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Interaction Between Food Attributes in Markets: The Case of Environmental Labeling

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Keywords: environmental labeling, food attributes, food marketing, quality perception

JEL Classification: L15, Q13, Q18

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Introduction

Some consumers derive utility from buying and using food products produced under specific processes, such as environmentally friendly practices. Means of verifying the use of these practices are frequently necessary in order for markets to function efficiently and without fraud because the consumer cannot evaluate whether particular practices were used. Analysis of eco-labeling has focused to a large extent on the operation of markets for environmental attributes without adequately addressing the total food product. Our analysis differs by treating eco-friendliness as a component of a product's overall quality rather than as a stand-alone attribute. We explore the extent to which the importance and credibility of environmental claims interact with a product's other quality attributes in determining the likelihood of success in marketing eco-friendly food products.

If consumers perceive a correlation between a process attribute, such as eco-friendliness, and other product attributes that they can evaluate, the quality levels of such supporting attributes can be a substitute for or complement to direct verification of environmental attributes. Thus verifiable attributes that can be inspected for before purchase or evaluated after use can support the credibility of the process claim, without strictly proving its truthfulness. Similarly, the credibility of an eco-friendly claim can be damaged by a failure to provide adequate levels of other verifiable attributes. Our results suggest that the market success of environmentally friendly food products requires a mix of environmental and other verifiable attributes that together signal credibility.

An Overview of Quality Perception and Assurance

Understanding of the operation of markets for food, and food attributes, has evolved greatly based on analysis of the information environment available to consumers. Consumers' perception of quality is influenced by the product's intrinsic attributes as well as by extrinsic indicators and cues provided by the seller of the product. Intrinsic attributes relate to a broad array of attributes including food safety, nutrition, convenience, composition, and process attributes such as eco-friendliness (Caswell, Noelke, and Mojduszka). The information environment for different intrinsic attributes may be search, experience, or credence in nature (Akerlof; Nelson; Darby and Karni): the consumer can learn about the quality level prior to purchase (search), after purchase and use (experience), or not at all (credence). Extrinsic indicators (e.g., certification, labeling) and cues (e.g., brand name, packaging, price) convey search information to the consumer since they are available prior to purchase (Steenkamp). The consumer's perception of quality is formed from a blend of information from these multiple sources.

An attribute can switch between the categories of search, experience, and credence based on transaction conditions, including the use of extrinsic indicators and cues, the technology of testing and labeling, and the benefits and costs of information acquisition for buyers (Caswell and Mojduszka). Figure 1 presents examples of such transformations. For example, mandatory labeling can change an a priori credence characteristic such as use of genetically modified organisms (GMOs) into a search characteristic. Opaque packaging changes a search attribute such as color into an experience attribute. The transformation of an attribute is sometimes the result of changes in the food distribution system. For example, long, global supply chains may

make origin and production practices less transparent to consumers in the absence of traceability and labeling.

The analysis of whether the market will deliver products with different quality levels, particularly higher quality, has also been anchored in the context of the information environment (see, e.g., Stigler; Akerlof; Lancaster). Problems of adverse selection and moral hazard can occur where important product attributes are experience or credence in nature. Adverse selection is *ex ante* opportunism due to hidden information. It could occur, for example, where some producers provide false labeling about environmental attributes and underlying production practices causing consumers to choose products that do not in fact have the attributes they want. Moral hazard is an *ex post* opportunism due to hidden action. In quality assurance, a moral hazard situation arises when the producer is tempted to not carry out all the practices necessary to achieve a certain quality level because the consumer cannot or finds it difficult to check whether the actions have been taken.

In cases of both adverse selection and moral hazard, the market will not fully reward high quality producers or adequately punish low quality producers. While moral hazard is a real issue in environmental certification, it may be mitigated to some extent by the need for producers to make significant initial investments in knowledge, skills, materials, and time to become certified. Indeed, acquiring and assimilating environmental abilities implies initial sunk costs and can be considered as a choice made once and for all (see Rogerson for a similar hypothesis). Once acquired these abilities can generate a kind of "self lock-in," partly due to a win-win-win strategy, i.e. wins for the firm, the consumer, and the environment. We focus here on the consumer end of the market where adverse selection, of the type first analyzed by Akerlof, remains a significant problem.

Several mechanisms, such as reputation, efficient quality signaling, advertising, and government standards can mitigate adverse selection generated by experience goods. (Nelson; Klein and Leffler; Bagwell and Riordan; Kirmani and Rao). Credence attributes, such as environmental friendliness, pose more problems in markets because the cost of defining, measuring, and verifying them can be high, along with the temptation to cheat. A potential remedy to the measurement problem is to use a proxy or a signal. Efficient measurement will be undertaken by that party to exchange that has easy access to information and lower costs of measurement, provided that incentives to cheat are curbed and trust is established (Eggertsson; Barzel). For example, because safety output may be too costly to measure (e.g., the absence of pesticide residues), it may be more cost effective to measure management practices (e.g., organic farming) instead of the final product characteristics. At the end of the food chain, consumers can search for the organic label, which is a signal for the proxy, and thereby avoid excessive transaction costs in finding and evaluating products. Of course, the proxy and signal may convey information about multiple attributes.

Insuring the credible operation of markets for credence attributes may require external intervention to allow consumers to choose products that correspond to their preferences and honest producers to credibly signal their products. Macho-Stadtler and Perez-Castrillo suggest sufficient conditions for a market for credence attributes to function effectively (i.e., for a separating equilibrium to exist), allowing eco-friendly producers to label their products at a non-prohibitive cost. These conditions are: 1) eco-friendly producers can acquire the eco-seal at a lower cost than conventional producers, 2) the expected profit with an eco-seal minus the cost of acquiring the signal is greater than the profit without the eco-seal for eco-friendly producers, and

3) the expected profit with an eco-seal minus the cost of acquiring the signal is less than the profit without the eco-seal for conventional producers.

If successful in designing and supporting the costs of signaling through a labeling program, eco-friendly producers transform a credence attribute into a search attribute where consumers can make successful selections based on reliable information. In other cases, governmental intervention or credible third party intervention may be needed to mitigate market failure and guarantee fair-trading (McCluskey).

Even though information about credence characteristics may be disclosed, consumers may have difficulty in processing it because of time constraints or a lack of specific skills. Eco-label design matters because of these information problems. For example, Wynne shows that environmental report cards (graphical presentation of environmental performance without value judgments) establish symmetrical but useless information for consumers who lack expertise and time to process them. Well-designed eco-labels can serve as cognitive supports that economize on the attention of consumers and on transaction costs (Valceschini; Wynne).

Overall, in many cases market mechanisms can be self-enforcing for both search and experience attributes, while credence attributes may require an increased level of external intervention in order for markets for quality to function effectively. Here we focus on the implications for the marketing of eco-friendly products of consumer perception of interactions between the search, experience, and credence attributes of food products.

A Basic Model of Interaction Between Product Attributes in Determining the Likelihood of Eco-Friendly Production

Consider the case of a consumer willing to promote environmentally friendly practices in farming and processing by buying credibly eco-labeled food products (for a similar model, see

van Ravenswaay and Blend). The consumer's utility from consuming an eco-labeled product is determined by both credence environmental characteristics and the product's related search and experience characteristics. To model the choice between two products assume that the typical consumer derives utility from: 1) consuming two goods, a conventionally produced product X that does not carry eco-labeling at a price P and a product with enhanced environmental features X' that is eco-labeled at a price P', and 2) consuming the quality of the environment Q.

Several factors play a role in the consumer's utility:

- The utility resulting from the consumption of the experience and search attributes of X or X', i.e. $\delta U/\delta X$ versus $\delta U/\delta X'$. Most generally, ($\delta U/\delta X' - \delta U/\delta X$) could be positive, zero, or negative.
- The environmental improvement resulting from X or X', i.e., $\delta Q/\delta X$ versus $\delta Q/\delta X'$.
- The utility resulting from the environmental improvement, i.e., $\delta U/\delta Q$.

Assume that utility increases with consuming the products X ($\delta U/\delta X>0$) or X' ($\delta U/\delta X'>0$), and enjoying the environment ($\delta U/\delta Q>0$). As noted above, the eco-labeled product could have related search and experience characteristics that are better or worse than the conventional product. X and X' are both harmful to the environment ($\delta Q/\delta X<0$ and $\delta Q/\delta X'<0$) but the eco-labeled product X' is less harmful than the conventional one X. The quality of the environment Q is decreasing with X and X' but more slowly with X' than with X so that $\delta Q/\delta X \leq \delta Q/\delta X' \leq 0$. The environmental improvement with X' is $\delta Q/\delta X' - \delta Q/\delta X$. Because of differences in related search and experience characteristics, the expected utility from consuming an eco-labeled product could be higher than ($\delta U/\delta X'>\delta U/\delta X$), the same as ($\delta U/\delta X'=\delta U/\delta X$), or less than ($\delta U/\delta X'<\delta U/\delta X$) the expected utility from consuming a conventional product.

Under these assumptions, the consumer problem is to:

(1) Max $U(X, X', Q(X, X'))$ under the constraint: $PX + P'X' = I$

where U is a quasi-concave utility function and I is consumer income spent on goods X and X'. The Lagrangian function is:

(2) $F(X, X', Q, \lambda) = U(X, X', Q(X, X')) + (I-P\cdot X-P'\cdot X')\lambda$

where λ is the Lagrange multiplier. The partial derivatives are:

(3) $F_X = \delta U/\delta X + \delta U/\delta Q\cdot\delta Q/\delta X - \lambda\cdot P = 0$

(4) $F_{X'} = \delta U/\delta X' + \delta U/\delta Q\cdot\delta Q/\delta X' - \lambda\cdot P' = 0$

(5) $F_\lambda = I-P\cdot X-P'\cdot X' = 0$

By rearranging the previous equations:

(6) $F_{X'} - F_X = \delta U/\delta X' - \delta U/\delta X + \delta U/\delta Q\cdot(\delta Q/\delta X' - \delta Q/\delta X) - \lambda\cdot(P'-P) = 0$

If $(\delta U/\delta X')-(\delta U/\delta X)>0$ and $\delta U/\delta Q\cdot(\delta Q/\delta X' - \delta Q/\delta X)>0$, $P'>P$ as consumers are willing to pay a price premium α for an eco-labeled good:

(7) $\alpha = P' - P = [(\delta U/\delta X' - \delta U/\delta X) + \delta U/\delta Q\cdot(\delta Q/\delta X' - \delta Q/\delta X)]/\lambda$

with

(8) $\lambda = [\delta U/\delta X + (\delta U/\delta Q\cdot\delta Q/\delta X)]/P = [\delta U/\delta X' + (\delta U/\delta Q\cdot\delta Q/\delta X')]/P'$

Assume that taking into account the environmental impacts of the production process increases production costs so that the marginal production cost of X', i.e., $C_m(X')$ is greater than the marginal production cost of X, i.e., $C_m(X)$, or in other words $C_m(X') > C_m(X)$. Therefore, producers adopt the eco-friendly process if the difference between the marginal costs of the two products is less than α, i.e., the marginal value of the utility resulting from the environmental improvement of the last unit $(\delta U/\delta Q\cdot(\delta Q/\delta X' - \delta Q/\delta X))$ plus the marginal utility resulting from the increase of related search and experience attributes of the last unit $(\delta U/\delta X' - \delta U/\delta X)$.

If $C_m(X') - C_m(X) > \alpha$, the price of the eco-labeled product would be too high and the consumer would only consume the conventional product X. If $C_m(X') - C_m(X) < \alpha$, then the price fixed by the eco-friendly producer would be low enough that the eco-friendly producer captures the whole demand and there is no demand for X. Lastly, if $C_m(X') - C_m(X) = \alpha$, the consumer will be indifferent between consuming the two goods. Consequently, producing an eco-labeled good and bearing the subsequent extra costs depends on the value of α, which is shaped by consumer preferences. The smaller α is the smaller the cost difference between the eco-labeled and conventional product must be for viability, which reduces the potential for producing an eco-labeled good. Similarly, the larger α is, the more likelihood there is that the eco-labeled product can be viably produced.

Several cases related to the interaction of different types of attributes are shown in Table 1. First, consider the situation where $(\delta U/\delta X' - \delta U/\delta X)$ is zero, i.e. the level of related search and experience attributes of the two products is equivalent (Row B). This is the only case analysed in most discussions of eco-labeling because attribute interactions are ignored. Here the exclusive focus is on the effect of eco-characteristics $(\delta U/\delta Q \cdot (\delta Q/\delta X' - \delta Q/\delta X))$. There are four cases:

- Cell B1. Producing the eco-labeled item generates a high environmental improvement, and consumers highly value it. The overall impact on α is significant and producers will be likely to produce the eco-labeled product.
- Cell B2. Producing the eco-labeled item has a low impact on environmental quality but consumers value this small impact highly. The overall impact on α is significant and producers may be likely to produce the eco-labeled product despite the fact that the overall environmental improvement as a result is modest.

- Cell B3. The environmental improvement resulting from producing the eco-labeled product is high but consumers place a low value on this change in environmental quality. The overall impact on α is weak. Producing an eco-labeled product can improve environmental quality significantly but the producer is not willing to do so under these market conditions.
- Cell B4. Producing the eco-labeled item generates a small environmental improvement and consumers do not value the improvement. The overall impact on α is insignificant and producers will be unlikely to produce he eco-labeled products.

Second is the case where (δU/δX' - δU/δX) is positive, i.e. the level of related search and experience attributes of the eco-friendly product is significantly higher than that of the conventional product. In all four cases (Cells A1, A2, A3, and A4), the higher level of related search and experience attributes for the eco-friendly product has a positive impact on the likelihood of production of eco-labeled products compared to the base case of no difference in these attributes for all combinations of environmental impact and consumer valuation of that impact.

Of particular interest is Cell A4. If both the effect of the environmental improvement (δQ/δX' - δQ/δX) and the valuation of the improvement (δU/δQ) is low or close to zero, the eco-friendly product may still be produced if the search and experience attributes are significantly better than for the conventional product. This case can be interpreted more as an investment of the producer in the signal (i.e., the label) rather than in the achievement of eco-characteristics.

Third is the case where (δU/δX' - δU/δX) is negative, i.e. the level of related search and experience attributes of the eco-friendly product is significantly lower than that of the conventional product. In all the corresponding cases (Cells C1, C2, C3, and C4), the lower level

of related search and experience attributes of the eco-friendly product has a negative impact on the likelihood that the eco-friendly product will be produced compared to the base case of no difference in search and experience attributes.

An indeterminate case is Cell C1 where there are two opposite effects. On one hand, the combined effect of a high environmental improvement ($\delta Q/\delta X' - \delta Q/\delta X$) and the high valuation of the improvement ($\delta U/\delta Q$) is likely to encourage the production of eco-friendly product. On the other hand, the lower level of related search and experience characteristics is likely to discourage such production. The stronger effect determines whether the producer produces the eco-friendly product.

The cases presented in Table 1 are scenarios for looking at the impact of different levels of related search and experience attributes on the likelihood of production of eco-friendly products when this production has different environmental effects and these effects are valued at varying levels by consumers. Where the search and experience attributes of eco-friendly products are superior to those of conventional products, eco-friendly production and marketing will be more likely.

When Search and Experience Attributes Are Used as Indicators of Credence Attributes

The interaction effect between search, experience, and credence attributes on the likelihood of eco-friendly production and marketing may be intensified where consumers use search and experience attributes as indicators of credence attributes. Products are bundles of attributes and in real markets information on some of these attributes may serve as indicators of the quality of others. Similarly extrinsic indicators (e.g., certification, labeling) and cues (e.g.,

brand name, packaging, price) can be used to provide signals about the level of intrinsic quality attributes.

To market their products more effectively and to avoid high measurement and signaling costs, producers may use the level of and information on search and experience attributes, which consumers can verify, to reinforce signaling about the quality level of credence attributes. For their part, consumers must use an array of information to give credence to claims about process quality. These include labels that represent testing efforts by parties in the supply chain as well as inspection and verification of the other quality attributes of the product. For example, consumers are generally unable to measure intrinsic process attributes such as the impact of production practices on the environment but may make inferences about these attributes from extrinsic quality indicators and cues such as eco-seals of approval or brand names.

In a multi-attribute/multi-signal atmosphere, attributes and certification systems interact and can reinforce or attenuate each other's effects. The precise dividing lines between types of certification may be fuzzy at the consumer level, particularly for credence attributes. For example, fair trade certification can reinforce the credibility of an environmental certification. Many fair trade labels, such as Max Havelaar, include environmental requirements and vice versa because final consumers in developed countries are sensitive to a range of issues regarding methods and conditions of production (Zadek, Lingayah, and Fortater). From another perspective, the co-existence of several certification systems tends to increase the consumers' transaction costs in acquiring and processing information making it more difficult to capture their attention. As a result there has been some evolution away from one-dimensional to multi-dimensional certification systems, such as integrated quality-environment-safety systems. Such

systems facilitate simplified signals to consumers that synthesize several attributes, allowing for lower transaction costs.

We focus on how the quality levels of search and experience attributes and information on them influence the consumer's evaluation of the credibility of an eco-seal, which signals the credence attribute of environmental friendliness. Figure 2 presents a simplified sequence for this interaction:

- Producers signal the credence attribute of environmental friendliness through use of an eco-seal of approval. The level of this credence attribute is a promise made by producers that is unverifiable by consumers.
- Consumers form expectations on the levels of related search (e.g., less packaging) and experience (e.g., better taste) attributes, which will be associated with the eco-seal. Consumers may also form expectations about extrinsic indicators (e.g., other types of certification) and cues (e.g., more expensive price, higher quality brand name).
- Consumers assess whether their expectations about the product's search and experience attributes are met by inspecting the product and/or buying and using it.
- Consumers are either satisfied with or disappointed in the degree to which the quality of the search and experience attributes corresponds to their expectations.
- If satisfied, consumers will give more credence to the truthfulness of the producers' signal regarding the credence attribute of environmental friendliness (positive feedback). If disappointed, consumers will give less credence to the truthfulness of the producers' signal regarding environmental quality (negative feedback).

The key links in the above sequence are the feedback loops that connect expectations and eventual product evaluation across quality attributes. These expectations may not be

scientifically proven and objective; they frequently correspond to subjective beliefs. They are well documented in several empirical studies. For example, Søndergaard surveyed consumers of ecological (i.e., organic) fish in Spain, Germany, and Denmark. She found that among the most important reasons for purchasing ecological food were that these products were believed to be of higher quality, tastier, and healthier than conventional food products. Similarly, CEC found that the interest of Canadian, Mexican, and American consumers in shade grown coffee was most influenced by the perception that this type of coffee is superior in taste and quality. In addition, the French Federal Consumers Union (Union Fédérale des Consommateurs) argues that consumers "often perceive environmentally friendly practices in farming and breeding like an indicator of the food safety and taste of the final product."

In many purchase situations, consumers face product attribute information that is too costly to evaluate directly and objectively, leading to use of heuristics to simplify decision-making. The interaction of information on the different types of attributes will influence the subsequent purchasing decisions of consumers. Note that the credibility of the claim about the credence attribute is reinforced or undermined without the consumer directly assessing its veracity. While these related search and experience attributes might be imperfect (or perhaps very imperfect) indicators of the credibility of the credence signal, consumers will use them to form their overall quality perceptions. They may use these related characteristics as a screening device to judge the reliability of the seller's credence claims.

This situation can be further developed from the basic model presented in the previous section. The consumer values eco-characteristics but cannot assess their presence and infers whether the expected and promised eco-characteristics are present based on observable related search and experience characteristics. In this case, Row C of Table 1 in not relevant because

producers have no incentive to produce eco-friendly products where the low level of search and experience attributes relative to conventional products undermines the credibility of the credence eco-friendly claim. The positive interaction effect will be strongest where the related search and credence attributes of the eco-friendly product are superior to those of the conventional product (Row A of Table 1).

Suppose that consumers have the same beliefs and give a certain credence to an eco-friendly claim if the difference in the search and experience attributes between the eco-friendly and conventional products is greater than an exogenous given level, U*, i.e., $(\delta U/\delta X' - \delta U/\delta X) \geq U^*$. The likelihood of buying an eco-friendly product, P_e, can be expressed as:

(9) $$P_e = p \cdot f(\delta U/\delta X' - \delta U/\delta X)$$

where $f(\delta U/\delta X' - \delta U/\delta X) = 1$ if $(\delta U/\delta X' - \delta U/\delta X) \geq U^*$ and $f(\delta U/\delta X' - \delta U/\delta X) = 0$ if $(\delta U/\delta X' - \delta U/\delta X) < U^*$. The probability p describes the level of trust the consumer has in the relationship between the level of the search and experience attributes and the credibility of the eco-friendly claim, where $p \in [0;1]$. This probability can also be interpreted in the case of informed parties, such as public authorities or environmental activists, as the degree of scientific certainty about the relationship between the achievement of a particular level of related attributes and the achievement of the eco-friendly promise.

Table 2 shows the polar cases. For example, if consumers wholly trust the relationship (p=1) and the eco-friendly product's search and experience attributes are high enough ($(\delta U/\delta X' - \delta U/\delta X) \geq U^*$), then they will trust the claim and buy the eco-friendly product because they infer the achievement of eco-characteristics from the observable related characteristics. In the other three cases shown in Table 2, the likelihood of purchasing an eco-friendly product is zero because there is no trust in the relationship between search and experience attributes and the

environmental claim, even though the levels of these attributes are high enough, or the levels of the search and experience attributes are not high enough to lend credence to the eco-friendly claim regardless of the level of trust consumers place in the link between verifiable and credence attributes.

In addition to the relationships between search, experience, and credence attributes shown in Table 2, consumers can make more complex connections between intrinsic attributes and extrinsic cues and indicators. Especially when consumers make repeated purchases over time, they can use inferences across attributes, cues, and indicators to evaluate attributes that they cannot verify. Doing so reduces the consumer's information and transaction costs by serving as a substitute for an expensive process of gathering and processing complex information or acquiring costly information from disinterested third parties. A common inference by consumers regards the extrinsic cue of price. For example, many consumers distrust environmental claims on low priced products because they perceive a dissonance between a low price and an environmental promise.

Implications for Marketing Eco-Labeled Products

Our analysis suggests that there is a credibility area for eco-friendly food products. This area depends on how the different attributes of a product are differentiated in a particular country or among particular market segments. The level of a product's environmental soundness or environmental stewardship may be vertically differentiated, that is at the same price and with identical other attributes all consumers would prefer the more environmentally sound product, although the degree to which this is the case may be weak among some consumers. Other attributes may be differentiated vertically or horizontally (i.e., at the same price and with

identical other attributes some consumers would prefer one quality level while others would prefer other levels).

Our conceptual definition of an eco-friendly product corresponds to a conventionally produced product with additional environmental attributes. As discussed above, the environmental attribute can interact with several other dimensions of product quality. These interactions can be objective or perceived. Eco-labels themselves correspond to different bundles of environmental criteria, selected according to the judgment of governments, certifiers, or producers, which can diverge from the individual preferences of market participants. As observers have noted, greenness is a confusingly multidimensional concept. Indeed environmental friendliness may frequently not be the dominant driver in consumers' product choices but instead be an additional and secondary consideration. In this case, environmentally friendly products may be horizontally differentiated.

Figure 3 shows a simplified two-dimensional attribute space for food products. The vertical axis indicates the level of environmental characteristics, while the horizontal axis indicates the level of search and experience attributes. In the characteristic space at time t, to be certified to a particular standard eco-friendly food products must have environmental characteristics with a minimum level A_e. At the same time, to be credible eco-friendly food products may have to have quality levels for search and experience attributes at least as high as A_c, the level of these attributes necessary to lend credence to the eco-friendly claim. The credibility area for eco-friendly food products is the shaded space where $(x, y) \in (A_c, A_e)$. From a conceptual point of view, all the products in this area could be successfully labeled and marketed as eco-friendly. At (t+1), the A_c and A_e thresholds could move to correspond to new consumer requirements.

The market success of eco-friendly food products is closely linked to the shape and location of this credibility area and to the products' position within it, taking into account not only environmental attributes but also related search and experience attributes. In a context where consumers have limited processing time and abilities, the credibility of environmental labeling is linked to the transaction environment. Consumer perceptions of these parameters can work together to mitigate or reinforce informational asymmetry and overload.

A high level of search and experience attributes detectable by consumers before or after the purchase can support the credibility of environmental claims by mitigating two distinct sources of market failure. First, these high levels will support the credibility of the credence claims regarding environmental attributes. Second, an expectation of high search and experience quality can attenuate the potential for free riding (i.e., fraud) linked to provision of most environmental attributes. Most environmental attributes are public goods and associating private with public benefits can mitigate free riding.

Consumers' inferences have important managerial implications for producers, marketers, and policymakers. To be successful, producers and marketers cannot rely only on third party certification to ensure the credibility of their claims but have to invest in the production of related search and experience attributes, even if consumer inferences based on them are subjective. The design of effective eco-labels has to include a clear understanding of how consumers make inferences about the credibility of an environmental claim.

An example is the Conservation Grade label developed in response to consumer demand for less intensively produced food that is marketed in several European countries, including the United Kingdom, the Netherlands, and France. It promises consumers minimal use of agricultural chemicals and pharmaceuticals, optimum animal welfare in food production, and

that the farmer cares for wildlife environments. Certification standards are less strict than for organic foods. The standards are defined by a union of producers and monitored by independent inspectors. In France, all Jordans (www.jordans.fr) breakfast cereals carry the Conservation Grade symbol. The label text (translated from the French) explains that the Conservation Grade is "both a label and a standard, defined in England where there are a lot of environmental protectors. It ensures that all products produced on farms respecting these specifications are farmed without chemical inputs leaving traces either in the soil or in the harvest. It means a double guarantee: an authentic taste and a better respect of the environment." The message conveyed by the label clearly links environmental protection and taste, encouraging the consumers to support the environmental credence claim by tasting the products.

Consumers' inferences about relationships between attribute levels may lead producers to over invest in search and experience attributes as signal and/or screening devices rather than in the production of high credence quality itself. In the extreme case, consumers may believe that the production of attractive search and experience related attributes implies the achievement of high quality in credence properties as well. This process can transform an a priori credence attribute into a search or experience characteristic (Figure 1). Such switching can be initiated by consumers' beliefs and activated by marketing. Taking heuristic procedures used by consumers into account may reduce transaction costs and prevent the waste of resources on expensive monitoring. On the other hand, producers may attempt to manipulate consumers' subjective inferences raising several questions about the accuracy and regulation of such hybrid claims.

Our central point is that the credibility of eco-labels among consumers is influenced by the accompanying search and experience attributes of the labeled product. Consumers form expectations about the levels of search and experience attributes based on the presence of an eco-

label. Their subsequent evaluation of these attributes then influences the credibility of the environmental claim and their interest in repeat purchase of the product based on its environmental soundness. Honest environmental differentiation can fail if it does not consider the multi-dimensional character of quality perception. An important further step is to identify which attributes are most likely to reinforce the credibility of environmental claims among different market segments. While private and public authorities define and enforce standards for eco-labeling, only products with the right array of accompanying quality attributes are likely to be fully credible and successful in the market.

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TABLE 1. Likelihood of Eco-Friendly Production for Different Levels of Search, Experience, and Environmental Attributes

		1	**2**	**3**	**4**
		($\delta Q/\delta X'$ - $\delta Q/\delta X$) high, ($\delta U/\delta Q$) high	($\delta Q/\delta X'$ - $\delta Q/\delta X$) low, ($\delta U/\delta Q$) high	($\delta Q/\delta X'$ - $\delta Q/\delta X$) high, ($\delta U/\delta Q$) low	($\delta Q/\delta X'$ - $\delta Q/\delta X$) low, ($\delta U/\delta Q$) low
A	($\delta U/\delta X'$ - $\delta U/\delta X$)>0	Likely to produce (+++)	Likely to produce (++)	Likely to produce (+)	Indeterminate (+/-)
B	($\delta U/\delta X'$ - $\delta U/\delta X$)=0	Likely to produce (++)	Likely to produce (+)	Unlikely to produce (-)	Unlikely to produce (--)
C	($\delta U/\delta X'$ - $\delta U/\delta X$)<0	Indeterminate (+/-)	Unlikely to produce (--)	Unlikely to produce (--)	Unlikely to produce (---)

TABLE 2. Likelihood of Buying an Eco-Friendly Product Based on Levels of Related Attributes and Consumer Trust in the Relationship to the Eco-Friendly Claim

	$(\delta U/\delta X' - \delta U/\delta X) \geq U^*$ so f=1	$(\delta U/\delta X' - \delta U/\delta X) < U^*$ so f=0
p = 0 (no trust in the relationship)	$P_e = 0$	$P_e = 0$
p = 1 (complete trust in the relationship)	$P_e = 1$	$P_e = 0$

FIGURE 1. Examples of Switching of Attributes Between Search, Experience, and Credence Categories

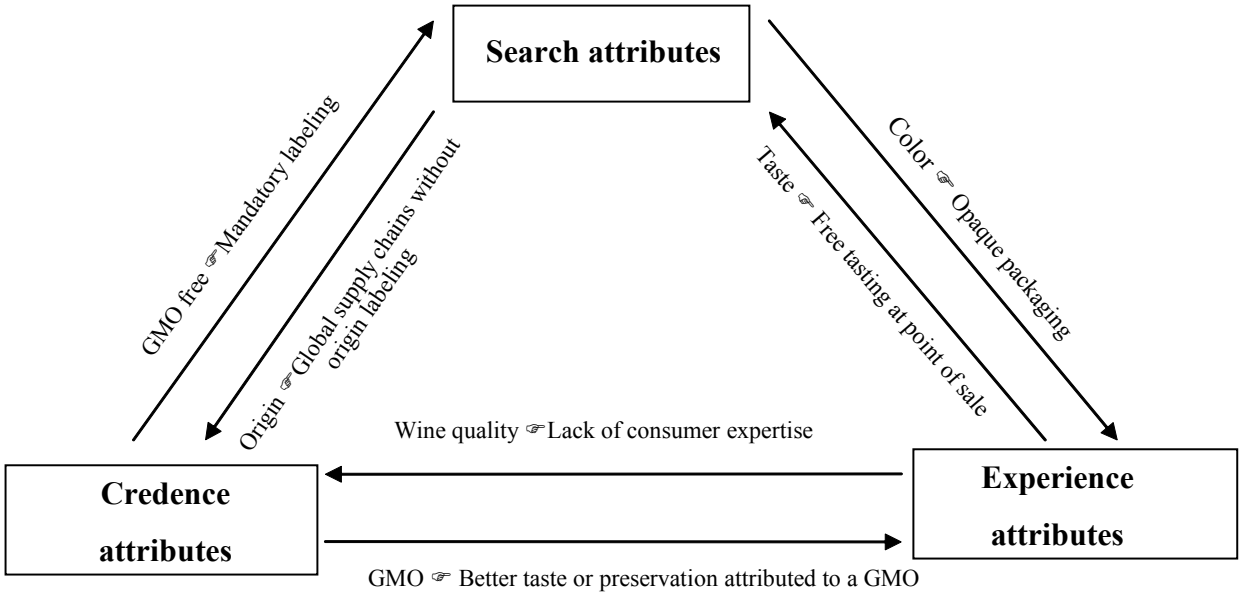

FIGURE 2. Impact of Search and Experience Attributes on the Credibility of Signaling for Credence Attributes

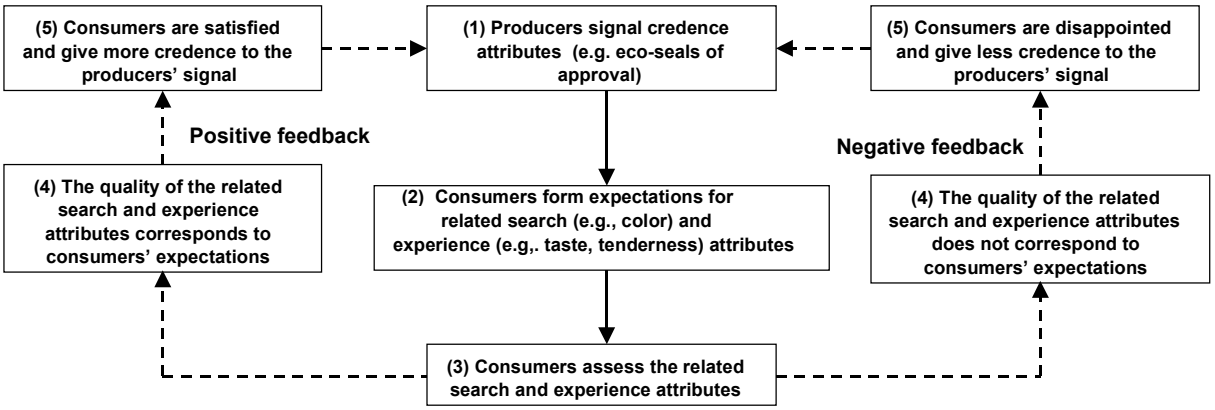

FIGURE 3. Credibility Area for Eco-Friendly Products in the Attribute Space