platform. Sampling followed a snowball technique by means of social media platforms. The starting sampling group for the snowballing procedure was made of students of a masterclass in environmental and food economics. We asked such students to invite their social media contacts to also share the link to the survey also among their own contacts in order to try to diversify the respondent base and reach a more heterogeneous population. Responses were collected from 1240 respondents from Italy. A screening question was included to identify meat-eating respondents. A final sample of 1139 respondents were included in the data set for the analysis.

Questions were mainly multiple-choice with a 1–7 Likert rating scale built following the indications by Ajzen (1991) and Verbeke and Vackier (2005). A definition of the EU ecolabel was provided to respondents in order to be sure that they could give correct evaluations to the questionnaire items.<sup>1</sup> In order to avoid social desirability bias, we tried to avoid any possible sentence which could influence consumer judgments. To test question comprehensibility and avoid issues of confusion or fatigue, the questionnaire was firstly pretested on a group of 20 students of the Faculty of Agriculture and Food Science of the University of Milan and on 40 consumers of the Milan area. Such data were excluded from the final data.

<sup>1</sup>The sentence reported in the questionnaire was the following: "The EU Ecolabel is a European Union certification that has already been applied to certain products (detergents, textiles, paints, etc.) or services (campgrounds, hotels, services for tourist recreation) signaling a better environmental performance (reduced environmental impact) while maintaining the product's other quality characteristics. Currently, it is not possible to apply this label to food products, but the possibility to extend it in the future also to food products is being considered".

The final sample of respondents was made of: 45% of male respondents and 55% female respondents; 30% of the respondents were aged between 18 and 24 years, 37% between 25 and 40, 26% between 41 and 59, 7% 60 or over. For what concerns the level of education: 6% of the respondents had completed only compulsory education, 28% had a high school diploma; 66% had a university degree or a higher title. In relation to income, we asked respondents to specify if their family income was below, about the same or above the national monthly income: 22% of respondents declared to have a lower income, 46% to be close to the average of 2500 € month<sup>-1</sup>, while 31% declared to have a higher monthly income. Comparing the sample to the Italian population, the sample was representative in terms of gender distribution and family income. Referring to age, the sample is skewed downwards compared to the average Italian population and suffer from an over representation of respondents with a high level of education. This could be related to the sampling method; however, we control for these variables in the regression analysis.

### Data analysis

The data collected were filtered so that only meat-eaters were included in the data set. This was firstly analyzed by means of descriptive statistics of the single variables. Then two confirmatory factor analyses (CFAs) were performed to verify the validity of the constructs included in the two measurement models of Figure 1. The CFAs were firstly implemented including all the items of the questionnaire associated to the single constructs (Table 1). However, for the final models, items with factor loadings lower than 0.50 were excluded (Hair *et al.*, 2010). Standardized factor loadings of the single items of the latent constructs are reported in Table 2, as well as the factor's Cronbach's  $\alpha$ . All constructs show a Cronbach's  $\alpha$  above 0.70 that is indicated as a threshold to consider internal consistency as satisfactory (Nunnally and Bernstein, 1978).

Finally, data were analyzed by means of structural equation models to study the effects of the variables included in our conceptual framework on the intention to purchase beef with an ecolabel certification. The first model that we test is a basic TPB model including attitudes, perceived behavior control and subjective norms as antecedents of purchasing intention (Model 1). The

**Table 2.** Cronbach's  $\alpha$  and factor loadings

Variable	$\alpha$	Factor loading	Variable	$\alpha$	Factor loading
Intention	0.92		Subjective norms	0.92	
INT <sub>1</sub>		0.83	SN <sub>1</sub>		0.91
INT <sub>2</sub>		0.88	SN <sub>2</sub>		0.90
INT <sub>3</sub>		0.91	SN <sub>3</sub>		0.88
INT <sub>4</sub>		0.92	SN <sub>4</sub>		0.76
INT <sub>5</sub>		0.59			
INT <sub>6</sub>		0.65	Food shopping habits	0.78	
			HAB <sub>4</sub>		0.84
Attitude	0.88		HAB <sub>5</sub>		0.72
ATT <sub>1</sub>		0.80	HAB <sub>6</sub>		0.67
ATT <sub>3</sub>		0.69	Environmental concern	0.75	
ATT <sub>5</sub>		0.79	EC <sub>1</sub>		0.72
ATT <sub>6</sub>		0.79	EC <sub>2</sub>		0.73
ATT <sub>8</sub>		0.66	EC <sub>3</sub>		0.68
ATT <sub>9</sub>		0.74			
			Trust	0.82	
Perceived behavioral control	0.73		TR <sub>1</sub>		0.73
PBC <sub>4</sub>		0.81	TR <sub>2</sub>		0.82
PBC <sub>5</sub>		0.70	TR <sub>3</sub>		0.79

Notes:  $\alpha$  refers to Cronbach's  $\alpha$ ; factor loadings are standardized ones.

main model that we analyze is however an extended TPB model that includes also other variables highlighted by the literature as relevant predictors of food choice intentions (Model 2). More specifically, we include the constructs related to food shopping habits, environmental concern and some control variables related to individual characteristics. The latter include frequency of consumption of beef and a set of socio-demographic variables, namely gender, age, education level and the number of family components. We also run the same model substituting education with income, obtaining similar results and finding no statistically significant evidence of a relationship between intention and the income variable. According to previous literature, we also added trust as a further antecedent of attitudes, perceived behavior control and food shopping habits.

Analyses were performed using the Lavaan package (Rosseel, 2012) of the R software (R Core Team, 2013).

## Results

The results about the estimated relationships between the constructs included in the conceptual framework are reported in Table 3. More in detail, we report the estimates and their significance level for both models analyzed. However, the discussion that follows will focus on the extended TPB model that provides more interesting insights and better values for the fit indices. In particular, in Model 2, the  $R^2$  related to purchasing intention in the structural equation model is 0.77. This highlights a satisfactory ability to explain such intention (Sutton, 1998; Armitage and Conner, 2001; Ajzen, 2011; Menozzi *et al.*, 2015). This value is higher than that for the basic TPB model, that still scores a good value (0.70).

Focusing on the full model (Model 2), fit indices show a reasonable fit. Indeed, the root mean square error of approximation is 0.06, that is below 0.08, that is considered as the limit for a fair fit (Bagozzi and Yi, 1988; MacCallum *et al.*, 1996; Perrini *et al.*, 2010; De Noni *et al.*, 2014; Nassivera and Sillani, 2015). The standardized root mean square residual is 0.066, which is also an indicator of good fit (Hu and Bentler, 1999). A sizeable improvement of fit indices is achieved moving from Model 1 to Model 2. This is also confirmed when looking at the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) that reach higher values with the full model.

Focusing on path analysis, our results suggest that the intention to purchase beef with an EU ecolabel certification can be predicted by the perceived behavioral outcomes, i.e., the attitudes toward the behavior, as postulated in the TPB theoretical framework. Indeed, both models show a positive and statistically significant effect.

As predicted by the TPB theory, the purchasing intention is also influenced by the perceived easiness to perform the behavior (PBC) in a positive and statistically significant way. Furthermore, also the presence of subjective norms is shown to have a positive effect on purchasing intentions. Such results are in line with the TPB theoretical framework, and they suggest that such a theoretical model can be considered effective in explaining the determinants of consumer intention to buy beef certified with the EU ecolabel. Indeed, the greater the perception of the benefits of performing the action, the greater the perceived easiness of doing so and the approval by important peers, the greater is the intention to purchase this type of beef, that is more environmentally friendly than a traditionally bred one.

**Table 3.** Structural equation model results

Variable	Model 1	Model 2
	Estimate	Estimate
Effect on intention1		
Attitude	0.329*** (0.03)	0.356*** (0.04)
PBC	0.162*** (0.04)	0.147*** (0.04)
Subjective norms	0.325*** (0.02)	0.295*** (0.02)
Habits		0.074*** (0.01)
Concern		0.047* (0.03)
Frequency of purchase		0.056*** (0.02)
Gender		0.068 (0.04)
Age		0.004** (0.00)
Education		0.069* (0.04)
Family members		-0.012 (0.02)
Effect on attitude		
Trust		1.226*** (0.05)
Effect on PBC		
Trust		0.990*** (0.05)
Effect on habits		
Trust		0.537*** (0.06)
Model fit indices		
CFI	0.87	0.91
TLI	0.85	0.90
SRMR	0.07	0.07
RMSEA	0.12	0.06

CFI, Comparative Fit Index; TLI, Tucker–Lewis Index, also known as Non-normed Fit Index; SRMR, Standardized Root Mean Square Residual; RMSEA, root mean square error of approximation.

Notes: Estimates refer to the unstandardized solution.

Significance levels: \*\*\* $P < 0.01$ ; \*\* $0.01 \leq P < 0.05$ ; \* $0.05 \leq P < 0.1$ .

1For a more clear representation of the relations tested by the model please refer to Figure 1.

Moreover, we tested the relations between intentions and other additional variables. Food shopping habits, that in our framework relate to the use of food labels, have a positive and statistically significant effect on purchasing intentions. This suggests that those that are already prone to read food labels and to use them to choose among food products would be more prone to select beef with a public standard such as the EU ecolabel. This further confirms the fact that consumers that choose more sustainable options form their preferences using product information reported on labels.

Our results suggest that intentions can be also predicted by the individual's environmental concern. Indeed, in our extended TPB framework, the more concerned is the person, the higher is the intention to purchase EU eco-labeled beef, as it would be expected.

For what concerns the effects of trust, we find that it has a positive and significant effect on attitudes toward eco-labeled beef, as well as on food shopping habits related to food label use, and on perceived behavioral control. This highlights how trust in the EU institutions and, especially, in the ecolabel labeling

system can play an important role in favoring more sustainable choices. This may be related to the fact that public standards may provide a certain level of warranty for consumers, that feel more assured that their purchase can be effective in achieving their sustainability-related goals. This is particularly important for sustainability attributes related to production processes that are invisible to the final consumer, making such attributes 'credence' in nature, i.e., requiring an act of faith by consumers.

Finally, for what concerns individual characteristics, our results suggest that respondents that consume more beef are more interested in this type of beef option. This may be connected to the fact that consumers that have a higher level of meat intake, often reluctant in reducing meat consumption (Macdiarmid *et al.*, 2016), are more interested in sustainable options for beef. This is quite an interesting result as it suggests that large beef eaters could, in some measure, potentially be part of the solution. Given the reluctance of meat consumers to reduce their meat consumption, a relatively quick way to, at least partly, reduce the environmental impact of beef consumption seems to be the promotion of more ecological technology supported by a public certification policy.

Results seem to also indicate that, *ceteris paribus*, older people are more prone toward this type of products. Moreover, higher educated people seem to also have a higher level of purchasing intentions.

## Conclusions

One of the most debated topics in the European Green Deal is the reduction of the environmental impact of livestock farming. This objective can be achieved with a reduction in per capita consumption of meat and/or with a shift toward meat production/consumption with a lower environmental impact. The reduction of meat consumption requires a drastic change in consumer behavior, which is quite difficult for regular meat-eaters and may take a long time to implement. The present study analyses in depth the determinants affecting consumer intention to buy beef produced via more environmentally friendly processes and procedures. Results highlight that beef consumers are quite likely to change their habits, in favor of more sustainable beef choices if given the option. Interestingly, among the results achieved in the analysis, institutional trust and food shopping habits play an important role to activate the consumer's cognitive decision-making process toward sustainable beef. These findings highlight that particular attention should be devoted to build trust for public institutions in order to promote sustainable food consumption behavior. Moreover, results validate previous studies on the effectiveness of information-based policies in fostering consumers toward sustainable consumption and give important policy suggestions on the possible effectiveness of the introduction of an institutional sustainability-related label for beef products and, in general, for food.

The above discussed results need to be analyzed in the light of a set of limitations of the research. Indeed, the data collected are based on stated preferences and on a hypothetical application of an existing label to beef products. The study may indeed suffer from common method bias, given that all variables are collected with the same response method, and we do not have measures of actual behavior (Podsakoff *et al.*, 2003; Chang *et al.*, 2010). Even if the use of stated preference data is in line with the theoretical framework of the TPB, such data could suffer from consistency motif, social desirability and hypothetical bias. However, it is



particularly difficult to capture individual attitudes, concerns and beliefs in a different way. We tried to mitigate this by interspersing the order of the items related to different attitudes, and by assuring and stressing respondent anonymity and by informing respondents that there were no right or wrong answers. The choice of a self-administered questionnaire can potentially also reduce the effects of the social desirability related to a face-to-face interviewer, even if it poses more cognitive burden on respondents.

Research could also focus on the generalizability and robustness of results by exploring consumer intention to buy other kinds of food labeled with a European Ecolabel and test possible rebound effects due to the lower environmental sustainability impacts of this type of beef. Finally, future work could be also devoted to assessing the determinants of consumer trust in order to identify policies to foster more-sustainable meat consumption.

**Conflict of interest.** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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