Are organic and environmentally-friendly attributes substitutes or complements? Evidence from a coffee choice experiment

Nicolas Gatti, Smithsonian Institution & Cornell Dyson School of Applied Economics and Management, gattin@si.edu
Miguel Gómez, Cornell Dyson School of Applied Economics and Management, mig7@cornell.edu
Ruth Bennett, Smithsonian Institution, bennettr@si.edu
Justine Bowe, Smithsonian Institution, bowej@si.edu
Scott Sillett, Smithsonian Institution, silletts@si.edu

Selected Paper prepared for presentation at the 2021 Agricultural & Applied Economics Association Annual Meeting, Austin, TX, August 1 – August 3

Are organic and environmentally-friendly attributes substitutes or complements? Evidence from a coffee choice experiment

Abstract

Eco-labels are certification standards informing consumers about environmental, social, and economic sustainability practices in production. As the market for sustainable products expands, understanding how consumers differentiate and select products for their sustainability attributes are critical for eco-label impact. This article aims to estimate the willingness to pay (WTP) for Bird-Friendly® attributes and investigate whether organic and environmentally-friendly attributes are substitutes or complements in consumption. We conducted a choice experiment with coffee consumers who chose between hypothetical coffee bag options. We consider three attributes: prices, agroforestry management systems, and chemical input management attributes. We use the choice experiment to estimate a Random Utility Model (RUM) to evaluate consumers' preferences and the willingness to pay (WTP) for these attributes. Our results show that consumers are willing to pay on average a 41% premium for 12 oz. of Bird Friendly coffee compared to a conventional coffee ($12 per bag on average). This premium is higher than for shade-grown coffee but lower than organic and pesticide-free coffee. Consumers consider Bird Friendly and organic attributes as substitutes for one another (as opposed to complements). Bird-Friendly organic coffee has the lowest WTP among combinations of attributes such as shade-grown and organic, shade-grown and pesticide-free, and Bird Friendly and pesticide-free. Further, we find that consumers who are more concerned about the environment are willing to pay an additional $1.14 per bag when coffee is marketed as BF only compared with the average consumer. These results contribute to the BF certification program's economic sustainability by justifying certified organic alternatives to reduce certification costs to farmers and increase the potential for expanding land areas protected under certification.

Keywords: eco-labels, choice experiment, organic, environmentally-friendly attributes, substitutes, complements

Are organic and environmentally-friendly attributes substitutes or complements? Evidence from a coffee choice experiment

The market for eco-labels has grown steadily since 1970 due to increasing consumer interest in sustainable products (Janßen & Langen, 2017; OECD, 2016). As of 2013, almost 190 initiatives inform consumers about sustainable food and forest products in the US alone (Gruere, 2013). A standard view is that eco-labels are related to a benevolent cause, and the more of them a product has, the better (Tebbe & von Blanckenburg, 2018). Rainforest Alliance and USDA Organic are examples of labels that promote conservation and organic practices in production, respectively. Further, Fair Trade is well-known for fostering fair conditions for agricultural workers. Many food products have multiple eco-labels, making it challenging for consumers to understand the differences (Janßen & Langen, 2017; Janssen & Hamm, 2012; Van Loo et al., 2015). As the market for sustainable products expands, understanding how consumers differentiate and select product sustainability attributes are critical for eco-label impact.

Labels often represent more than one aspect of sustainability, so there is an increasing burden on consumers to understand their various features. For instance, consumers may relate organic claims with health and freshness benefits when this might not be necessary. These preconceptions and misinformation can result in label redundancies and consumers' overvaluation of eco-label attributes (Syrengelas et al., 2018; Ufer et al., 2021; Wilson & Lusk, 2020). Alternatively, consumers may value sustainability as a concept without assigning a specific value to each product attribute. Consumers may see label attributes as either additive complements or interchangeable substitutes for one another if they can identify the differences, depending on their preferences (Fischhoff et al., 1993; Loomis et al., 1993). For example, consumers may consider organic production and biodiversity conservation as substitutes for each other as long as consumers understand that both attributes contribute to protecting the environment. Identifying attributes' complementarity in consumption is essential to determining the most valuable attributes of eco-labels. Determining the value of these various attributes is critical to eco-labels success, which aims to incentivize certain producer practices.

This study aims to estimate willingness to pay (WTP) for Smithsonian Bird Friendly® (BF) coffee and to investigate whether consumers consider its attributes as complements or substitutes for one another. The BF coffee certification is regarded as the gold standard in organic, biodiversity-friendly, shade-grown coffee production; however, it only accounts for ~15,000 certified hectares of 10 million hectares of global coffee lands (Smithsonian Institution, 2021). Shade-grown labels are a blanket marketing term that may include as few as 1 to 2 species of shade-tree cover over the coffee. In contrast, BF is a type of shade-grown coffee that is strictly controlled with stringent criteria. BF coffee is grown under a diverse shade canopy with at least 40% shade cover, 11 different shade tree species, and a minimum of 12 meters of canopy height. Globally, about 70% of global coffee is produced without shade (e.g., "sun-grown coffee") or light shade provided by only one or two shade tree species ("shade-grown coffee"; Jha et al., 2014). BF coffee conserves considerably more wildlife habitat than uncertified "shade-grown coffee" or "sun-grown coffee" (Perfecto et al., 2007).

A limitation for program expansion is that participating farmers must obtain organic certification, which bans the use of synthetic agrochemicals before the BF certification, which acts as a barrier to entry. The organic certification is a three-year process during which farmers may experience lower yields combined with higher operational costs for labor, organic pest control, and inputs. While there is anecdotal evidence of market premiums for BF coffee (a reported 5 to 10 cents per pound at the farm gate, according to the Smithsonian), the costs of certifying practices likely exceed the financial benefits from the certification. To reduce certification costs for farmers, we want to know whether the bird habitat conservation attribute is as valuable as the organic attribute for consumers. If these sustainability attributes are identified as complements to one another, there are potential gains from bundling together these attributes. If attributes prove to be substitutes for one another, then consumers might see these different attributes as similar, and combining multiple sustainability attributes on coffee labels might cause coffee companies and the farmers they source from to suffer from price discounts.

To study consumers' WTP and complementarity in coffee attributes, we designed and implemented a choice experiment where consumers choose between two hypothetical coffees and an opt-out option. These hypothetical products included price level, agroforestry management systems, and chemical input management attributes. We considered five price levels per 12 oz. bag of a coffee representative of ground coffee market prices. The shade management attributes considered here were sun-grown, shade-grown, and BF. The input management options in the experiment were conventional chemical inputs, organic, and pesticide-free. We defined the choice experiment in terms of the attributes themselves instead of eco-labels available in the market to address redundancy (Janßen & Langen, 2017; Wilson & Lusk, 2020). Given that the BF standard requires previous organic certification, we want to separate how much consumers are willing to pay for its biodiversity conservation value apart from its organic attribute.

We use 779 US coffee consumers' responses to estimate the WTP for each attribute using a Mixed Logit (ML) model estimation. Results show consumers' marginal WTP for 12 oz. of BF coffee as $4.92 higher than a sun-grown coffee grown using conventional chemical inputs. This premium is higher than for shade-grown coffee but lower than the WTP for organic and pesticide-free coffee. The relative comparison between marginal WTP shows that there could be redundancies in consumers' valuation of organic products with other eco-labels. Second, we explore the complementarity between the BF and organic attributes. The negative sign in the interaction between BF and organic attributes indicates that attributes are substitutes for one another. Furthermore, the WTP for organic BF coffee is the lowest among coffee marketed as a combination of shade-grown and organic, shade-grown and pesticide-free, and BF and pesticide-free. Third, to address heterogeneity in preferences, we look at how our results change consumers' environmental concerns. We use cluster analysis to identify consumers who care about the environment (61% of the sample) versus those less concerned about the environment based on consumers' agreement with statements concerning the environment (39% of the sample). We find that consumers who are more concerned about the environment are willing to pay $1.14 more when coffee is marketed as BF only compared with the average consumer. Lastly, we study the relationship between consumers' demographics and the BF attribute premium. Results suggest that the BF premium is negatively associated with consumers' age and positively associated with

income and recognition of eco-label logos. Moreover, female consumers who are environmentally concerned and non-concerned consumers who purchase coffee directly from coffee roasters (as opposed to third-party retailers like grocery stories) are positively associated with a higher BF premium.

Our research makes three main contributions to the literature. First, we bolster the sustainable labels literature by investigating how complementarity between attributes affects product demand (Meas et al., 2015; Tebbe & von Blanckenburg, 2018). Second, we provide evidence about whether consumers value environmentally-friendly attributes in the context of the saturation of eco-labels on the coffee market. Our results allow us to determine whether consumers' demand for BF coffee certification comes from its organic attributes, environmental attributes, or both. Third, the substitutability of these attributes raises the possibility of the program introducing new policies that continue to ban synthetic agrochemicals while removing the program's certified organic pre-requisite without degrading market demand. These results contribute to the BF certification program's economic sustainability by providing alternatives for making the certification more affordable for farmers and increasing the potential for expanding the area under certification while retaining equally high-quality habitat.

2. Methodology

2.1. Experimental design

We designed a choice experiment for US coffee consumers using a 12-oz. bag of coffee with a combination of coffee attributes and prices. We created two coffee options combining three attributes: price, and agroforestry and input management attributes (Table 1). The price levels are 8, 10, 12, 14, and 16 dollars per 12 oz. bag of coffee, which are values representative of coffee market prices. We specify three levels of agroforestry management attributes for coffee production: sun-grown, shade-grown, and BF. The chemical input management options considered are conventional, organic and pesticide-free.

Table 1. Attributes from the choice experiment

Attribute	Label	Levels
A1	Coffee Price $/12 oz. bag	8
		10
		12
		14
		16
A2	Agroforestry management attribute	Sun-grown
		BF
		Shade-grown
A3	Input management attribute	Conventional
		Organic
		Pesticide-free

Before administering the choice experiment, we gauged respondent's knowledge of sustainable coffee markets. First, we asked whether respondents were aware of organic and BF attributes. In addition, we showed respondents the major eco-labels in the market— USDA Organic, Rainforest Alliance, BF, Fair Trade, and 4C—and asked questions about what consumers think these labels represent. Later, we provided a brief glossary of coffee attributes included in the choice experiment so that all respondents had the same information to make decisions about their coffee purchases (Table 2).

To design the choice experiment, we used a factorial design that assumes no prior knowledge about the relationship between the probability of a specific coffee choice. We use a D-efficient design that minimizes the size of the variance-covariance matrix (Carlsson & Martinsson, 2003; Cook & Nachtrheim, 1980; Zwerina, Huber, & Kuhfeld, 1996). This type of design has two characteristics: orthogonality and level balance. The orthogonality condition guarantees that choices are independent of each other. The level balance condition ensures that levels of the attributes occur with equal frequency in the design. The modified Fedorov algorithm for experimental design is available in Stata under the *dcreate* command. The modified Fedorov algorithm first creates an initial combination of attributes and choices based on a randomly drawn factorial design. The algorithm will exchange alternatives until D-efficiency is minimized. With the D-efficiency design, we selected 20 combinations in two blocks of questions. The respondent is assigned to one block of 10 randomly selected questions. We added an opt-out option to avoid forcing the respondent to choose, thus achieving more similarity to real-world choices.

Table 2. Coffee attributes definition

Group	Attribute	Provided Definition
Agroforestry management	Shade-grown	The coffee is planted under a canopy of trees rather than land that has been cleared of all other vegetation by agriculture
	BF	The coffee farm protects and provides habitat for birds and other wildlife
	Sun-grown coffee	The coffee is planted in land that has been cleared by agriculture
Input management	Organic coffee	The coffee was farmed and processed without any chemicals (including synthetic fertilizers, pesticides, herbicides)
	Pesticide-free	The coffee is grown without pesticides, but may permit other chemicals such as fertilizers
	Conventional	The use of chemicals is allowed

2.2. Econometric analysis of the choice experiment

Following the random utility theory (McFadden, 1974), consumer n obtains utility from choosing between *J* alternatives in *T* choice tasks. The utility function is as follows:

$$U_{njt} = x_{njt}\beta + \epsilon_{njt} \; with \; n = 1, \dots N, j = 1, \dots, J, t = 1, \dots, T \quad (1)$$

where x_{njt} is a vector of attributes describing alternative j in choice task t of individual n, β_n is a vector of parameters, and ϵ_{njt} is a random term. The probability of choosing alternative j (P_{njt}) can thus be modeled as follows:

$$P_{njt} = Prob\left(U_{njt} > U_{nlt}\right) \forall\, l \neq j \quad (2)$$

where P_{njt} depends on whether the utility of alternative j is higher than the utility of alternative l. The probability of choosing alternative *j* against alternative *l* depends on the utility that each option reports to the consumer.

We approximate the random utility model expressed Eq.1 using a Mixed Logit (ML) model. In this model, the β_n are considered to be random and allow for correlations between the choices of attributes. To investigate complementarity between attributes, we can extend Eq. 1 to assess the effects of the interactions in the utility function.

$$U_{njt} = \beta_p x_{p(njt)} + \beta_q x_{q(njt)} + \beta_{pq} x_{p(njt)} \times x_{q(njt)} + \epsilon_{njt} \quad (3)$$

where β_p and β_q are the main effects and β_{pq} are the interaction effects on consumers' utility. Given that attributes are dummy variables, the coefficients can be interpreted as the marginal effect of x_p when x_q is not present. The coefficient from the interaction between attributes β_{pq} can determine whether attributes are substitutes or complements to consumers.

We estimate the WTP of each attribute by applying a transformation to the utility function's estimated parameters. Marginal WTP values are calculated as a negative ratio as follows:

$$WTP_k = -\frac{\beta_k}{\beta_{price}} \quad (4)$$

where the nominator is the estimated mean value of the coefficient associated with a sustainability attribute β_k and the denominator is the price coefficient β_{price} from the choices.

When having coffee with more than one attribute, we need to consider the interaction effect between the two. Then, the marginal WTP estimation will be:

$$WTP_{k,l} = -\frac{\beta_k + \beta_l + \beta_{kl}}{\beta_{price}} \quad (5)$$

where k and l are two attributes that are present in the coffee. To estimate the marginal WTP, we follow Hole (2007; 2016) and we use the delta method.

We consider whether consumers see attributes as complement or substitutes for one another. Well-informed consumers may consider that chemical input regimes and agroforestry management attributes are complements. Likewise, another plausible hypothesis is that consumers face an information burden while understanding the differences between labels and choosing the products that best represent their preferences. Again, the sign of the interaction terms between input and agroforestry management attributes by group of consumers allows us to test these hypotheses.

To investigate heterogeneity in consumer preferences, we split the sample to explore differences in environmental concerns. First, we hypothesize that environmentally-concerned consumers may

consider consuming sustainable coffee (instead of less concerned consumers) because they may have stronger preferences over environmentally sustainable production.

3. Results

3.1. Characteristics of the sample

A total of 779 participants completed the survey (Table 3). The age of participants is well-distributed, with adults in the 55-64-year cohort comprising the largest segment (25.9%). Male and female respondents are equally distributed, and the most frequent household size is 2 members (32.3%), and 63.6% of the sample has a yearly income less than $75,000. Regarding formal education, 18% of the sample hold master's or doctorate degrees, while the most frequent segments are respondents with a secondary or bachelor's degree.

Table 3. Socio-demographic characteristics of the sample

	Percentage
Age group	
18 to 24 years	12.3
25 to 34 years	18.4
35 to 44 years	20.8
45 to 54 years	19.8
55 to 64 years	25.9
65 to 74 years	2.8
Gender	
Female	50.4
Male	49.6
Education	
Secondary	49.7
Bachelor	32.3
Master	14.9
Doctorate	3.1
Household size	
1	17.8
2	32.3
3	19.0
4	19.1
5	7.6
6 or more	4.1
Income	
Less than $25,000	21.1
$25,000 - $50,000	23.0
$50,000 - $75,000	19.5
$75,000 - $100,000	17.2
100,000 and more	19.3
Observations	779

We asked consumers to rank the attributes that are the most important to them. We provided six options: coffee brand, eco-labels, origin, price, size of the bag, and taste. Table 4 shows how the respondents rank attributes when purchasing coffee. Taste (48.1%) and brand (23%) are the top-ranked qualities by consumers. In second order, 17.6% and 7.7% of consumers ranked price and size of bags, respectively. The origin of the coffee is ranked first only by 2.3%, while labels were ranked first by only 1.3% of the respondents. The ranking clearly shows that eco-labels are not a top priority for the average coffee consumer.

Table 4. Ranking of coffee qualities

Attributes	1	2	3	4	5	6
Taste	48.1%	22.1%	12.6%	12.8%	2.8%	1.5%
Brand	23.0%	22.7%	22.6%	21.1%	6.7%	4.0%
Price	17.6%	26.2%	27.9%	17.2%	6.3%	4.9%
Size of bag	7.7%	20.5%	25.3%	31.1%	9.9%	5.5%
Origin	2.3%	5.5%	6.5%	8.6%	51.6%	25.4%
Labels	1.3%	3.0%	5.1%	9.2%	22.7%	58.7%

In Table 5, we show information about survey respondent's coffee consumption. Coffee prices informed by consumers are within the range of prices that we include in the choice experiment. On average, respondents consume almost 10.3 cups of coffee per week, paying $13.80 per 12 oz. bag of coffee, or $2.3 for a cup of brewed coffee; 41% of consumers buy organic coffee. In addition, we asked consumers about their preferred locations to purchase coffee. Each respondent could choose multiple locations if they buy coffee through various channels. Most consumers purchase coffee at the grocery store (64%), 31% buy coffee at a coffee shop or directly from a roaster, and 16% have also made online purchases. Only 3% of the sample buy coffee at gas stations or convenience stores. Hence, in-person purchases are preferred over online purchases.

Table 5. Coffee Shopping decisions

	Obs	Mean	Sd	Min	Max
Coffee consumption (cups per week)	779	10.35	5.95	1	20
Typical price paid for one bag (12 oz.) of coffee	704	13.81	4.44	9	20
Typical price paid for a regular-size cup of coffee	779	2.33	0.99	1	4
Buy organic (=1 if yes)	779	0.32	0.31	0	1
Purchasing locations					
In person at grocery store	779	0.64	0.48	0	1
In person at a coffee shop or roaster	779	0.31	0.46	0	1
Online	779	0.16	0.37	0	1
Gas station/convenience store	779	0.03	0.17	0	1
Other	779	0.16	0.37	0	1
Knowledge about main eco-labels					
USDA Organic	779	0.85	0.35	0	1
Rainforest Alliance	779	0.37	0.48	0	1
BF	779	0.21	0.41	0	1
Fair Trade	779	0.14	0.34	0	1
4C	779	0.10	0.30	0	1

When we asked about the main eco-labels in the coffee market, 85% of the respondents recognized the USDA Organic logo. The high level of recognition for this label could be related to label redundancy, well-documented in the literature (Janßen & Langen, 2017; Ufer et al., 2021). Redundancy in this context means that a label can represent more than one attribute when its bound is narrower. For instance, in Wilson and Lusk (2020), there is evidence that more than 30% of organic consumers still would like to pay for organic labels even after being confronted with information about the redundancy of the label. The fact that USDA is known by 85% of the respondents might obscure the fact that there is low a priori information about what the label claims.

The second and third most recognized eco-labels are Rainforest Alliance with 37%, and BF with 21% of the respondents. Lastly, Fair-Trade and 4C are the eco-labels with less recognition compared to other presented options. Interestingly, only 14% of respondents recognize the Fair Trade logo compared to BF recognized by 21% of respondents, which in general, is less well-known. Given that we find that eco-labels are the least relevant aspect for consumers (see Table 4), it might be that consumers do not associate the name of the certification with their logos.

Coffee decisions regarding eco-labels may be related to consumer preferences regarding their value from environmental sustainability. For instance, we can hypothesize that those who care about the environment are more willing to pay for a coffee with environmental claims than consumers who do not. To capture this potential source of heterogeneity, we ask consumers to evaluate whether they agree or disagree with a set of statements that are often used to assess environmental attitudes (Dunlap et al., 2000). Results indicate some level of agreement on statements related to the magnitude of environmental problems (Table 6). For example, "The

balance of nature is very delicate and easily upset" has a relatively high level of strong agreement from consumers (32.3%). On the other hand, the lowest level of agreement can be found in statements about the overstated severity of the environmental problem and whether it is possible to solve it. For instance, "The environmental crisis is greatly exaggerated" and "There is nothing we can do about climate change it is already too late" have the least level of agreement.

Table 6. Agreement with environmental statements

Statements	Strongly disagree	Somewhat disagree	Neither agree/ disagree	Somewhat agree	Strongly agree
The balance of nature is very delicate and easily upset	3.7%	6.4%	22.0%	35.6%	32.3%
When humans interfere with nature, it often produces disastrous consequences	4.2%	5.8%	19.6%	38.1%	32.2%
If things continue their present course, we will soon experience a major environmental crisis	6.8%	9.1%	24.5%	31.1%	28.5%
We should protect the environment, even if it hurts the economy	6.3%	12.6%	26.6%	27.6%	27.0%
The earth has plenty of natural resources, if we just learn how to extract or develop	5.6%	18.0%	20.4%	29.5%	26.4%
We are approaching the limit of the number of people the earth can support	13.1%	12.7%	27.7%	27.1%	19.4%
The environmental crisis is greatly exaggerated	30.7%	20.5%	21.6%	15.7%	11.6%
There is nothing we can do about climate change is already too late	27.5%	23.0%	27.7%	14.0%	7.8%
Observations	779				

In Table 7, we show environmentally-friendly activities respondents report they regularly conduct to contrast opinions with action. The most highly selected options are planting native plants in the backyard (27.7%) and saving water and energy at home (25.9%). Interestingly, only 12.2% mentioned recycling as an active environmentally-friendly activity in the household. Regarding transportation, using public means, walking, cycling, and driving slower than the speed limit adds up to 25.3%. Lastly, 8.9% do not engage in any of these environmentally-friendly activities. Within this group, the main reasons for engaging in these activities are lack of money (31.9%), no regulation requirement (21.7%), lack of time (17.4%), and lack of knowledge (13%).

Table 7. Engaging in environmentally-friendly activities

	Percentage
Environmentally-friendly activity	
Planting native plants in my backyard	27.7
Saving water/energy at home	25.9
Using public transportation/walking/cycling	14.9
Recycling	12.2
Driving slower than speed limit	10.4
I/We don't do any of these activities	8.9
Observations	779
Reasons for not doing any of these activities	
Lack of money	31.9
No regulation requiring me	21.7
Lack of time	17.4
I don't know anything about these	13.0
Not my responsibility	8.7
Too difficult	7.2
Observations	69

While there are some activities that families already participate in, we wanted to know what activities they would adopt to help achieve a healthier environment (Table 8). Among the options, respondents strongly agreed that volunteer work on environmental causes (32.3%) is the most adequate. Purchasing products with eco-labels (32.2%) and recycling more (28.5%) also generated high levels of agreement. Interestingly, only 11.6% of respondents strongly agreed that buying local products is an environmentally-friendly activity that can be adopted.

Table 8. Activities that respondents may adopt to having a healthier environment

Activities	Strongly disagree	Somewhat disagree	Neither agree/ disagree	Somewhat agree	Strongly agree
Volunteer 1-2 hours each month for environmental causes	3.7%	6.4%	22.0%	35.6%	32.3%
Buy products with sustainability labels	4.2%	5.8%	19.6%	38.1%	32.2%
Recycle more	6.8%	9.1%	24.5%	31.1%	28.5%
Give up using plastic bags	6.3%	12.6%	26.6%	27.6%	27.0%
Travel less by motor vehicle	5.6%	18.0%	20.4%	29.5%	26.4%
Higher individual taxes	13.1%	12.7%	27.7%	27.1%	19.4%
Buy local products	30.7%	20.5%	21.6%	15.7%	11.6%

3.2. Random Utility Model estimates

In this section, we present the utility function estimates using the choice experiment data. To estimate the ML model, we assume that there is a correlation between coffee alternatives (Hensher & Greene, 2003). Consumers with preference over chemical input management practices will also likely value agroforestry management attributes for their coffee given these characteristics contribute to environmental sustainability. In Table 10, columns 1 and 2 show the Mixed Logit (ML) model, including each attribute's direct effect only and the model with the interaction effects, respectively. We perform a chi-squared test to the individual attributes' coefficients in the two estimates, and we find they are statistically different. To select the model for the analysis, we use Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) to choose the best model for interpretation and WTP calculation. The model with the lowest AIC and BIC is the ML with the interaction effects.

Following column 2 of Table 9, as expected, there is a negative relationship between price and utility, which means that a higher price is related to a lower utility. The negative no-purchase coefficient shows that consumers prefer to choose any coffee rather than not consuming coffee. In our results, the selected base category to compare the coffee attributes is a sun-grown coffee that uses conventional production methods, which is representative of standard coffee brands available on the market.

The comparison between attributes shows that there is a demand for sustainable coffee attributes. The direct-effect coefficients for each attribute show that all sustainability attributes increase utility for consumers. The interaction effects show that our sustainability attributes are substitutes for one another. All coefficients show a negative sign, suggesting a disutility from a product that contains both attributes together. The effects are statistically significant for a coffee with shade-grown and pesticide-free, BF and organic, and BF and pesticide-free attribute combinations. The combination of shade-grown and organic attributes' coefficient is not statistically significant.

Our results are similar to findings related to trade-offs between organic and local products (Meas et al., 2015; Onozaka & McFadden, 2011) and health concerns and nutrition attributes (Barreiro-Hurle et al., 2010; Bond et al., 2008; Hu et al., 2004). Finding that input and agroforestry attributes are interchangeable substitutes consistent with the literature, suggesting that consumers may obtain utility from sustainability as a concept (Janßen & Langen, 2017). According to Tebbe and von Blanckenburg (2018), one plausible explanation is that the benefits of the information related to coffee attributes are lower than the costs of accessing the information to understand them. Consumers suffer from information overload, are unlikely to closely research eco-labels and attributes, and perceive these attributes as very similar to one another.

Table 9. Utility function estimates

	Mixed Logit (ML)	
	No interactions	Interactions
	(1)	(2)
Price	-0.205***	-0.216***
	(0.00728)	(0.00975)
No purchase	-3.344***	-3.473***
	(0.115)	(0.183)
Shade-grown	0.190***	0.771***
	(0.0657)	(0.170)
BF	0.168***	1.062***
	(0.0622)	(0.219)
Organic	0.559***	1.226***
	(0.0763)	(0.175)
Pesticide-free	0.590***	1.374***
	(0.0758)	(0.254)
Shade-grown & organic		-0.320
		(0.236)
Shade-grown & pesticide-free		-0.736***
		(0.274)
BF & organic		-0.964***
		(0.233)
BF & pesticide-free		-0.970***
		(0.310)
Log-likelihood	-6,553.17	-6,309.7
AIC	13,138.34	12,711.39
BIC	13,267.29	13,082.12
Observations	23,370	23,370

Note: Both models are estimated assuming a correlation between choices of attributes. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

We estimated the variance-covariance matrix for each attribute to indicate preference heterogeneity and correlation between alternatives (Hole, 2007). We found heterogeneity in the variance of all the individual qualities and the combinations of all attributes except for BF and pesticide-free coffee. The latter means that preferences between individuals are homogeneous. When looking at the covariances in Table 10, BF and shade-grown attributes have significant correlations with most individuals and combinations of attributes. Specifically, BF alone is correlated with shade-grown, organic, and pesticide-free both individually and together, except with the combination of shade-grown and pesticide-free.

Table 10. Covariance matrix for the random coefficients

	Shade-grown	BF	Organic	Pesticide-free	Shade-grown & organic	Shade-grown & pesticide-free	BF & organic	BF & pesticide-free
Shade-grown	2.453***	1.975***	2.339***	2.710***	-2.647***	-2.583***	-1.867***	-2.142***
BF		-1.763***	-0.445**	-0.588**	-1.665***	0.450	1.734***	1.093**
Organic			1.437***	1.037***	-0.282	-0.264	-0.0565	-0.278
Pesticide-free				-1.308**	0.311	0.998	-0.116	0.729
Shade-grown & organic					1.021***	0.785***	0.260*	0.260
Shade-grown & pesticide-free						-0.379**	-0.515**	-0.557
BF & organic							0.663***	-0.354
BF & pesticide-free								0.369

Note: The matrix corresponds to the estimation of the ML model in column 2 of Table 9.

Following Revelt and Train (2000) and Train (2009), even though preferences can change over time, we can infer the proportions of the sample that have positive and negative preferences for the given coffee attributes. We used the estimated β for each consumer to obtain the percentage of consumers that like or dislike the attribute. If $\beta > 0$, consumers prefer or like the attribute. If $\beta < 0$, consumers have negative preferences or dislike the attribute. Table 11 shows the predicted percentage of consumers that like the given coffee attributes out of the 779 respondents. The BF attribute has the highest proportion of positive preferences (71.6%), followed very closely by organic (71%), pesticide-free (69.8%) and shade-grown (69.6%). When looking at the combination of attributes, we see that 74.2% of consumers prefer the shade-grown and pesticide-free combination, followed by shade-grown and organic (72.8%), and BF and pesticide-free (71.63%). Lastly, the combination BF and organic has the lowest positive preference among consumers (71%).

Table 11. Predicted portion of consumers with positive preferences (n = 779)

Attributes	Frequency
Shade-grown	69.58%
BF	71.63%
Organic	70.99%
Pesticide-free	69.83%
Shade-grown & organic	72.79%
Shade-grown & pesticide-free	74.20%
BF & organic	70.99%
BF & pesticide-free	71.63%

3.3. Consumers' marginal WTP

Table 12 presents the marginal WTP for sustainable coffee attributes using the model in Table 9, column 2. The reference price for making the comparisons is $12 per 12 oz. bag of conventional, sun-grown coffee. We find that respondents are willing to pay $5.76 more per bag of organic coffee over a conventional, sun-grown coffee. It is no surprise that organic coffee has a WTP higher than

BF, given US consumers have the greatest awareness of organic practices in the world (Van Loo et al., 2015). While our estimates of marginal WTP for environmentally-friendly coffee are high compared to other studies (Liu et al., 2019; Oh, Herrnstadt, & Howard, 2015), label redundancy can be playing a role (Janßen & Langen, 2017; Ufer et al., 2021; Wilson & Lusk, 2020). For instance, Wilson and Lusk (2020) found that prior beliefs often inflate organic premiums. When consumers receive new information about redundancies in labels, they modify their prior information and reduce the WTP.

To obtain the marginal WTP for coffees with two attributes we use Eq. 5. The shade-grown and organic attributes combination yields the highest marginal WTP ($7.80 per bag), followed by BF and pesticide-free ($6.82 per bag), and finally, shade-grown and pesticide-free ($6.15 per bag). We find that the Organic and BF combination yields the lowest WTP from all possible attribute combinations ($6.15 per bag). For the latter case, if coffee is marketed as pesticide-free only, the average marginal WTP is higher than the WTP for the BF and organic combination.[1] If the coffee is marketed as pesticide-free, the premium is $0.21 higher than the BF and organic combination. In the literature, consumers are willing to pay for pesticide-free attributes related to freshness and local production of fruit and vegetables (Bernard & Bernard, 2010; Coulibaly et al., 2011; Misra et al., 1991; Weaver et al.1992). Hence, a BF coffee that is pesticide-free is a certification strategy that is worth exploring.

Table 12. Marginal Willingness to pay (WTP) for sustainability attributes

Model 2: ML with interactions	WTP	5^{th} WTP percentile	95^{th} WTP percentile
Shade-grown	3.57	1.97	5.17
BF	4.92	2.78	7.05
Organic	5.67	3.99	7.35
Pesticide-free	6.36	3.94	8.78
Shade-grown & organic	7.80	5.71	10.04
Shade-grown & pesticide-free	6.54	4.86	8.33
BF & organic	6.15	4.53	7.88
BF & pesticide-free	6.82	4.74	8.98

Note: WTP is calculated using the model in Table 9, column 2. Confidence intervals are calculated using the delta method.

3.4. Heterogeneity in preferences

In this section, we investigate whether there is heterogeneity in preferences related to environmental concerns. We create two groups of consumers using a k-means cluster approach defined by consumers' agreement with the environmental statements presented in Table 6 (Hartigan & Wong, 1979). The groups are classified into two groups: "environmentally-concerned" and "less concerned about the environment" (see Appendix A). We hypothesize that consumers' preferences regarding coffee attributes and their interaction effects will be different

[1] We perform a t-test for the difference between the marginal WTP estimates by attribute and they are statistically significant at 1%.

between these groups. We expected that consumers who care about the environment would have a higher willingness to pay for coffee with sustainability attributes than less concerned consumers.

In Table 13, we present these estimates and find that the significance of coefficients from the ML estimation is similar, showing an increase of utility from consuming coffee with eco-labels. The interaction effects are not always statistically significant, meaning that the substitution effects amongst these attributes are not determinant for all consumers. Shade-grown and organic, shade-grown and pesticide-free, and BF and pesticide-free combinations are not statistically significant. The interaction between organic and BF is always statistically significant, showing that consumers prefer one or the other, not both.

Table 13. Utility function estimation by groups of consumers

	Attitude towards the environment	
	Non-concerned	Concerned
	(1)	(2)
Price	-0.225***	-0.218***
	(0.0156)	(0.0128)
No purchase	-3.628***	-3.477***
	(0.281)	(0.246)
Shade-grown	0.480*	0.870***
	(0.246)	(0.236)
BF	0.517*	1.321***
	(0.299)	(0.302)
Organic	0.455*	1.603***
	(0.259)	(0.236)
Pesticide-free	0.891***	1.721***
	(0.338)	(0.412)
Shade-grown & organic	-0.396	-0.241
	(0.339)	(0.325)
Shade- grown & pesticide-free	-0.740**	-0.797*
	(0.375)	(0.432)
BF & organic	-0.516	-1.176***
	(0.333)	(0.320)
BF & pesticide-free	-0.922**	-1.137**
	(0.394)	(0.471)
Log-likelihood	-2522.4	-3732.5
Observations	9,000	14,370

Note: All models are estimated assuming correlation between choices of attributes. Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1.

To evaluate whether consumers' environmental concerns have a role in the WTP estimates, in Table 14, we show the WTP for each group of consumers. As expected, consumers who care about the environment are willing to pay more for coffee with sustainability attributes. Consumers who care about the environment are willing to pay on average a $6.06 premium for a BF coffee, while skeptical people are willing to pay a lower amount for it ($2.30 per bag). Again, BF combined with organic yields the lowest WTP ($5.95 per bag) among coffee with two attributes.

Overall, WTP estimates are not precise and often negative for specific attributes. The 5th percentile WTP shows that it is possible for consumers who are not concerned about environmental problems

to pay a lower price for sustainable coffee than conventional and sun-grown coffee. We find a negative premium for all the combination of attributes except for shade-grown and organic regarding concerned consumers.

Table 14. Consumer marginal WTP by type of consumers.[2]

Attributes	Less concerned			More concerned		
	WTP	5th WTP percentile	95th WTP percentile	WTP	5th WTP percentile	95th WTP percentile
Shade-grown	2.14	-0.04	4.32	3.99	1.78	6.20
BF	2.30	-0.41	5.01	6.06	3.10	9.02
Organic	2.02	-0.27	4.32	7.36	5.06	9.65
Pesticide-free	3.96	0.89	7.04	7.90	4.05	11.74
Shade-grown & organic	2.40	-5.02	9.81	10.24	2.82	17.66
Shade-grown & pesticide-free	2.81	-5.80	11.42	8.23	-1.76	18.23
BF & organic	1.86	-5.59	9.32	5.95	-1.62	13.52
BF & pesticide-free	2.16	-7.20	11.52	8.74	-2.41	19.89

Note: WTP is calculated using the estimates from Table 13. Confidence intervals are calculated using the delta method.

3.5. Factors explaining WTP premiums for BF coffee

In this section, we investigate the WTP premiums determinants for BF coffee. We focus on coffee with only the BF attribute for the overall sample and organize responses by environmental preferences. In Table 15, we regress the WTP premium in percentage with respect to the average price in the experiment ($12 per bag) against consumers' demographics. In column 1 of Table 15, we present the regression analysis for the total sample of consumers. In columns 2 and 3, we split the sample into environmentally non-concerned and concerned consumers.

We find that age, middle, middle-high, and high income, and BF and USDA logo recognition are statistically significant to explain the reported WTP for BF. Age is negatively associated, so an extra year decreases the premium by 0.4 percentage points. Consumers with incomes in the $50,000-$75,000 income range per year and those in the range higher than $100,000 are willing to pay 17 percentage points more than low-income consumers, while consumers in the $75,000-$100,000 are willing to pay 22 percentage points more than low-income consumers. People who recognize the BF and the USDA organic logos are willing to pay 11 percentage points and 36 percentage points more than people who do not recognize them, respectively.

When splitting responses by environmental preferences, less-concerned consumers who purchase coffee in person at the roaster are willing to pay 23 percentage points more of premium for BF coffee than consumers that use other marketing channels. In addition, USDA Organic recognition is statistically significant for these non-concerned consumers. Among concerned consumers, age is negatively associated with the BF premium as for the full sample. Within this group, female consumers are willing to pay 12 percentage points more than male consumers for BF coffee. In

[2] We perform a t-test for the difference between the main marginal WTP estimates and by group of consumers and they are statistically significant at 1%.

addition, household size and middle-income categories are positively associated with paying more for a BF coffee.

Table 15. Determinants of BF coffee premiums

	Full sample (1)	Less concerned (2)	More concerned (3)
Demographics			
Age	-0.00490**	-0.00106	-0.00859***
	(0.00226)	(0.00306)	(0.00308)
Female (=1 if yes)	0.0609	0.0249	0.128*
	(0.0589)	(0.0882)	(0.0759)
Education			
Bachelor	0.0738	0.0845	0.0757
	(0.0696)	(0.101)	(0.0950)
Masters	0.0309	-0.164	0.174
	(0.0936)	(0.140)	(0.119)
Doctorate	-0.0612	-0.158	0.0389
	(0.152)	(0.214)	(0.207)
Household size	0.0327	-0.00919	0.0704***
	(0.0208)	(0.0287)	(0.0269)
Income			
$25,000 - $50,000	0.144	0.130	0.148
	(0.0876)	(0.116)	(0.122)
$50,000 - $75,000	0.169*	-0.0296	0.252**
	(0.0925)	(0.129)	(0.126)
$75,000 - $100,000	0.222**	0.156	0.231*
	(0.102)	(0.133)	(0.139)
$100,000 and more	0.177*	0.127	0.170
	(0.107)	(0.157)	(0.142)
Coffee shopping			
In person at the grocery	0.0495	0.0236	0.0376
	(0.0629)	(0.0863)	(0.0876)
In person at the roaster	0.0522	0.234***	-0.106
	(0.0648)	(0.0901)	(0.0879)
Online	-0.0132	0.0751	-0.0504
	(0.0746)	(0.114)	(0.0975)
Convenience store	0.101	0.0272	0.0775
	(0.174)	(0.233)	(0.205)
Recognize BF logo (=1 if yes)	0.106*	0.113	0.0999
	(0.0639)	(0.0953)	(0.0842)
Recognize USDA Organic logo	0.358***	0.215**	0.393***
(=1 if yes)	(0.0767)	(0.100)	(0.109)
Constant	-0.0537	-0.108	0.0768
	(0.161)	(0.224)	(0.220)
Observations	779	300	479
R-squared	0.057	0.060	0.093

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

4. Conclusions

Studying consumers' preferences for sustainability attributes is critical for the international coffee market. Coffee production certification programs, such as BF, are invested in increasing differentiation and new marketing strategies to survive in a saturated eco-label market. Endeavoring to change certification program practices requires a careful study of consumer preferences regarding these sustainability attributes to avoid losing market participation. We designed and implement a choice experiment to study whether sustainability attributes are complements or interchangeable substitutes for one another in coffee consumption. Determining how consumers choose various attributes and eco-labels is key to identifying potential gains from changes in coffee marketing strategies and introducing new certification standards adapted to market demand.

This study first investigates preferences for and complementarity of input and agroforestry management attributes. Results show consumers' WTP for BF coffee is $4.92 per 12 oz. bag of coffee higher with respect to a sun-grown coffee with a conventional production system. Second, we explored the complementarity between the BF and organic attributes by looking at their effect on consumers' WTP. We find that sustainability attributes are interchangeable substitutes for one another in coffee consumption. In particular, we found the BF and organic combination yields the lowest WTP among the possible combination of attributes.

The BF certification program should consider the marketing of the BF coffee to retain and increase demand for BF growing practices. We find that consumers consider their main sustainability attributes—organic production and high-quality agroforestry—to be interchangeable, meaning that marketing BF coffee as a bundle of these attributes may unwittingly create a discount in the premium paid for these coffees. In conclusion, to reduce costs to farmers, those seeking BF certification may need to maintain formal Organic certification to retain consumer demand. Instead, in order to reward farmers with the highest market prices, it is important to evaluate what combinations of attributes are the most valuable to consumers when marketing these products. Given that coffee labeled as pesticide-free yields the highest willingness to pay, there are potential gains from instead certifying that BF coffee farms continue to employ synthetic chemical bans while maintaining high-quality bird habitat.

We also look at how WTP for coffee attributes changes with consumers' environmental concerns. Our results show that there are additional benefits from targeting environmentally-concerned consumers. Unsurprisingly, consumers classified as less concerned have a lower WTP for sustainability attributes than environmentally-friendly consumers. Furthermore, at the 5^{th} percentile of WTP distribution, there is a negative premium for sustainability attributes in coffee. These results show that increasing market participation for sustainable coffee has its limits, given that not all consumers have the same preferences.

Our study has two main implications. First, it points out that the average consumer is willing to pay for coffee with sustainability attributes. Compared to Williams et al. (2021) that study bird watchers as a potential market for BF coffee, we focus on standard coffee consumers. However, it is worth noticing that eco-labels are one of the least important attributes for coffee

consumers. BF campaigns may focus on informing about the BF attribute because the program's other sustainability attributes are interchangeable substitutes in the eyes and pockets of consumers. Second, the BF certification can obtain higher WTP by exploring alternative standards and messaging to ban synthetic agrochemicals. For instance, the coffee with pesticide-free attributes and all other combinations of attributes yield a higher WTP than the current sustainability attributes of today's BF certification.

This study is not free from limitations. Our findings were also subject to potential hypothetical biases. While we provide as much information as possible to approximate real-world decisions, consumers still must make choices over hypothetical coffee options that may affect our results, which includes more real-life variables familiar to all shoppers: other products on the shelf, favorite brands, differences in product packaging and materials, and point of sale promotions. Future studies should approximate real-life choices using laboratory experiments that use a more visual product selection exercise or include a tasting experience, which is a relevant aspect for repeated purchases of BF products. A lousy tasting experience or packaging that does not appeal to coffee drinkers can reduce coffee premiums. The design and implementation of these experiments may provide insights into coffee taste and packaging qualities to increase market participation.

5. References

Barreiro-Hurle, J., Gracia, A., & de-Magistris, T. (2010). The effects of multiple health and nutrition labels on consumer food choices. *Journal of Agricultural Economics*, *61*(2), 426–443. https://doi.org/10.1111/j.1477-9552.2010.00247.x

Bernard, J. C., & Bernard, D. J. (2010). Comparing parts with the whole: Willingness to pay for pesticide-free, non-GM, and organic potatoes and sweet corn. *Journal of Agricultural and Resource Economics*, *35*(3), 457–475.

Bond, C. A., Thilmany, D. D., & Bond, J. K. (2008). What to choose? The value of label claims to fresh produce consumers. *Journal of Agricultural and Resource Economics*, *33*(3), 402–427. https://doi.org/10.2307/41220601

Carlsson, F., & Martinsson, P. (2003). Design techniques for stated preference methods in health economics. *Health Economics*, *12*(4), 281–294. https://doi.org/10.1002/hec.729

Cook, R. D., & Nachtrheim, C. J. (1980). A comparison of algorithms for constructing exact d-optimal designs. *Technometrics*, *22*(3), 315–324. https://doi.org/10.1080/00401706.1980.10486162

Coulibaly, O., Nouhoheflin, T., Aitchedji, C. C., Cherry, A. J., & Adegbola, P. (2011). Consumers' perceptions and willingness to pay for organically grown vegetables. *International Journal of Vegetable Science*, *17*(4), 349–362. https://doi.org/10.1080/19315260.2011.563276

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues*, *56*(3), 425–442. https://doi.org/10.1111/0022-4537.00176

Fischhoff, B., Quadrel, M. J., Kamlet, M., Loewenstein, G., Dawes, R., Fischbeck, P., … Stroh, P. (1993). Embedding effects: Stimulus representation and response mode. *Journal of Risk and Uncertainty*, *6*(3), 211–234. https://doi.org/10.1007/BF01072612

Gruere, G. (2013). *A Characterisation of Environmental Labelling and Information Schemes*. (62), 43. Retrieved from http://www.oecd-ilibrary.org/environment-and-sustainable-development/a-characterisation-of-environmental-labelling-and-information-schemes_5k3z11hpdgq2-en

Hartigan, J. A., & Wong, M. A. (1979). A k-means clustering algorithm. *Journal of the Royal Statistical Society. Series C (Applied Statistics)*, *28*(1), 100–108.

Hensher, D. A., & Greene, W. H. (2003). The mixed logit model: The state of practice. *Transportation*, *30*(2), 133–176. https://doi.org/10.1023/A:1022558715350

Hole, A. R. (2007). Fitting mixed logit models by using maximum simulated likelihood. *Stata Journal*, *7*(3), 388–401. https://doi.org/10.1177/1536867x0700700306

Hole, A. R. (2016). *Creating efficient designs for discrete choice experiments*. (September), 1–22.

Hu, W., Hünnemeyer, A., Veeman, M., Adamowicz, W., & Srivastava, L. (2004). Trading off

health, environmental and genetic modification attributes in food. *European Review of Agricultural Economics*, *31*(3), 389–408. https://doi.org/10.1093/erae/31.3.389

Janßen, D., & Langen, N. (2017). The bunch of sustainability labels – Do consumers differentiate? *Journal of Cleaner Production*, *143*, 1233–1245. https://doi.org/10.1016/j.jclepro.2016.11.171

Janssen, M., & Hamm, U. (2012). Product labeling in the market for organic food: Consumer preferences and willingness-to-pay for different organic certification logos. *Food Quality and Preference*, *25*(1), 9–22. https://doi.org/10.1016/j.foodqual.2011.12.004

Jha, S., Bacon, C. M., Philpott, S. M., MÉndez, V. E., Läderach, P., & Rice, R. A. (2014). Shade coffee: Update on a disappearing refuge for biodiversity. *BioScience*, *64*(5), 416–428. https://doi.org/10.1093/biosci/biu038

Liu, C. C., Chen, C. W., & Chen, H. S. (2019). Measuring consumer preferences and willingness to pay for coffee certification labels in Taiwan. *Sustainability (Switzerland)*, *11*(5), 1–13. https://doi.org/10.3390/su11051297

Loomis, J., Lockwood, M., & DeLacy, T. (1993). Some empirical evidence on embedding effects in contingent valuation of forest protection. *Journal of Environmental Economics and Management*, Vol. 25, pp. 45–55. https://doi.org/10.1006/jeem.1993.1025

McFadden, D. (1974). Conditional logit analysis of qualitative choice behavior. In P. Zarembka (Ed.), *Frontiers in Econometrics* (pp. 105–142). https://doi.org/10.1080/07373937.2014.997882

Meas, T., Hu, W., Batte, M. T., Woods, T. A., & Ernst, S. (2015). Substitutes or complements? Consumer preference for local and organic food attributes. *American Journal of Agricultural Economics*, *97*(4), 1044–1071. https://doi.org/10.1093/ajae/aau108

Misra, S. K., Huang, C. L., & Ott, S. L. (1991). Consumer willingness to pay for pesticide-free fresh produce. *Western Journal of Agricultural Economics*, *16*(2), 218–227. Retrieved from http://www.jstor.org/stable/10.2307/40982747

OECD. (2016). *Environmental Labelling and Information Schemes. Policy Perspectives*. p.6, 8. Retrieved from https://www.oecd.org/env/policy-persectives-environmental-labelling-and-information-schemes.pdf

Oh, C. O., Herrnstadt, Z., & Howard, P. H. (2015). Consumer Willingness to Pay for Bird Management Practices in Fruit Crops. *Agroecology and Sustainable Food Systems*, *39*(7), 782–797. https://doi.org/10.1080/21683565.2015.1017896

Onozaka, Y., & McFadden, D. T. (2011). Does local labeling complement or compete with other sustainable labels? A conjoint analysis of direct and joint values for fresh produce claim. *American Journal of Agricultural Economics*, *93*(3), 689–702. https://doi.org/10.1093/ajae/aar005

Perfecto, I., Armbrecht, I., Philpott, S. M., Soto-Pinto, L., & Dietsch, T. V. (2007). Shaded coffee and the stability of rainforest margins in northern Latin America. In *Stability of tropical rainforest margins* (pp. 225–261). Berlin: Springer.

Revelt, D., & Train, K. (2000). Customer-Specific Taste Parameters and Mixed Logit: Households' Choice of Electricity Supplier. *Working Paper, Universidad de California, Berkeley*, (June 2000), 1–32.

Smithsonian Institution. (2021). About Bird Friendly Coffee. Retrieved March 1, 2021, from https://nationalzoo.si.edu/migratory-birds/about-bird-friendly-coffee

Syrengelas, K. G., DeLong, K. L., Grebitus, C., & Nayga, R. M. (2018). Is the Natural Label Misleading? Examining Consumer Preferences for Natural Beef. *Applied Economic Perspectives and Policy*, *40*(3), 445–460. https://doi.org/10.1093/aepp/ppx042

Tebbe, E., & von Blanckenburg, K. (2018). Does willingness to pay increase with the number and strictness of sustainability labels? *Agricultural Economics (United Kingdom)*, *49*(1), 41–53. https://doi.org/10.1111/agec.12394

Train, K. E. (2009). *Discrete Choice Methods with Simulation* (Second Edi). https://doi.org/10.2514/5.9781600868535.0000.0000

Ufer, D., Ortega, D. L., & Wolf, C. A. (2021). Information and consumer demand for milk attributes: Are redundant labels an effective marketing strategy? *Applied Economic Perspectives and Policy*, 1–22. https://doi.org/10.1002/aepp.13155

Van Loo, E. J., Caputo, V., Nayga, R. M., Seo, H. S., Zhang, B., & Verbeke, W. (2015). Sustainability labels on coffee: Consumer preferences, willingness-to-pay and visual attention to attributes. *Ecological Economics*, *118*, 215–225. https://doi.org/10.1016/j.ecolecon.2015.07.011

Weaver, R. D., Evans, D. J., & Luloff, A. E. (1992). Pesticide use in tomato production: Consumer concerns and willingness-to-pay. *Agribusiness*, *8*(2), 131–142. https://doi.org/10.1002/1520-6297(199203)8:2<131::AID-AGR2720080205>3.0.CO;2-W

Williams, A., Dayer, A. A., Hernandez-Aguilera, J. N., Phillips, T. B., Faulkner-Grant, H., Gómez, M. I., & Rodewald, A. D. (2021). Tapping birdwatchers to promote bird-friendly coffee consumption and conserve birds. *People and Nature*, (April 2020), 312–324. https://doi.org/10.1002/pan3.10191

Wilson, L., & Lusk, J. L. (2020). Consumer willingness to pay for redundant food labels. *Food Policy*, *97*(June), 101938. https://doi.org/10.1016/j.foodpol.2020.101938

Zwerina, K., Huber, J., & Kuhfeld, W. (1996). A general method for constructing efficient choice designs. *Durham, NC: Fuqua School of Business, Duke Univesrsity*, (September), 39–59.

Appendix A. Composition of consumers clusters using the k-means approach

In Table A1 and A2, we show the distribution of agreement by a cluster of consumers. The first table shows that environmentally concerned consumers are defined mainly by agreement with statements that manifest the severity of the environmental crisis. The second table shows that the statements that describe less-concerned consumers are mostly related to a positive view regarding the potential to find a solution and skepticism associated with the actual magnitude of the environmental crisis.

Table A1. Agreement with environmental statements concerned consumers

Statements	Strongly disagree	Somewhat disagree	Neither agree/ disagree	Somewhat agree	Strongly agree
The balance of nature is very delicate and easily upset	0%	1%	7%	42%	50%
When humans interfere with nature, it often produces disastrous consequences	1%	1%	6%	43%	49%
If things continue their present course, we will soon experience a major environmental crisis	1%	3%	8%	43%	45%
We should protect the environment, even if it hurts the economy	1%	4%	14%	39%	42%
The earth has plenty of natural resources, if we just learn how to extract or develop	6%	22%	14%	29%	29%
We are approaching the limit of the number of people the earth can support	5%	8%	19%	39%	29%
The environmental crisis is greatly exaggerated	46%	26%	8%	10%	10%
There is nothing we can do about climate change it is already too late	36%	27%	14%	14%	10%
Observations	479				

Table A2. Agreement with environmental statements non-concerned consumers

Statements	Strongly disagree	Somewhat disagree	Neither agree/ disagree	Somewhat agree	Strongly agree
The earth has plenty of natural resources, if we just learn how to extract or develop	4%	12%	31%	31%	22%
The environmental crisis is greatly exaggerated	7%	12%	43%	24%	14%
When humans interfere with nature, it often produces disastrous consequences	10%	13%	41%	30%	6%
The balance of nature is very delicate and easily upset	9%	14%	46%	25%	5%
There is nothing we can do about climate change it is already too late	13%	17%	50%	14%	5%
We are approaching the limit of the number of people the earth can support	25%	21%	42%	8%	4%
We should protect the environment, even if it hurts the economy	15%	26%	46%	9%	3%
If things continue their present course, we will soon experience a major environmental crisis	16%	19%	51%	13%	2%
Observations	300				