



Consumers preferences food safety perceptions for beef – a cross-country comparison in the wake of COVID-19

Oliver Meixner¹ · Rainer Haas¹ · Drini Imami² · Iliriana Miftari³

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Abstract

Food safety is a pressing global concern, particularly in developing and emerging economies. The recent COVID-19 pandemic has further heightened consumer attention towards food safety, quality, and maintaining a healthy diet. This study provides insights into consumer awareness and perceptions related to food safety and the origin of beef products, with a specific focus on the impact of COVID-19. It draws comparisons between emerging economies, specifically Albania and Kosovo, where significant food safety challenges exist, and a highly developed economy, Austria. To assess consumer preferences, a discrete choice experiment was conducted, aiming to gauge the significance of various product attributes and consumers' willingness to pay (WTP) for specific product features. The study's findings revealed a strikingly strong sense of consumer patriotism across all surveyed countries. WTP estimates indicated a clear preference for domestically sourced food over imported alternatives. While the COVID-19 pandemic exerted a notable influence, its effects were generally contained. However, respondents from emerging economies perceived the pandemic's impact to be more severe. Additionally, factors such as risk perception and risk acceptance played a role in shaping the importance of relevant product attributes in all the food markets examined in this study. Furthermore, distinct variations emerged between the countries concerning the importance of food safety standards. For instance, in Albania, the European Union (EU) food safety certificate holds higher utility compared to the national certificate, suggesting a potential lack of trust in national agencies. Notably, low trust in institutions, including those related to food safety, is a common issue in emerging and developing economies. This lack of trust, in turn, influences consumers' perceptions of personal food safety, given that it is a credence attribute.

Keywords Choice-based conjoint analysis (CBCA) · Consumers' choice · Willingness to pay · Risk perception · Western Balkan · Country of Origin

1 Introduction

Food safety is a prominent global concern, with a particular emphasis on developing and emerging economies (Jaffee 2001; Zhllima et al. 2015a). These regions often grapple with weak institutional frameworks and pervasive corruption, which undermine the capacity and public trust in institutions responsible for ensuring food safety throughout the agri-food value chain (Imami et al. 2021). This issue is especially pertinent to the Western Balkan region, which is the primary focus of this paper.

Over the past decades, several food safety crises, notably in the livestock sector, have raised significant concerns among consumers worldwide, including in Western Balkan countries (Zhllima et al. 2015b; Gjenci et al. 2016; Udovicki et al. 2019). The region has experienced various outbreaks

✉ Oliver Meixner
oliver.meixner@boku.ac.at

¹ Institute of Marketing and Innovation, Department of Economics and Social Sciences, University of Natural Resources and Life Sciences, Vienna, Austria

² Faculty of Economics and Agribusiness, Agriculture University of Tirana, Hochschule Rhein-Waal and CERGE-EI, Tirana, Albania

³ Department of Agricultural Economics, Faculty of Agriculture and Veterinary, University of Prishtina, Pristina, Kosovo

of animal diseases, such as brucellosis (Tolaj et al. 2014; Zeqiri et al. 2015; Hamidi et al. 2016). Moreover, the presence of mycotoxins and aflatoxins in cereals, exacerbated by climatic changes (Zhllima et al. 2022), has posed a significant concern for dairy farmers (Bhat and Vasanthi 2003; Schatzmayr and Streit 2013; van Asselt et al. 2017). Additionally, soil pollution, particularly regarding higher metal concentrations, has implications for both plant and animal by-product safety standards (Zogaj et al. 2014).

Albania and Kosovo are marked by a perception of high corruption, weak institutions, and inadequate law enforcement. Both countries face substantial challenges in their national food safety control systems, particularly concerning livestock products (Haas et al. 2016). Producers and farmers in these regions exhibit low levels of awareness and compliance with food safety standards, a situation exacerbated in the case of livestock and dairy (Gjeci et al. 2016). Consequently, neither country can export livestock products, such as meat or dairy, to markets with stringent food safety standards, such as the EU.

This research aims to analyze the determinants of consumers' risk perception and food safety concerns regarding beef products, with a specific focus on the context of the COVID-19 pandemic. We compare consumers from Western Balkan emerging economies (Albania and Kosovo) with those from a highly developed EU country (Austria). We anticipate that there are country-specific variations in the importance assigned to risk and food safety attributes and in the perceived impact of COVID-19. For instance, respondents from emerging economies may perceive more severe effects from COVID-19.

The paper's structure is as follows: The subsequent section presents the literature review, which frames the empirical research design. The third section outlines the materials and methods employed, followed by the discussion of the results in the fourth section and the conclusions. The fifth and final section outlines the study's limitations.

2 Literature review

Food safety influences consumer purchasing choices with a well-documented significance (Jaffee 2001; Zhllima et al. 2015a). As a credence attribute, food safety relies heavily on trust in the information source (Fandos Herrera and Flavián Blanco 2011). Trust in public authorities is paramount for ensuring both food safety and quality standards, including geographical indications (Fandos Herrera and Flavián Blanco 2011). In developed nations with robust institutions, consumers tend to trust public institutions and supermarket chains to uphold food safety. As Lappalainen et al. (1998) note, "Almost all Europeans trust health professionals (91%)

and government agencies (80%) with great consistency across countries." This trust is bolstered by the high level of food knowledge among food handlers, such as retailers, restaurants, and catering businesses, particularly in developed countries. For instance, in Austria, a study revealed exceptionally high food knowledge scores, surpassing those of countries like Canada or Switzerland (Pichler et al. 2014). However, in countries with weaker institutional frameworks, deficient food safety systems inevitably erode consumer perceptions and confidence in the quality and safety of food products in the market, leading to lower trust in public institutions tasked with guaranteeing food safety. We anticipate that Western Balkan countries (Albania and Kosovo) in our study exhibit lower trust in local institutions compared to highly developed EU economies like Austria. Furthermore, the importance of the food safety and quality attribute varies even among developed countries. For example, in a pan-European study across 15 developed countries, it was found that quality (and freshness) holds the utmost importance for Austrians (Lappalainen et al. 1998). This emphasis on quality is supported by the extensive development of core EU food quality policies, resulting in numerous collective quality marks, geographical indications, and quality assurance schemes across member countries (Becker 2010). In this context, attributes such as origin (domestic/local origin) and brand reputation play a crucial role in ensuring food quality and safety (Becker 2010; Haas et al. 2016, 2021).

Research in emerging economies reveals that consumers often place greater trust in butchers (retailers) than in public institutions responsible for ensuring food safety, as reflected in the veterinary stamp on meat carcasses (Imami et al. 2011; Zhllima et al. 2015a). Trust in institutions tends to reduce the perceived risk of food contamination and enhance consumer satisfaction (Fandos Herrera and Flavián Blanco 2011). This trust, particularly in PDO (Protected Designation of Origin) food products, can lead to increased loyalty and purchase intention. In developing and emerging economies, consumers often prefer buying food directly from producers due to the absence of trustworthy origin certification, such as geographical indications. This practice is common for products like raki (a traditional alcoholic beverage/distillate), wine, and olive oil, as demonstrated in an Albanian study (Imami et al. 2013). There is also a growing trend for households to purchase fresh meat directly from farmers. Additionally, the purchase of processed meat products, like dry meat, directly from farmers is common practice in these economies, as it shortens the value chain for meat products. Purchasing directly from producers not only assures perceived food safety but also offers a reliable source of origin. Recent findings from Bosnia-Herzegovina suggest shifts in food sourcing and shopping behavior, with increased consumption of local and domestic products due

to food safety concerns (Ben Hassen et al. 2021). Consumer trust is traditionally linked to the length of the supply chain, with shorter connections between consumers and producers generally fostering higher trust (Imami and Skreli 2013).

Origin (both domestic and local) and brand reputation remain pivotal attributes for consumers in ensuring food safety. Recent surveys in Albania and Kosovo reveal that information about the expiry date, domestic or local origin, and familiarity with the producer or brand name are the most commonly used cues for assessing food safety and quality (Haas et al. 2016, 2021). In addition, within a country, specific regions may be perceived as having polluted soil or water, while others, particularly mountainous areas, are seen as more natural, providing conditions for safer and higher-quality food (Cela et al. 2019). Austria has witnessed a clear shift towards consumer patriotism, with an emphasis on regionality and local food production, especially in the food sector (Schermer 2015). Given these factors, we expect that origin is a significant attribute for the consumers surveyed, closely associated with perceptions of food safety and quality.

Empirical research has demonstrated that during times of uncertainty and stress, such as the COVID-19 pandemic, individuals alter their food purchasing behaviors, food consumption habits, and adhere more closely to food-related guidelines and recommendations (Altarrah et al. 2021). These changes have implications for both food safety awareness and maintaining a healthy diet, two interrelated aspects that are equally important in the context of meat consumption. Numerous multi-country studies have explored the diverse impacts of the COVID-19 pandemic on food-related behaviors. Acton et al. (2022) found, in a five-country study, that the pandemic led to changes in food sourcing, including a shift towards fewer meals prepared outside the home and overall healthier dietary choices. Lamy et al. (2022), in a 16-country study, identified a decrease in concern for convenience attributes of food, increased home cooking, and a shift towards healthier diets. Grunert et al. (2021) conducted a study across 10 European countries, revealing that the majority of consumers (60%) reported no significant changes. However, among those who experienced alterations, most embraced a more mindful approach to healthier or more sustainable food choices, although some exhibited the opposite trend. These findings align with other studies that specifically addressed the health-related aspects of people's dietary behaviors (Backer et al. 2021; Molina-Montes et al. 2021). During the COVID-19 pandemic, protocols for food safety were reinforced, emphasizing proper hand hygiene after shopping, handling food packages, maintaining social distance, using personal protective equipment, and ensuring proper food preparation (Maragoni-Santos et al. 2022).

In addition to protective measures crucial for the farm-to-fork process, compliance with food safety standards like Hazard Analysis and Critical Control Points (HACCP) and Good Manufacturing Practices (GMP) were considered vital to reduce the risk of COVID-19 infection (Olimat et al. 2020). Food safety certifications may have gained more importance among consumers during the COVID-19 pandemic, particularly in (emerging) economies with low trust in food safety enforcement institutions. Research forming the basis of this study by Meixner and Katt (2020) suggests that food safety concerns intensified during the COVID-19 pandemic. These collective findings indicate that the pandemic ushered in a variety of changes in food-related behaviors, including shifts towards healthier diets and heightened awareness of food safety.

The COVID-19 pandemic also affected the structure and coordination of the value chain, giving rise to new producer-consumer partnerships and short food chains that may yield benefits beyond COVID-19 adaptation (Tittonnell et al. 2021). Other studies have examined consumer behavior during COVID-19 through the lens of ethnocentrism (Mitarfi et al. 2021). Empirical research has shown that COVID-19 has heightened consumer ethnocentrism (Čvirik et al. 2023). This aspect is particularly relevant in this study, as it explores empirical findings from different European countries while considering the influence of COVID-19. The reference study by Meixner and Katt (2020) is based on Lim et al. (2014), which estimated the country-of-origin effect for beef, including willingness to pay (WTP). Conducted in the USA with a sample size of 1,000, the study revealed a preference for domestic beef (U.S.) associated with food safety perceptions. This preference was also confirmed by Gifford and Bernard (2011), reflecting high trust in the U.S. food safety system. Traceability and BSE (Bovine Spongiform Encephalopathy) testing increased WTP in that context (Lim et al. 2014). The replicative US study by Meixner and Katt (2020) was published in 2020, shortly after the onset of the COVID-19 pandemic, and demonstrated that the extent of COVID-19's impact influences risk perception, risk acceptance, and partly WTP. In the present study, we were interested in analyzing food safety in relation to country-specific differences, as was done by Tait et al. (2016), who revealed that food safety is valued highest in emerging economies, in contrast to animal welfare, which is highly regarded in developed economies, a trend also confirmed by van Loo et al. (2014) in a Belgian sample for chicken meat. Tait et al. (2016) compared survey data from China, India, and the UK. Additionally, our study involves a comparison of countries with varying levels of development (Albania, Austria, and Kosovo).

Table 1 Sample descriptive statistics

	Albania <i>n</i> = 463	Austria <i>n</i> = 502	Kosovo <i>n</i> = 501
Age			
Up to 29	25.5%	15.9%	30.7%
30 to 44	27.4%	24.5%	35.9%
45 to 59	24.8%	14.7%	26.1%
60 to 74	20.3%	28.3%	6.4%
75 plus	1.9%	16.5%	0.8%
Gender			
Female	48.0%	48.6%	51.1%
Male	52.0%	51.2%	48.9%
Other	0.0%	0.2%	0.0%
Education			
Basic school (4 years)	1.5%	3.2%	2.0%
Middle (9 years)	11.9%	32.9%	9.6%
High school (12 years)	41.8%	33.7%	42.5%
University	44.8%	30.2%	45.9%
Household income			
-- lowest	21.2%	2.9%	2.2%
- 2nd lowest	34.0%	20.8%	20.4%
+/- middle	23.6%	38.1%	40.3%
+ 2nd highest	14.2%	27.6%	25.1%
+ + highest	7.0%	10.5%	12.0%

3 Materials and methods

3.1 Data collection

For the recruitment of study participants in Austria, an online provider was employed. The composition of the Austrian sample closely mirrors the demographic makeup of the overall Austrian population. However, in the case of Albania and Kosovo, the absence of established online panels and the limitations of data collection in predominantly urban areas led us to opt for personal face-to-face street interviews. Participants in these regions were selected using a random route method. It is important to acknowledge that the composition of the samples in Albania and Kosovo does not precisely match the demographic quotas within the respective populations.

The structure of the samples exhibited variations in several aspects, as outlined in Table 1. Notably, the Albanian and Kosovo samples are characterized by being younger and more educated compared to the sample from Austria. There are specific reasons behind these differences. In the case of Albania and Kosovo, conducting interviews online was not a feasible option due to limited access to potential respondents, especially among less educated older individuals residing in rural areas. Consequently, face-to-face interviews were conducted, primarily targeting urban consumers in the respective capital cities, where there is a higher concentration of more educated and younger residents.

Table 2 Overview of product attributes

Attribute	Attribute levels
Country of origin (CoO)	<ul style="list-style-type: none"> • Domestic (ALB, AT, KOS) • Italy (from EU) • Brazil (outside EU)
Production practices (PP)	<ul style="list-style-type: none"> • Not specified • Pasture grazing: natural livestock farming, no hormones, antibiotics, concentrated feed, etc.
Food safety certificates (FSC)	<ul style="list-style-type: none"> • Not specified • National food safety certificate: e.g., “AMA Gütesiegel” in AT • EU food safety certificate
Tenderness (T)	<ul style="list-style-type: none"> • Not Specified: no guarantees on tenderness level of the steak • Assured Tenderness: guaranteed tender by testing the steak using a tenderness measuring instrument
Price (P)	<ul style="list-style-type: none"> • Lowest price: 11 €/kg • Medium price: 18 €/kg • Highest price: 25 €/kg

It is important to note that the gender distribution in all samples is consistent, and any differences in income distribution among the countries exist. However, given that the structure of the samples does not exert an influence on the research findings, these deviations are not considered problematic. Several statistical tests were conducted to assess whether variables such as age, gender, education, and income had any impact on factors like the importance attributed to product attributes.

3.2 Measurement instruments and analysis

The basic model of this study is derived from the work of Meixner and Katt (2020), who, in turn, drew inspiration from a study conducted by Lim et al. (2014) in a pre-COVID-19 context. We retained the same core product attributes, which include country of origin, production practices, food safety assurance, tenderness, and price. However, we made necessary adjustments to the specific product features (attribute levels) to align with the European perspective within the beef meat market. The relevant product features can be found in Table 2.

This study also incorporated several essential dimensions pertaining to the perception of food safety:

1. Risk perception (RP) and risk acceptance (RA).
2. Perceived personal food safety (PFS).
3. The impact of COVID-19 (CI).

To measure these dimensions, relevant scales were adopted from the study by Meixner and Katt (2020). Additionally, the CI scale was enhanced by including two additional items

to capture a more comprehensive assessment of the impact of COVID-19.¹

3.3 Experimental design and estimation of WTP

The central component of this study revolves around the experimental design, which is based on discrete choice modeling², helps to approximate consumer preferences and perceptions e.g., for the country-of-origin effect and locality of food (Aoki et al. 2017; Profeta and Hamm 2019) or for food labelling (Meyerding 2016; Meyerding and Merz 2018). For meat, several studies have applied discrete choice modeling (Demartini et al. 2018; Kallas et al. 2019; Hong et al. 2023), for instance, to approximate the importance of extrinsic and intrinsic attributes that are important for consumers when purchasing red meat (Steiner et al. 2010), to assess preferences on poultry meat in combination with food safety concerns (Indrawan et al. 2021), or to evaluate important pork bacon attributes (McLean et al. 2017). Many more examples are available, as the method is widely used to analyze purchasing behavior of consumers. In line with actual shopping scenarios, participants are presented with various product alternatives, forming their “evoked set,” that align with their preferences and expectations (Sammer and Wüstenhagen 2006). Importantly, they also retain the option to abstain from selecting any of the presented alternatives, mimicking a “no-choice option.” This approach closely mirrors real shopping behavior.

The consumer choices were coded as binary data (choice/no-choice), out of which the importance of product attributes and attribute levels were approximated based on the random utility theory (McFadden 1974). The choice decision of consumer j can be expressed as $U_{ijs} = V_{ijs} + \epsilon_{ijs}$, with the deterministic element $V_{ijs} = \beta_j \cdot X_{ijs}$ and the stochastic element ϵ_{ijs} . X_{ijs} is the vector of attributes with the i^{th} option of choice set s ; β_j is the (unknown) vector describing the preferences of the j^{th} individual. As in Meixner and Katt (2020), β_j is then approximated by confirming Eq. (1) to assess individual part-worth utilities of attributes by means of Hierarchical Bayes (HB) estimation:

$$U_{ijs} = \beta_0 + \beta_1 \cdot CoO_{ijs} + \beta_2 \cdot PP_{ijs} + \beta_3 \cdot FSC_{ijs} + \beta_4 \cdot T_{ijs} + \beta_5 \cdot P_{ijs} + \epsilon_{ijs} \quad (1)$$

¹ The items CI06: “The negative impact the coronavirus (COVID-19) is very high.” and CI07: “The coronavirus (COVID-19) is a serious threat for someone like me.” were not part of the original US study. The constructs’ core basis for the scales RP, RA, and PFS can be taken from Lim et al. (2014).

² In economic publications, quite often the term “choice-based conjoint analysis (CBCA)” is used as a synonym. To avoid any misunderstandings and following Louviere et al. (2010), we consistently use the term “discrete choice modeling (DCE)”.

Hierarchical Bayes (HB) estimation is commonly used in consumer research as “[r]ecent advances in Bayesian estimation make the estimation of these models computationally feasible, offering advantages in model interpretation over models based on indirect utility, and descriptive models that tend to be highly parameterized” (Chandukala et al. 2008). With this approach, it is possible to analyze the influence of RA, RP, PFS, and CI on the importance of attributes β_i and part-worth utilities U_i . In addition, it is possible to approximate WTP for specific product features (as the price attribute is part of the research design) which “is the marginal rate of substitution of particular attributes/levels for money (price levels)” (Louviere and Islam 2008). As Breidert et al. (2006) pointed out in their review of WTP measurement methods, the “WTP for a competing product [product features changed] is then estimated as the price at which the respondent would switch away from the status quo product”. The change in total utility is compensated by a change in the price of the product. WTP can be interpreted as the ratio (Louviere and Islam 2008) :

$$WTP = -\beta_i / \beta_{price} \quad (2)$$

where β_1 is denoted as the utility per level and β_{price} as the linear price function. Altogether, we again follow the considerations of our base literature (Lim et al. 2014; Meixner and Katt 2020). Meixner and Katt (2020) name several studies covering appropriate WTP approximations in discrete choice experiments (Jedidi and Zhang 2002; Chang et al. 2012; Balogh et al. 2016; Paci et al. 2016; Britwum and Yiannaka 2019; Yang et al. 2020). Although discrete choice experiments have several shortcomings, e.g., market data would be more appropriate to cover real shopping behavior (Breidert et al. 2006), it is one important methodological approach (besides, e.g., experimental auctions) that can cope with WTP in a better way than traditional approaches (e.g., direct surveys) (Breidert et al. 2006).

4 Results

We conducted reliability tests for the scales using Cronbach’s Alpha, and the results indicate acceptable reliability for all scales. For the Risk Perception (RP) scale, Cronbach’s Alpha was calculated at 0.95, and there would be no significant improvement if any of the items were excluded from the scale. Similarly, the Risk Acceptance (RA) scale demonstrated good reliability with a Cronbach’s Alpha of 0.92, and no noticeable improvement would result from removing any RA item from the scale. The Perceived Personal Food Safety (PFS) scale achieved an acceptable level

Table 3 Perceived risk statistics

Category	Albania (<i>n</i> = 473)		Austria (<i>n</i> = 507)		Kosovo (<i>n</i> = 501)	
	μ	σ	μ	σ	μ	σ
Risk index and items ***						
Risk perception (RP) (1 = low perceived risk ... 7 = high perceived risk) (Mean RP1 to RP3)	3.46	2.15	2.29	1.26	2.58	1.57
RP1: When eating beef, I am exposed to ... (1 = very little risk ... 7 = a great deal of risk)	3.48	2.22	2.23	1.35	2.61	1.73
RP2: I think eating beef is risky. (1 = strongly disagree ... 7 = strongly agree)	3.44	2.15	2.43	1.43	2.64	1.54
RP3: For me, eating beef is ... (1 = not risky ... 7 = risky).	3.47	2.25	2.21	1.38	2.50	1.73
Risk acceptance (RA) (1 = risk is not accepted ... 7 = risk is accepted) (Mean RA1 to RA3)	3.26	1.83	4.87	1.52	4.13	1.95
RA1: I accept the risks of eating beef. (1 = strongly disagree ... 7 = strongly agree)	3.36	1.86	4.89	1.70	4.19	1.94
RA2: For me, eating beef is worth the risk. (1 = strongly disagree ... 7 = strongly agree)	3.15	1.93	4.87	1.71	4.13	2.06
RA3: I am ... to accept the risk of eating beef. (1 = not willing ... 7 = willing)	3.24	2.09	4.83	1.73	4.08	2.22

*** All mean differences significant $p < 0.001$; μ = Mean; σ = Standard Deviation

Table 4 Self-assessed level of food safety of domestic beef – answer to the question: “Whether you have ever knowingly purchased beef produced in another country or not, what is your perception of the level of food safety of domestic beef?”

Level	Albania	Austria	Kosovo
1 very low	15.0	5.7	38.5
2 low	34.2	5.3	28.7
3 moderate	34.2	13.0	24.4
4 high	12.1	26.0	4.2
5 very high	2.1	48.3	2.0
6 no opinion	2.3	1.6	2.2
μ , without “no opinion” (σ)	2.51 (0.97)	4.08 (1.17)	2.00 (1.00)

of reliability with a Cronbach’s Alpha of 0.80. Although the first item (“...food is too expensive”) may not fit as seamlessly as the other two items, it was retained in the scale due to the small number of items. Excluding it would increase Cronbach’s Alpha to 0.86. However, the reliability of the scale measuring the impact of the COVID-19 pandemic (CI) yielded the least reliable results, with a Cronbach’s Alpha of 0.71. Even if one of the items were excluded, there would be no significant increase in Cronbach’s Alpha. While the reliability is still acceptable, it suggests that there is potential for improvement in this scale, especially given the increase in the number of items.

4.1 Risk perception and risk acceptance

Concerning the perceived risk of eating beef, the Albanian respondents showed a slight disagreement concerning the perceived personal risks of eating beef ($\mu = 3.46$) (Table 3). Austrians ($\mu = 2.25$) and Kosovars ($\mu = 2.58$), attributed much lower risk to beef consumption. Differences in means are highly significant with $p < 0.001$. Concerning the differences in RA, the Albanian participants showed a comparable low acceptance of the risk of eating beef ($\mu = 3.26$) compared to Austria ($\mu = 4.87$) and even Kosovo ($\mu = 4.13$), all differences with $p < 0.001$. The effect size of these differences amounts to an Eta²-level of $\eta^2 = 0.12$, a large to

medium effect size confirming Cohen(1988) for RA and $\eta^2 = 0.08$ for RP (medium effect size).

This is in accordance with a further important question being part of all surveys, the self-assessed level of food safety. The respondents were asked, what their perception of the level of food safety of domestic beef is (Table 4). According to the distribution of answers and the means μ in Table 4, the perceived food safety is considered to be much higher and around 4 (scale max. 5) in Austria ($\mu = 4.05$) compared to Albania ($\mu = 2.51$) and Kosovo ($\mu = 2.00$). The proportion of those who attributed very low or low food safety in Albania and, in particular, in Kosovo was by far larger compared to Austria; the effect size is considerable with $\eta^2 = 0.42$. Obviously, there is less trust in the beef production sector in Albania and Kosovo, probably, because there is a lack of a trustworthy national food safety institutional framework.

4.2 The impact of COVID-19 on risk perception, risk acceptance, and perceived personal food safety

PFS was measured using three items (expensive food, changing habits, and worried about buying enough food). There were considerable and significant differences ($p < 0.001$) between the 3 countries of this study (Table 5). Confirming Cohen (1988), the effect size of these differences is rather high with $\eta^2 = 0.16$. The lowest PFS was in Albania with $\mu = 5.50$ (with 1 = PFS is very high to 7 = PFS is very low); which was much lower compared to all other countries. In particular, Albanian respondents consistently found food to be too expensive. This was a general tendency within all samples but the level of agreement to the 3 PFS items differed significantly. Austrian respondents tended to perceive food as significantly safer in terms of their PFS, but also widely believed that food is too expensive. Regarding μ (PFS), Kosovo exhibited similar levels to the compared groups (these differences were not statistically significant; $p > 0.05$). Furthermore, differences in μ between Austria

Table 5 Perceived personal food safety and impact of the COVID-19 pandemic

Index / item ***	Albania (n = 473)		Austria (n = 507)		Kosovo (n = 501)	
	μ	σ	μ	σ	μ	σ
Perceived personal food safety (1 = high ... 7 = low)	5.50	1.35	4.08	1.52	4.29	1.31
PFS01: [...] food is too expensive.	6.14	1.17	4.94	1.64	5.75	1.22
PFS02: [...] forced me to change my food habits.	5.32	1.71	3.99	1.88	3.73	1.84
PFS03: [...] worried about buying enough food.	5.04	1.83	3.31	1.82	3.37	1.79
Impact of COVID-19 (1 = not affected ... 7 = totally affected)	5.23	1.00	4.31	0.94	4.47	0.85
CI01: [...] has affected me personally.	5.10	1.78	4.37	1.63	5.11	1.79
CI02: [...] will change society.	5.52	1.46	5.04	1.37	6.09	1.29
CI03: [...] optimistic regarding my financial situation. ^{rev}	3.56	1.87	4.33	1.55	5.30	1.46
CI04: [...] worried about my financial future.	5.32	1.63	4.04	1.68	3.93	1.66
CI05: [...] optimistic regarding the economy. ^{rev}	2.28	1.55	3.73	1.47	3.63	1.82
CI06: The negative impact [...] is very high.	5.92	1.23	5.21	1.27	5.86	1.32
CI07: [...] is a serious threat for someone like me.	4.60	1.94	3.55	1.64	3.22	1.70

*** all mean differences significant $p < 0.001$; μ = arithmetic mean; σ = standard deviation; ^{rev} reversed scale values to calculate CI

Table 6 Correlation (Pearson’s *r*) between indices PFS, CI, RP, RA

Correlation total sample (n = 1480)	PFS	CI	RP	RA
PFS (1 = high food safety ... 7 = low)	1			
CI (1 = no impact of COVID- 19... 7 = high impact)	0.58***	1		
RP (1 = low risk ... 7 = high risk)	0.24***	0.25***	1	
RA (1 = risk is not accepted ... 7 = risk is accepted)	-0.30***	-0.21***	-0.33***	1

*** Sig. < 0.001

and Kosovo did not reach statistical significance (as determined by Bonferroni and Tamhane index; $p > 0.05$).

To assess the impact of the COVID-19 pandemic, we introduced 2 additional items (CI06 and CI07) to the CI scale, and for the calculation of CI, items CI03 and CI05 were reversed. The differences in μ (mean) for the CI scale were statistically significant ($p < 0.001$), ranging from $\mu = 4.31$ (indicating a medium impact) for Austria to $\mu = 5.23$ (indicating a higher impact) for Albania, measured on a scale where 1 represents no impact from COVID-19, and 7 represents a high impact. The effect size, as indicated by $\eta^2 = 0.16$, is considered large, in line with Cohen’s (1988) classification. These differences become even more pronounced when examining the frequency of agreement with statements CI01 to CI07. In Table S1 (Supplementary Information), we further aggregated the frequencies into 3 major agreement categories (1,2 = disagreement; 3,4,5 = mid; 6,7 = agreement). The distribution clearly highlighted the disparities between the countries. Generally, participants from Albania and Kosovo appeared to be significantly more affected compared to those from Austria. For example, approximately 60% of respondents from Albania and Kosovo agreed with the statement CI01, “I feel the

coronavirus pandemic has affected me personally,” while only 20% of Austrian respondents shared this sentiment. A similar pattern was observed for the other CI statements. Overall, respondents from Albania and Kosovo exhibited less optimism and perceived the impacts of COVID-19 as considerably more severe.

The indices PFS, CI, RP, and RA are interrelated, as demonstrated in Table 6. Specifically, there was a notable correlation between CI and PFS ($r = 0.51$). CI also had a significant influence on RP ($r = 0.14$) and RA ($r = -0.18$), although to a lesser extent. These findings suggest that a higher impact of COVID-19 was associated with a heightened perceived risk for consuming beef. Furthermore, a higher perception of the influence of COVID-19 was linked to lower RA regarding beef consumption. Individuals who believed they have been more affected by COVID-19 also tended to be more cautious about eating beef, possibly due to more health awareness. PFS and RP showed a moderate to high correlation ($r = 0.32$), while the relationship between PFS and RA was slightly negative ($r = -0.20$). The overall comparison of the correlations between the indices provided valuable insights into their relationships. However, this analysis lacked precision as it did not consider the specific outcomes in each of the 4 countries. For a more accurate assessment, the country-level comparison yielded more detailed results. As shown in Table 7, the relationships were notably stronger in Albania and Austria, particularly for PFS and CI ($r = 0.52$ and 0.61, respectively). In contrast, in Kosovo, some of the relationships were either not significant or had very low correlation coefficients ($r < 0.10$). For instance, the correlation between RP and RA was much stronger in the samples from Kosovo and Austria ($r = -0.39$ and -0.34 , respectively), and Kosovo exhibited a higher correlation between PFS and RP ($r = -0.28$), as well as insignificant correlations between CI and RA. These findings emphasize the importance of

Table 7 Correlation (Pearson's r) between indices PFS, CI, RP, RA – countries

Correlation Albania ($n = 473$)	PFS	CI	RP	RA
PFS	1			
CI	0.52***	1		
RP	0.15**	0.20***	1	
RA	-0.13**	-0.22***	-0.05	1
Correlations Austria ($n = 507$)				
PFS	1			
CI	0.61***	1		
RP	0.18***	0.15***	1	
RA	-0.17***	-0.13**	-0.34***	1
Correlations Kosovo ($n = 501$)				
PFS	1			
CI	0.34***	1		
RP	0.13**	0.09*	1	
RA	-0.28***	0.08	-0.39**	1

* Sig. < 0.05; ** Sig. < 0.01; *** Sig. < 0.001

interpreting the correlations between the indices on a country-specific basis (Table 7).

4.3 Approximation of part-worth utilities and importance of product attributes

In alignment with the methodologies of Meixner and Katt (2020) and Lim et al. (2014), a discrete choice experiment (DCE) was conducted to facilitate further analysis. The primary objective of the DCE was to gauge the significance of attributes related to beef and to determine the part-worth utilities associated with specific beef characteristics (attribute levels). By merging the outcomes of the risk awareness and perception, perceived personal food safety, and COVID-19 sections with the findings from the DCE, this study aimed to ascertain whether the relationships observed in these sections (based on self-assessed scales) were also replicated in the choice experiment. Our hypothesis was that individuals who were more significantly affected by COVID-19 would exhibit distinct choice patterns, resulting in different utility approximations when compared to those who were less affected or unaffected by the pandemic. In this study, the approximation methodology outlined by Meixner and Katt (2020) was employed. To determine the relative importance of each attribute group, we calculated it as the difference between the highest and lowest part-worth utility within that group, divided by the total utility (i.e., the sum of all part-worth utilities for all attribute groups). The estimation of part-worth utilities was carried out individually using the Hierarchical Bayes estimation method (Meixner and Katt 2020).

Table 8 Relative importance of beef attributes and part-worth utilities

Importance / part-worth utilities	Albania $n = 468$	Austria $n = 488$	Kosovo $n = 500$
Country of origin (CoO)	42.2%	33.9%	38.4%
Domestic	0.00	0.00	0.00
Italy	-3.66	-2.62	-1.37
Brazil	-7.12	-5.34	-8.89
Production practices (PP)	6.5%	8.4%	13.6%
Not specified	0.00	0.00	0.00
Pasture grazing	0.92	1.06	3.55
Food safety certificates (FSC)	27.4%	28.4%	25.8%
Not specified	0.00	0.00	0.00
National food safety certificate	3.58	4.40	6.35
EU food safety certificate	4.21	1.32	3.24
Tenderness (T)	2.7%	6.0%	8.1%
Not Specified	0.00	0.00	0.00
Assured Tenderness	0.23	0.58	-2.07
Price in €/kg (P)	21.2%	23.4%	14.2%
Non-random Coefficients	-0.25	-0.22	-0.25

*** Significance of all differences ALB/AT/KOS $p < 0.001$

Concerning the importance of the applied product attributes, evidently the country of origin stood out as the most important attribute for all 3 countries (Table 8). The importance ranged from 42.2% in Albania to 33.9% in Austria. Importantly, the presence of imported beef significantly reduced the utility for consumers in all countries included in this study.

The second most important attribute is the assurance of specific food standards, with its importance ranging from 28.4% in Austria to 25.8% in Kosovo. This attribute's significance is relatively consistent across the countries. Interestingly, in Albania, the EU food certificate holds an even higher utility compared to the national standard or no standard, while in Austria and Kosovo, the national food safety certificate surpasses the EU standard by a significant margin. The importance of production practices ranged from 13.6% in Kosovo to 6.5% in Albania. Notably, the attribute "pasture grazing" carried a higher utility compared to the "not specified" option, as expected. Tenderness appeared to be generally less important, potentially due to the limited application of this product characteristic in beef marketing in Europe. Price was the second most important attribute, with higher prices resulting in lower part-worth utilities. The utility approximation for different price levels followed an almost perfect linear trend, making it feasible to estimate a non-random coefficient, which can be useful for approximating consumers' WTP for specific product characteristics.

4.4 Willingness to pay

Based on the results of the DCE, it is feasible to estimate the Willingness to Pay (WTP) on an aggregate level, as

confirmed by Eq. (2). As demonstrated in Table 9, there were substantial differences in part-worth utilities for certain attributes. Notably, the Country of Origin (CoO) effect is particularly pronounced in this study. The required changes in the price attribute to offset these variations would need to be quite substantial, rendering them unrealistic in practice. This underscores the limitations of WTP approximations through DCE and will be discussed further below. Despite the impracticality of the level of deviation in price attributes, the approximations clearly illustrate that attributes related to origin and food safety exert a significant influence on the price of the respective product. In contrast, other attributes have only a minor impact on the price of beef in all countries. Specifically, imported beef from outside the EU is considerably less preferable compared to domestic beef.

Regarding the Country of Origin (CoO) effect, the results for the 3 countries were relatively comparable, although there was a notable difference in the negative WTP for beef originating from Brazil, which is much larger in Kosovo (-36.2€). An intriguing finding came from Albania regarding Food Safety Certificates (FSCs), where the EU FSC was associated with an even higher WTP (+17.2€) compared to the national FSC (+14.6€). Whereas in Austria, where trust in the national food safety system is high, the WTP for the EU FSC was much lower compared to the national FSC. This pattern also holds in Kosovo, albeit with a smaller difference: +25.9€ for the national FSC vs. +13.2€ for the EU FSC. These findings strongly suggest that, especially in Albania, the national food safety system may not be as highly regarded as the EU system.

4.5 The influence of COVID-19

To assess the impact of the COVID-19 pandemic, including the indices PFS, RA, and RP, once again a correlation analysis was conducted (Table 10; the distribution of CI01 to CI07 is presented in Table S1 of the Supplementary Information). The test design and the results of the correlation analysis aimed to reveal whether there is an influence of CI, PFS, RA, or RP on the various attributes. The impact of the COVID-19 (CI) was relatively low. Table 10 shows some significant correlations, primarily a positive correlation (r) between CI and the price attribute (in all countries), and a negative correlation between CI and the importance of Food Safety Certificates (FSCs) in Austria and Kosovo. These correlations suggest that as respondents' exposure to COVID-19 increases, the importance of the price attribute also rises, accompanied by a decreased significance of FSCs. However, it is worth noting that these correlations, while significant and as expected, are relatively weak, indicating that the impact of CI is limited.

Table 9 WTP for beef attributes

Attributes	ALB	AT	KOS
CoO Italy	-15.0€	-12.2€	-5.6€
CoO Brazil	-29.1€	-24.8€	-36.2€
Pasture grazing	+3.7€	+4.9€	+14.5€
National FSC	+14.6€	+20.4€	+25.9€
EU FSC	+17.2€	+6.1€	+13.2€
Assured tenderness	+0.9€	+2.7€	-8.4€

All differences are significant at the 1% level, in accordance with Meixner and Katt (2020) and Lim et al. (2014): results produced by simulation with 5,000 draws

Table 10 Correlation (Pearson's *r*) between indices CI, PFS, RP, RA, and Weights (W)

Cor-relation	W Origin	W pro-duction practices	W FSC	W tenderness	W price
Albania (n = 468)					
PFS	-0.03	-0.07	-0.23***	-0.04	0.24***
CI	-0.11*	-0.08	-0.07	0.01	0.16***
RP	-0.00	0.05	0.14**	-0.05	-0.12*
RA	0.12*	-0.03	-0.23***	-0.11*	0.12*
Correlations Austria (n = 488)					
PFS	-0.02	-0.17***	-0.24***	0.12**	0.22***
CI	0.03	-0.10*	-0.12**	0.02	0.10*
RP	-0.02	0.05	-0.04	-0.00	0.03
RA	-0.05	-0.13**	0.03	0.04	0.04
Correlations Kosovo (n = 500)					
PFS	-0.12**	0.02	-0.07	0.09	0.24***
CI	0.04	0.04	-0.21***	0.01	0.19***
RP	0.17***	-0.15**	-0.10*	-0.13**	0.02
RA	0.08	0.11*	-0.13**	-0.06	0.01

Significance *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

The highest effect was measured for PFS; it slightly correlated with the weighting of the applied attributes for beef. The less secure the respondents perceived their individual situation, the less important were FSCs and the more important was the price attribute. The correlation index reaches rather low levels (in ALB, AT). In Kosovo, the price attribute correlated significantly with PFS, but not the importance of the FSC attribute. Altogether, the relationship between the importance of the price attribute and PFS seemed to be valid for all investigated countries; the impact of PFS on other attributes needs an individual country-by-country interpretation.

5 Discussion and conclusion

The findings of this study provide an interesting comparison with the original US study conducted by Meixner and Katt (2020). Despite several modifications in the empirical design, the core results of both studies remain comparable. There were important differences in the outcomes among the countries, which can be partly explained by the timing of data collection (immediately after the outbreak of the COVID-19 pandemic in the USA and in 2022 in Albania, Austria, and Kosovo). Additionally, differences are possibly linked to the developmental status of the countries, particularly concerning food safety mechanisms and the trust of the population in the national food safety system. One notable difference was the higher level of consumer patriotism observed for European countries of this study compared to the US study by Meixner and Katt (2020). This aligns with the existing research highlighting regional food and consumer patriotism as significant market trends, especially in countries like Austria. This sense of consumer patriotism extends to emerging European economies, although the study's findings also indicate some mistrust in the national food system, particularly in national agencies and public authorities. In this study, European consumers showed a strong preference for domestic food compared to the US market. The required price reductions for imported beef to compete with domestic products are far beyond feasible limits, which might also be attributed to the limitations of the WTP approximations based on the DCE study design. Other WTP methods may yield more realistic results. Despite some differences in food safety perceptions between the countries, the importance of food safety certificates was relatively consistent across the 3 European countries and was not significantly different from the USA, where this attribute was even more important. However, the specific attribute levels of food safety certificates did vary between the countries. For instance, in Albania, the EU food safety certificate had a higher utility compared to the national one, suggesting lower trust in national agencies.

Regarding the influence of the COVID-19 pandemic, the results show that the impact on the importance of product attributes was relatively low, even though there were some isolated effects that were partly significant. This was somewhat unexpected, as previous research suggested that food safety concerns increased during the COVID-19 pandemic. The correlation analysis revealed limited and low-effect size relationships, which may not fully explain consumer food choices. The study acknowledges that the timeframe of the original study (immediately after the pandemic outbreak) and the present study (data collection in mid-2022) might have played a role in the results, with implications potentially being less significant on an individual level.

Overall, while the results were consistent, there were some limitations to consider, including the WTP approximations based on DCE and the sampling methodology, particularly in Albania and Kosovo, where the survey mainly captured urban consumer behaviors. Consequently, interpretation of the results in terms of representativeness should be cautious, as they primarily reflect urban markets. Nonetheless, these findings are valuable for the private sector, given that urban markets are the main drivers in both countries.

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Declarations

Conflict of interest The authors declare that there are no conflicts of interest regarding the publication of this article.

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