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Eco-Labeling Strategies and Price-Premium: The Wine Industry Puzzle

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Abstract

Although there is increasing use of eco-labeling, conditions under which eco-labels can command price premiums are not fully understood. In this article, we demonstrate that the certification of environmental practices by a third party should be analyzed as a strategy distinct from—although related to—the disclosure of the eco-certification through a label posted on the product. By assessing eco-labeling and eco-certification strategies separately, researchers can identify benefits associated with the certification process, such as improved reputation in the industry or increased product quality, independently from those associated with the actual label. In the context of the wine industry, we show that eco-certification leads to a price premium while the use of the eco-label does not.

Keywords

information disclosure policy, eco-label, certification, hedonic regression, information asymmetry

Introduction

Eco-labels are parts of a new wave of environmental policies that emphasize information provision to elicit more cost-effective private market and legal

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forces (Delmas, Montes, & Shimshack, 2009). Eco-labels signal to consumers the environmental attributes of a product. The goal of eco-labels is to provide easily interpretable information and thereby elicit increased demand for products perceived as environmentally favorable. Examples of eco-labels include the organic label for agricultural products, the Energy Star label for energy appliances, and the Forest Sustainable Stewardship label for lumber. The value of eco-products on the market and the number of new eco-label programs are growing rapidly. For example, retail sales of organic foods increased from US$3.8 billion in 1997 to US$16.7 billion in 2006 (Organic Trade Association, 2006). The number of eco-label programs has grown from a mere dozen worldwide in the 1990s to more than 415 programs today (see www.ecolabels.com).

One of the conditions for effective eco-labels is that customers be willing to pay a price premium that helps defray the higher cost of improved environmental management practices. However, circumstances under which eco-labels can command price premiums are not fully understood. Many previous studies use contingent values regarding the hypothetical purchase of eco-labeled products rather than actual purchases (Leire & Thidell, 2005; Loureiro & Lotade, 2005). Evidence of actual behavior along these lines is still limited (Bjorner, Hansen, & Russell, 2004, Teisl, Roe, & Hicks, 2002).

Although this literature emphasizes consumers' reaction to eco-labels, it does not identify whether eco-certification could yield benefits for the manufacturer independent of the signal provided by the label. This is mainly because it assumes that eco-certification equals eco-labeling, when in fact they represent two sequential but distinct strategies. An organization needs to have its products eco-certified to label them as such. However, a producer could eco-certify the practices but decide not to label the certification on its products. There is evidence that some organizations seek certification without informing their customer about it. Frog's Leap Winery in Rutherford, California is such an example. The winery has adopted organic certification but does not want to be known as such by customers. As the founder of Frog's Leap Winery put it, "We don't want to be known as the organic winery of the Napa Valley" (Inc.com, 2006). Why would wineries seek costly eco-certification without informing their customers about it? Can eco-labeling strategies trigger beneficial changes in the production process independently from the signal associated with the policy?

In this article, we analyze eco-labels as two sequential management strategies: the certification of environmentally friendly practices by a third party and the labeling of the eco-certification on the product. We demonstrate that these distinct components provide specific benefits to the producers. By assessing

the steps of eco-labeling, we are able to identify benefits that could be associated with the certification process independently from those associated with the actual display of the label. More specifically, we argue that eco-certification can provide benefits, such as improved reputation in the industry or increased product quality, which can lead to a price premium without the need to advertise or disclose the eco-label to end consumers. The label is an additional signaling device directed at end consumers that can have a distinct effect on price.

The provision of information is often presented as an effective alternative to traditional environmental regulation (Delmas et al., 2009; Jin & Leslie, 2003; Kennedy, Laplante, & Maxwell, 1994; Khanna, Quimio, & Bojilova, 1998; Konar & Cohen, 1996; Weil, Fung, Graham, & Fagotto, 2006). Our research contributes to this literature by showing that eco-certifying strategies can trigger beneficial changes in the production process beyond the label information.

We test the effect of eco-certification and labeling practices on prices in the wine industry. Wine is particularly well-suited to answer our research question for two reasons. First, wine eco-certification is relatively recent and still lacks positive public recognition. Many wineries that are eco-certified still do not disclose this information on their wine bottle. Therefore, wine represents an interesting case of eco-certification with variation in labeling strategies. This distinctive feature allows us to identify potential benefits that could be associated with the certification process independently from those associated with the actual label. Second, wine is a differentiated product, celebrated for its many attributes and allowing for heterogeneous consumer tastes. We can determine the effect of certification while controlling for a broad range of other product attributes in our data set, such as wine quality.

We use characteristics of 13,400 wines including wine price, quality rating, varietal(s), vintage, and number of bottles produced, for the period 1998 to 2005. In addition, we use data on two types of eco-certification, organic and biodynamic, and the decision to label as such. Using hedonic regression, we compare the price premium of certification with the additional effect of eco-labeling contingent on certification. We find that consumers are not willing to pay a premium for wine eco-labels but that certified though unlabeled wine enjoys a significant premium.

Our article has important policy implications for the design and effective use of eco-labels beyond the case of the wine industry. As policy makers and nongovernmental organizations (NGOs) increasingly rely on the use of eco-labels to promote environmental performance, we demonstrate that effective eco-labels are associated with changes in production processes that result in

superior products, even if this might not be necessarily communicated directly to consumers through the label. As more and more corporations consider the adoption of eco-labels to communicate their environmental strategies, we provide a better understanding of the circumstances under which such strategies can be attractive.

This article proceeds as follows: in the section on eco-labeling versus eco-certification, we discuss the difference between eco-certification and eco-labeling; in the sections on the value of eco-labeling in the wine industry and the benefits of eco-certification, we develop hypotheses on the impact of eco-certification and eco-labeling on the price of wine; the Method section presents the methodology and the data used in this analysis; The Results section describes the results; and the Discussion and Conclusion section concludes the article.

Eco-Labeling Versus Eco-Certification

The emerging empirical literature on the effectiveness of eco-labels has identified changes in consumer awareness after exposure to the label (Leire & Thidell, 2005; Loureiro & Lotade, 2005) and consumer inclination to change their purchasing behavior in favor of eco-labels (Blamey, Bennett, Louviere, Morrison, & Rolfe, 2000; Loureiro, 2003). However, the literature on eco-labels rarely addresses the potential pitfalls of labeling. In addition, this literature focuses mostly on consumer responses to eco-labels with few mentions to the potential benefits associated with the certification process independently from the label. Such benefits, however, have been highlighted by another strand of literature, rooted in management and policy, which describes potential efficiencies gained from eco-certification or the codified adoption of sustainable practices (Delmas, 2001; Prakash & Potoski, 2006). We describe below the potential pitfalls associated with the communication of environmental attributes through eco-labeling and the potential value associated with changes in the production process derived from eco-certification.

The Pitfalls of Eco-Labeling

Green products are credence goods; consumers cannot ascertain their environmental qualities during purchase or use. Customers are not present during the production process of the product and therefore cannot observe environmental friendliness of production. The objective of eco-labels is to reduce information asymmetry between the producer of green products and consumers by providing credible information related to the environmental attributes of the

product and to signal that the product is superior in this regard to a nonlabeled product (Crespi & Marette, 2005). The implicit goal of eco-labels is to prompt informed purchasing choices by environmentally responsible consumers (Leire & Thidell, 2005, p. 1062). Although the goal of eco-labels is to reduce information asymmetry between the producer and the consumer regarding the environmental attributes of a product, the lack of credibility or the lack of understanding of some eco-labels might lead to consumer confusion or even negative reactions toward eco-labels (Delmas, 2008; Hamilton & Zimmerman, 2006; Ibanez & Grolleau, 2008; Mason, 2006).

As Weil et al. (2006) have shown in the context of information policies, whether and how information is used depends on its incorporation into complex chains of comprehension, action, and response. For example, the presence of competing eco-labels might lead to consumer confusion (Leire & Thidell, 2005). In addition, because it is often difficult to identify with accuracy the true attributes of product environmental impacts, the credibility of the eco-labeling process is important to facilitate consumer choices of green products (Mason, 2006). In some cases, eco-labels are issued by independent organizations that have developed transparent environmental criteria and are third-party verified. In other cases, eco-labels just represent claims made by manufacturers related to some environmental friendliness (Cason & Gangadharan, 2002; Ibanez & Grolleau, 2008; Kirchhoff, 2000).[1] The presence of the second type of eco-label may produce some confusion in the mind of consumers over the credibility of eco-labels. These unsubstantiated claims can result in adverse selection if some producers provide false or misleading labeling about environmental attributes and underlying production practices, causing consumers to choose products that do not in fact have the attributes implied by the label (Grodsky, 1993; Hamilton & Zimmerman, 2006; Ibanez & Grolleau, 2008). For example, in April 2007, the U.S. Organic Consumers Association launched a boycott of two leading U.S.-based organic brands Aurora and Horizon for mislabeling products "USDA Organic" when milk was coming from factory farms (http://www.ethicalconsumer.org/Boycotts/currentUKboycotts.aspx). As a result, eco-labels with confusing or noncredible messages might affect negatively the reputation of companies that carry them. Such eco-labels can also indirectly damage the reputation of companies adopting other more credible but related labels. As we will describe with the case of wine eco-labels, a lack of understanding of the production process of eco-labeled wines could lead to confusion about the quality of the product and might deter some consumers from purchasing eco-labeled wines.

Not only do consumers need to recognize eco-labels, understand their production process, and trust the claim of the label but also do they need incentives

to purchase the products. Green products have been defined as "impure public good" because they yield both public and private benefits (Cornes & Sandler, 1996; Ferraro, Uchida, & Conrad, 2005; Kotchen, 2006). They consist of a private good, such as the pleasure of drinking wine, jointly produced with a public good, like biodiversity protection due to organic farming. Emerging research indicates that consumers are more likely to purchase green products if the certified practices provide them additional private benefits. For example, Magnusson, Arvola, Koivisto Hursti, Aberg, and Sjoden (2001) found that the most important purchase criteria for organic products were related to quality rather than the environmental attribute. These include criteria such as "taste better" and "longer shelf-life." Miles and Frewer (2001) reported that organic foods were viewed as healthier than conventional products. Several other studies showed that health concerns were a major reason, along with environmental concerns, why people choose organic food products (Davies, Titterington, & Cochrane, 1995; Tregear, Dent, & McGregor, 1994; Wandel, 1994; Wandel & Bugge, 1997). Conversely, because some of the early generations of eco-labeled products were associated with lower quality products, some consumers might still associate eco-labels with lower quality products and be reluctant to purchase them (Galarraga Gallastegui, 2002; Peattie & Crane, 2005). In conclusion, if consumers do not perceive that labels are associated with private benefits, such as an increase in product quality, they might not be willing to pay a price premium for the eco-labeled product.

As we will describe in the wine industry, consumers might not identify clear private benefits associated with wine eco-labels. This uncertainty regarding consumers' reaction to eco-labels might prompt some producers who have adopted certified environmental management practices to refrain from disclosing such practices on their products. Because of the costs associated with eco-certification, we study the producers' motives to pursue eco-certification strategies without communicating it to customers via a label on their products. We consider benefits associated with eco-certification that are independent from the signal that the label is providing to consumers.

The Value of Eco-Certification

Eco-certification is categorized as validation that management practices are meeting minimum codified standards and certification of adherence (Terlaak, 2007). To be eco-certified, an organization needs to adopt codified environmental management practices and obtain third-party verification. The international environmental management standard ISO 14001 is a good example of eco-certification without label because the standard certifies

environmental management practices but firms cannot use the ISO logo on their products (Barla, 2007; Delmas, 2001).

Research suggests that the adoption of such codified management practices can help firms reduce some inefficiencies while improving social welfare (Darnall, Henriques, & Sadorsky, 2008; Delmas, 2001; Prakash & Potoski, 2006). Management inefficiencies remain mostly because of the search and information costs associated with the development of these new practices (DeCanio, 1993). Certified management systems provide a compilation and codification of available best practices and reduce the costs associated with searching for these practices and their associated benefits (Terlaak, 2007). For example, Rondinelli and Vastag (2000) show how the ISO 14001 certification of a manufacturing facility affects both its operations and management processes and helps the harmonization of environmental management practices in a coherent and more efficient framework. They also demonstrate that adoption of ISO 14001 can be associated with improved product quality. Using the case of wine production, we will describe how eco-certification could lead to increase in wine quality.

In addition to helping efficiency gains and improvement in the quality of manufacturing, certified management standards can also function as an effective signaling mechanism through the third-party certification process (Jiang & Bansal, 2003; King, Lenox, & Terlaak, 2005). Although the adoption of certified management standards is usually not labeled as such on companies' products, firms can use other ways to communicate to stakeholders the adoption of such standards through the third-party certification system. Companies can, for example, indicate their certification on their letterhead, their Web site, or their company environmental report. Certified management standards can signal the adoption of practices to a broad set of stakeholders including regulators, trade associations, or NGOs without needing to post a label on their product. Potoski and Prakash (2005) conceptualized certified management standards as club goods that provide members nonrival but potentially excludable benefits. Adopting a certified management system allows the firm to participate in a club and to appropriate the club's positive reputation with stakeholders. An ISO 14001 certified company can for example signal to regulators its commitment to improved environmental performance. It has been shown that the adoption of ISO 14001 in some countries could lead to regulatory flexibility for companies adopting the standard (Darnall, 2003; Delmas, 2002; Potoski & Prakash, 2005). In conclusion, the literature suggests that even without product labeling, eco-certification can serve as a signaling mechanism of environmental and/or quality attributes to stakeholders who value these attributes.

In this article, we bring the eco-label and eco-certification literature together to get a better understanding of the effectiveness of eco-labeling strategies and their effect on product prices. We argue that the benefits of eco-certification and eco-labeling can be combined or that they can work independently. We analyze the effectiveness of both eco-certification and eco-labeling in the wine industry, where few of the requirements identified by the eco-label literature are present.

When it comes to wine, eco-certification is not well understood by consumers and seems to provide unclear value to them. Based on these characteristics, we predict an insignificant or even negative effect of eco-labeling on wine prices. We argue, however, that eco-certification could be associated with price premium if there are additional benefits associated with the eco-certification process that are understood by wine makers but not communicated to consumers. We argue that eco-certification could lead to a change in production process that leads to higher quality and therefore price premiums. In addition, it might allow wineries to participate in associations or "clubs" to enhance their reputation and reach within the industry. In this case, the production process related to certification could lead to quality benefits that consumers may not associate with eco-certification.

The Value of Eco-Labeling in the Wine Industry

As the eco-label literature indicates, eco-labels that are credible, easy to understand, and associated with private benefits are more likely to command a price premium than eco-labels that do not fulfill these conditions. We discuss how the complexity of the wine eco-labeling process might lead to consumer confusion regarding the quality of eco-labeled wine.

Consumer Awareness and Understanding of Wine Eco-Certification

In the wine industry, there are several competing eco-labels related to organic certification and to biodynamic certification that are still not well recognized and understood by consumers.

Organic certification follows the U.S. National Organic farming standard, which defines a farming method prohibiting the use of additives or alterations to the natural seed, plant, or animal including, but not limited to, pesticides, chemicals, or genetic modification.[2] In addition, labeling standards were created based on the percentage of organic ingredients in the product:

- *Organic* labeled products must consist of at least 95% organically produced ingredients and may display the USDA Organic seal.
- *Made with organic ingredients* labeled products are those that contain at least 70% organic ingredients.[3]

Biodynamic agriculture is a method made popular by Austrian scientist and philosopher Rudolf Steiner in the early 1920s. Often compared to organic agriculture, biodynamic farming is different in a few distinct ways. Biodynamic farming prohibits synthetic pesticides and fertilizers in the same manner as certified organic farming. However, whereas organic farming methods focus on eliminating pesticides, growth hormones, and other additives for the benefit of human health, biodynamic farming emphasizes creating a self-sufficient and healthy ecosystem. In 1928, the Demeter Association was founded in Europe to support and promote biodynamic agriculture. The United States Demeter Association certified its first biodynamic farm in 1982.[4] In addition to the vineyard agricultural requirements, Demeter provides a separate set of wine-making standards for biodynamic wine.

As there is a variety of wine eco-labels and of wine eco-certification bodies, consumers may be confused about the actual meaning of wine eco-certification. First, consumers may be confused over the definition of organic wine and may not understand the difference between "wine made from organically grown grapes" and "organic wine." Second, consumers may not be familiar with biodynamic certification, which has been introduced recently in California and has still only been adopted by a few wineries.

Wine made from organic grapes is wine made from grapes that have been grown without pesticides. Organic wine is also made with organic grapes but prohibits sulfite use in the wine-making process.[5] This distinction is important because sulfites affect the quality of the wine. Sulfites act as a preservative. Eliminating sulfites can reduce the quality of the wine because the wine is not as stable and cannot be kept very long. There is no such problem for wine made from organically grown grapes, which constitute the vast majority of eco-certified wines because sulfites are used in the wine-making process.

A survey conducted at the University of California (UC), Santa Barbara in 2006 provides insights into wine consumers' familiarity with organic and biodynamic wines. In this survey, 400 respondents from California expressed their attitude toward wine eco-labels. Although 66% of the respondents were familiar with "organic wine" and 39% had knowledge that they had tasted organic wine, only 19% were familiar with the difference between organic wine and organically grown grapes (Delmas, 2008). Because the distinction

between organic wine and wine made from organic grapes is not readily known, people might associate both with lower quality.

In addition, there may be little recognition of biodynamic certification. Results from the survey conducted at UC Santa Barbara showed that a small percentage of respondents (17%) were familiar with "wine from biodynamically grown grapes" and only 8% had tasted biodynamic wine. Among the respondents who were familiar with organic wine, the vast majority (76%) had not heard of biodynamic wine. Few actually understood what the term *biodynamic* meant, and most (77%) had an initial negative reaction to the term.[6]

The existence of several competing labels might therefore confuse consumers about the content of eco-certification and most importantly about its impact on wine quality.

Eco-Wines and Quality

Concerning the perception of the quality of organic and biodynamic wines, results from the survey conducted at UC Santa Barbara showed that it varied greatly according to the familiarity of the respondents with those wines. Among the respondents who had had knowledge that they tasted organic wine, 55% had a positive to very positive opinion of the quality of the wine. Among the respondents who had not tasted organic wine, only 31% had a positive opinion of the quality of organic wine.

Because of the lack of clarity on the value added by wine eco-labels, some wineries currently follow organic and biodynamic practices without being certified. Others become certified but do not provide the information on their bottle label (Rauber, 2006). One reason is that growers want to have the flexibility to change their inputs if it becomes necessary to save a crop during bad weather conditions or other pestilence (Wine Institute of California, 2006). The other reason is that most of these wineries think that there is a negative image associated with organic wine.

For example, Tony Coturri from Coturri winery has certified organic vineyards and uses no chemicals in his wine making but he does not use the word *organic* on the Coturri Winery labels. According to him,

> In all honesty, wine consumers have not embraced quality and organic in the same line yet. They still have the attitude that organic wine is a lower quality than what you can get in a conventional wine. It's a stigma. If you're strictly looking for organically grown, no-sulfite wine, then you're looking at what I consider a lesser-quality product. These wines have to stand on their own merits. (Gleason, n.d.)

Eco-Wines and Health

Although many consumers presume that organic foods taste better and provide greater health benefits than their conventionally grown counterparts (Huang, 1996; Huang & Lin, 2007; Jolly & Norris, 1991), this is not the case with wine made from organically grown or biodynamic grapes. Although the health benefits of wine consumption are touted in recent dietary and medical studies, the research has not made the link of added personal benefits due to environmental practices.[7] The link may be more indirect to consumers than is the case for other agricultural products because wine is processed for differentiation and pleasure after the certification requirements are met. This construction convolutes the quality and health values of eco-labels in the wine industry.

Eco-Wines and the Environment

Without clear benefits of eco-wine on health and quality, we might envisage that organic certification may appeal to the altruistic values of environmentally aware consumers who would like to promote sustainable agriculture. Altruistic customers may want to purchase eco-wine as a substitute for donations to an environmental organization (Kotchen, 2005). However, the environmental impact of wine making is not well known. The wine industry is typically not an industry targeted by environmental NGOs as a major environmental polluter. On the contrary, wine making may be associated in the minds of customers as an environmental practice since most bottles or advertisements illustrate wine making with bucolic scenery. This is not to say that the wine industry does not have an impact on the environment. In the wine grape cultivation stage, soil erosion, toxicity (as a result of pesticide and fertilizer use), and water use are the main environmental concerns.[8] However, these concerns may not be associated with the current image of the wine industry.

In summary, several elements need to be combined for an effective eco-label. These include consumer awareness, consumer acceptance (credibility/comprehension), and consumer behavior change. First, consumers need to be aware of and understand the information produced on eco-labels. Second, credibility of the eco-labeling process is also important to facilitate consumer choices of green products. Third, once consumers have been exposed to the information provided by an eco-label, they must express preference for eco-labeled products through their purchasing practices. In the wine industry, because of (a) consumers' lack of understanding of the meaning of biodynamic or organic certification, (b) the perception that eco-certification might

not be associated with increased quality or health benefits, and (iii) the fact that wine growing might not be perceived as having a high environmental impact, we hypothesize that eco-labeling might not be associated with price premiums in the wine industry:

Hypothesis 1: Eco-labeling is not associated with price premiums in the wine industry.

Benefits of Eco-Certification

If eco-certification has an unclear value for consumers, why would wineries pursue it? Both organic and biodynamic agricultures are more labor intensive than conventional farming methods because they require more attention to detail. Cost studies suggest that switching from a conventional to an organic certified winery can add 10% to 15% in cost for the first 3 to 4 years (Weber, Klonsky, & De Moura, 2005). Can wineries still obtain a price premium if customers do not value eco-certification? What would be the mechanism that could lead to a price premium related to certification independently from the eco-label? We hypothesize that eco-certification is associated with an increase in the quality of the grapes and the wine.

Eco-Certification and Quality

Although most consumers may not associate benefits with eco-certification, wine makers seem to find some advantages related to the use of eco-certificated grapes. In particular, many wine makers claim that the adoption of green practices is a way to increase the quality of their wines. For example, Ron Laughton from Jasper Hill Vineyards says that wines without chemicals can better express the flavors of the "terroir":

> Flavors are created in the vine. The building blocks are the minerals in the soil. If you keep applying synthetic chemicals, you are upsetting the minerals in the soil. So if you wish to express true terroir, you should be trying to keep the soil healthy. Let the minerals that are already there express themselves in the flavor in the vine. Herbicides upset the balance of the vineyard simply because dead grasses are an essential part of the vineyard floor. Those dying grasses act as food for another species, and they in turn act as food for some other species. You go right down the food chain to the organisms that create the minerals for your plant to suck up and create the building blocks for the flavors. It is not rocket science (Morganstern, 2008).

Similarly, wine maker John Williams, owner of Frog's Leap Winery in Napa Valley, uses organically grown grapes to produce better wines. According to him,

> The bottom line is wine quality, not the organic movement's "save the world" agenda [.] Organic growing is the only path of grape growing that leads to optimum quality and expression of the land in wine. And that's for the same reason that a healthy diet and lifestyle make for healthy people. When the soil is healthy, then the vines are healthy. The analogy is almost totally complete. (Cox, n.d., para. 5)

These wine makers also prefer to put the quality of their products up front rather than discuss eco-certification or even label it on their bottle. This is because the label may not be associated with high-quality wines. According to Mike Benziger of Benziger Sonoma Mountain Estate,

> When I talk about our wines I always approach it from quality first. If I can make that connection with people, and the wine is good, the whole hope is they'll ask me how it was made. Once they ask me, I have permission to tell them about biodynamics. That order has the most effect. (Morganstern, 2008)

An online survey conducted at the UC Los Angeles in 2009, confirmed this anecdotal evidence (Delmas et al., 2009). In this survey, owners and managers of California wineries were asked to provide their top motivation to adopt sustainable certification. The list, shown in Figure 1, included motivations related to the public benefits associated with certification (provide clean environment for future generations) and motivations related to the private benefits of certification (improved quality of grapes/wines, long-term viability of business, maintaining soil quality, growing consumer demand, increased demand from restaurants and retailers, improved community relationships, improved relationships with regulatory agencies, wide local adoption, diversification of product offerings, increased export potential, and association with top industry performers).[9] As expected, "improved quality of grapes/wines" was the top "private benefit" motivation and was chosen as the first most important motivation for 25% of the 346 respondents. This rationale was even higher for those who had actually adopted certification, with 28% for certified wineries against 24% for wineries that produce conventional wine. Motivations related to consumer demand or stakeholder relationships were far behind. The only motivation that was chosen first by a higher number of respondents was "to provide a

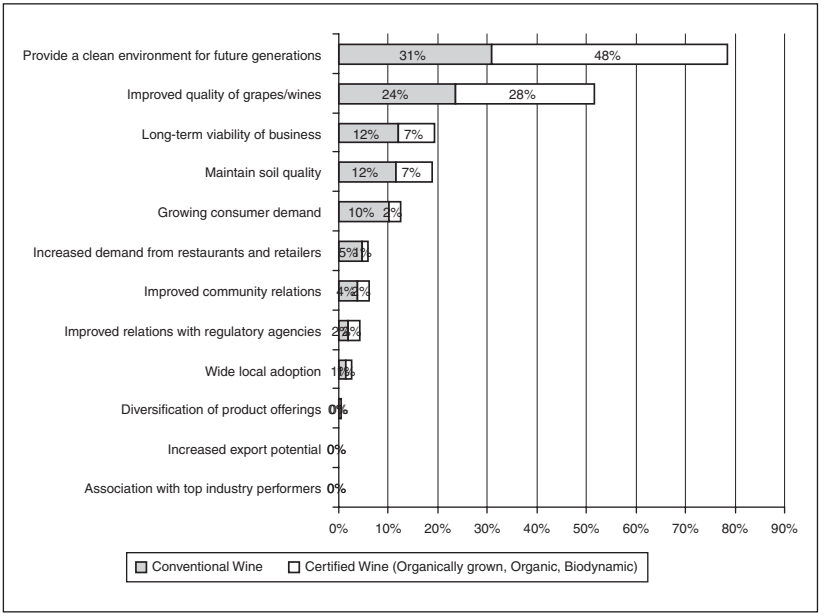

Figure 1. Motivations of California wineries to adopt certification—survey results
Note: Shaded bars represent the percentage of respondents from wineries producing conventional wine. White bars represent the percentage of respondents of certified wineries. Total number of respondents $N = 346$.

clean environment for future generation," which represents the ultimate goal or certification. However, this motivation represents the public good objective of the certification rather than the business objective of certification.

If environmental practices lead to better grapes, do wineries still need to go through third-party certification? One could imagine that some of these benefits could be obtained by wineries without obtaining certification. However, certification is usually not limited to a stamp of approval of the conformity of adopted practices to a specific standard. Some wineries and third-party certification agencies claim that the process of certification helps wineries learn about the best environmental management practices and helps them formalize their practices.[10] In summary, the process of certification would be associated with consulting services that help wineries improve their existing practices. This phenomenon has been identified in many eco-certification processes, such as for example the ISO 14001 certification process (Thornton, 2000).

Eco-Certification and Signaling Through Third-Party Certification

In addition, eco-certification allows wineries to be part of trade associations focusing on environmental issues. Eco-certification is required to be considered a member of these associations. For example, the California Certified Organic Farmers (CCOF) organization was one of the first organizations to certify organic farms in North America. It is a nonprofit that plays the role of a trade association. It helps promote certified farmers and wineries to the wine industry and the public at large and has a long history of helping implement organic legislation.[11] This is similar to other certification agencies providing capabilities to enhance organizations' business capabilities and markets.[12]

In other industry context, research has shown a positive relationship between eco-certification, participation in a trade association, and price premiums derived from eco-certification (Rivera, 2002). Scholars have conceptualized trade association as "clubs" that "promulgate standards of conduct targeted to produce public benefits by changing members' behaviors. In return, club members receive excludable and nonrivalrous (club) benefits, such as affiliation with the club's positive 'brand name'" (Potoski & Prakash, 2005, p. 235). In the case of wine, eco-certification provides a broad reputation benefit through participation in trade associations. In addition, participation in such associations could help wineries avoid costly government regulation and other liabilities as a result of their environmental impact (Lenox, 2006).

In conclusion, because of the potential benefits of eco-certification on wine quality and on positive brand name within the industry, we hypothesize the following:

Hypothesis 2: Eco-certification is associated with price premiums in the wine industry.

Overall, we hypothesize that eco-certification and eco-labeling will have differing effects on the price of wine. Whereas eco-certification would be associated with price premium, eco-labeling would not.

Method

To determine the price effect of organic and biodynamic certification and labeling, we study 13,426 wines of California, ranging in vintage from 1998

to 2005. These represent 1,495 wineries, mostly from the coastal regions of the state, and about 72% of all California wineries. California accounts for an estimated 90% of the U.S. wine production, making more than 260 million cases annually.[13] In fact, if California were an independent nation, it would be ranked the fourth largest producer of wine in the world behind France, Italy, and Spain (Food and Agriculture Organization, 2005).

Description of Variables

We include all available California wine observations, accessed from the *Wine Spectator* Web site database of more than 180,000 wine ratings and tasting reports, with data on varietals, regions, and appellations. The *Wine Spectator* magazine is a bimonthly publication that provides information, articles, and recommendations about wine. Each publication has a "buying guide" section, rating newly released wine on a 100-point scale. The *Wine Spectator* designed a blind-tasting procedure to rank overall quality within categories of wines (*Wine Spectator*, n.d.). They perform the tasting with reference to varietal, region, and vintage without other knowledge of the wine. *Wine Spectator* publishes this score with winery, wine name, vintage, grape varietal(s), region, and the suggested retail price and often gives tasting notes about the wine's appeal. The number of cases is reported when available. Significant to our test, the magazine does not publish eco-certification or labeling practices with the guide.

Table 1 provides summaries of the primary variables for these data. The price information included in the *Wine Spectator* database shows the prices of wines at the time they were released for sale. This release "price" is the manufacturer's suggested retail price (MSRP), varying from US$5 to US$500 with mean price of US$35.48 and is not adjusted for inflation. We consider this price variable to reflect the wine maker's educated expectation of market value but may differ from actual retail price. To identify potential disparity between MSRP and retail price, we obtained transaction prices for a subsample of 1,110 wines from a wine retailer located in Santa Barbara, California.[14] Transaction prices may differ from MSRP for many reasons such as retailers' mark-ups or State tax rates. However, we found a very high correlation between the logs of list and transaction prices ($p = .91$). This is consistent with previous findings that did not identify significant difference between *Wine Spectator*–listed prices and retail prices (Roberts & Reagans, 2005). We also found a very high correlation between the list price and retail price for eco-certified and eco-labeled wines ($p = .94$ and $p = .99$, respectively).

Table 1. Data Description

Summary statistics

	Observations	13,426			
	Wineries	1,495			
	Variable	*M*	*SD*	Min	Max
	Price (nominal)	35.48	26.16	5.00	500.00
	Ln[price]	3.37	0.61	1.61	6.21
	Score	85.98	4.13	55	99
	Vintage			1998	2005
	Year of issue			1999	2007
	Age at issue (years)	2.54	0.79	1	8
	Cases (1,000s)	8.47	33.40	0.02	1,000
	Certified[a]	0.023	0.151	0	1
	Eco-label[b]	0.008	0.091	0	1
Varietals[c]					
	Cabernet Blend	2.6%			
	Cabernet Sauvignon	16.9%			
	Chardonnay	17.2%			
	Merlot	7.6%			
	Pinot Noir	16.2%			
	Red Blend	4.0%			
	Sauvignon Blanc	6.2%			
	Syrah	9.6%			
	Zinfandel	9.5%			

Vintage by certification

	Not certified	Certified	Total
1998	1,900	31	1,931
1999	2,237	47	2,284
2000	1,110	19	1,129
2001	2,585	67	2,652
2002	2,381	74	2,455
2003	1,705	36	1,741
2004	1,026	27	1,053
2005	168	13	181
Total	13,112	314	

a. Twenty-eight wineries are certified.

b. Sixteen wineries use eco-labels.

c. Varietal listed if representing more than 2% of the data. Other varietals in the data set include Semillon, Marsanne, Riesling, Barbera, Rose, Chenin Blanc Gewerztraminer, Pinot Blanc, Dessert Wine, Other Red, Mourvedre, Roussanne, Grenache, Cabernet Franc, Sangiovese, Sparkling Wine, Pinot Gris, Other White, White Blend, Petite Sirah, and Viognier.

The variable "score" is used as a proxy for overall wine quality. It averages 86 with a standard deviation of 4, indicating a fairly narrow range of quality specification. One professional tastes Californian wines for the publication, lending consistency to the score. Wine "vintage" specifies the year the grapes were grown, harvested, and pressed into wine juice; this variable captures and reflects the weather of the year. "Issue year" is the date the *Wine Spectator* released the tasting scores and evaluations. We calculate "age" using year of issue less vintage; the magazine representative tastes and releases wine scores an average of 2.5 years after the vintage year. Production is measured in thousands of cases, ranging from small, vineyard-specific, 20-case wines to corporations producing up to 1,000,000 cases of a particular wine each year. Many varietals comprise the data, with classics like Cabernet Sauvignon, Chardonnay, and Pinot Noir dominating the collection. The varietals can be lumped into red wine, white wine, and other; the numbers of observations are 9,377, 3,902, and 147 of each type, respectively. The spatial coverage of our data is 160 wine-growing appellations, such as Napa Valley and Santa Rita Hills, nested in seven large regions of the state.

The "certified" variable is of primary interest for our research, indicating that the wine observation is eco-certified. There are three main ways we distinguish an observation as certified. First, the winery has certified organic vines. We match our wine list to data of organically certified vineyards and year of certification as provided by certifier California Certified Organic Farmers. Second, the winery follows biodynamic practices as certified by and listed with Demeter Certification Services. Finally, a winery purchases grapes from one of the two preceding sources. About 2.3% of the data are certified wines. Twenty-eight wineries have sought one of the eco-certifications and a handful of others purchase these eco-certified grapes. Each vintage year shows an increase from the previous in the percentage of wines that are certified within our data set, with 15 wineries becoming certified during the period of observation.

The variable "eco-label" specifies that the certified winery uses language and/or symbols on their products, signaling their greenness to consumers. We contacted each certified winery to determine its labeling practices and rationale. Sixteen wineries have an eco-label on the bottle, or about half the certified wineries, and account for 34.5% of the eco-wine observations. In our sample, the vast majority of the eco-labeling represented "wine made out of organically grown grapes" and fewer labeling representing "wine made from biodynamic grown grapes." There was no "organic wine" labeling in our sample. The average price of an eco-label wine is US$37.65, a few dollars lower than a certified but unlabeled bottle averaging US$40.54.

These prices are both higher than the average bottle of wine in the data, by 6% and 14%, respectively.

Descriptive Statistics

Many variables factor into wine price. Table 2 provides the linear correlation between prices and these factors. Score and price are correlated, and as expected, a higher quality wine will cost more to produce and will garner a better price. Issue year and vintage are also positively correlated, relating the decision to release wine 1 to 3 years after bottling. The certification variable does not covary strongly with other variables; however price and certification are certainly related because the certification process and practices are added costs that potentially increase the price of wine. Figure 2 shows the relationship of issue year and vintage as related to price. The attributes of vintage and issue year have a strong patterned relationship with price. Each line represents a specific vintage and tracks the price over a few issue years. These price changes are positive through time; the longer a wine is aged, the higher the release price. However, the fact may be that wines of higher quality are just released later. The data are further distinguished as certified (indicated with open symbols and key name marked with a "c") or not certified. Certified wines show a price premium for nearly all vintages and issue years. The price wedge for certification appears to grow over time. Of course, we are not accounting for other controls in this apparent trend. A full hedonic approach is necessary to understand the nuanced wine attributes' effect on price.

Description of the Model

Wine has considerable variation in quality, character, style, and flavor. Wine also tends to be a cultural pursuit, providing consumers with a wide array of choice at various prices to match the palate. Our research follows in the tradition of hedonic price models—decomposing the consumer demand for a product using the attributes (Rosen, 1974). Earlier work has queried the effects of wine characteristics on price. Oczkowski (1994, 2001) determines the relationship of reputation to the price of premium wine controlling for varietal, vintage, region, and a professional quality metric. Others ask whether these quality indicators factor in the price of wine; Combris, Lecocq, and Visser (1997) find that professional quality ratings do not predict Bordeaux wine prices. However, Bombrun and Sumner (2001) also employ a hedonic equation of determinants of wine using *Wine Spectator* data; they find a positive and significant relationship between the quality and price over a wide variety

Table 2. Data Correlation

	Price	Ln[price]	Vintage	Score	Issue	Cases	Certified	Label
Price	1.00							
Ln[price]	0.89***	1.00						
Vintage	0.01	0.00	1.00					
Score	0.35***	0.41***	–0.03***	1.00				
Year of issue	0.16***	0.18***	0.91***	–0.02**	1.00			
Cases (1,000s)	–0.17***	–0.28***	0.01	–0.12***	–0.04***	1.00		
Certified	0.02***	0.03***	0.04***	0.01	0.04***	–0.01	1.00	
Labeled	0.01	0.01	0.04***	0.00	0.04***	0.00	0.58***	1.00

**Significant at 5%. ***Significant at 1%.

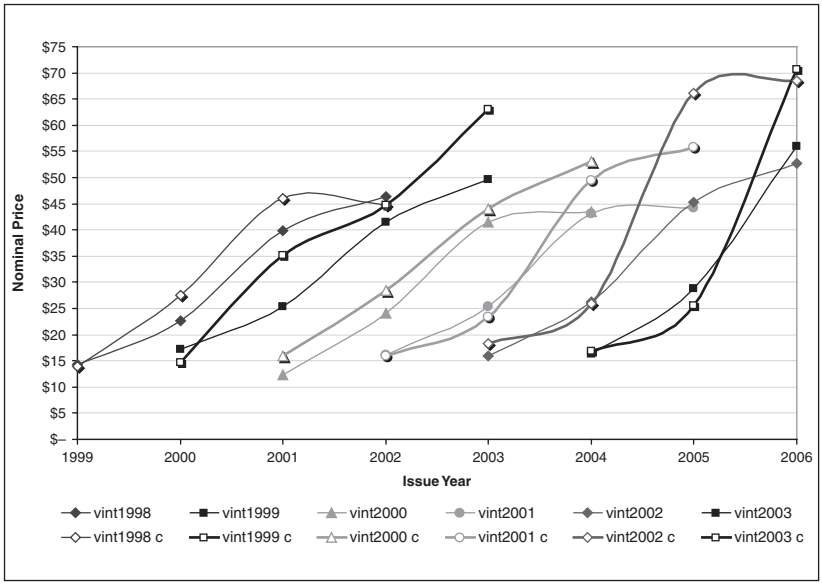

Figure 2. Price as a function of vintage, issue year, and certification

of California wines. Other wine literature shows price sensitivity to be quite high for Swedish consumers, which is expected due to the "luxury" nature of wine (Nerlove, 1995). However, Unwin (1999) suggests that hedonic specifications cannot capture the nuances of the industry, although Thrane (2004) rebuffs the criticism and demonstrates the applicability of this approach.

These previous research approaches commonly use the typical wine characteristics and qualities of varietal, age at release, appellation, label designation, vintage, tasting score, and tasting notes such as color, scent, and texture. Our research makes an important contribution to this agenda, incorporating two additional controls: winery skill and eco-practices.

The full regression specification estimates the hedonic price of wine as a function of eco-label, certification, and other control variables. We control for idiosyncratic winery attributes using longitudinal data, following wineries over time in most of our specifications:

$$InPrice_{its} = \varphi\, Eco - Label_s + \beta\, Cert_s + \varphi\, X_{its} + \alpha_i + \delta\, Varietal_s + \rho\, Appellation_s + \varepsilon_{its} \quad (1)$$

where i = winery, t = vintage, and s = wine.

Following convention in price hedonic studies, we use the log-linear specification instead of the linear specification (Thrane, 2004).[15] The covariates in X include Vintage, Score, Issue year, and Cases for each wine observation; all models control for appellation and varietal. We also estimate variations of the above equation, such as not including score and not controlling for winery fixed effects. The eco-premium may be specific to the type of wine or to certain price ranges, so we estimate the price equations for red wine and white wine separately. In addition, we break the data into quartile subsets by average winery price and estimate four specifications to determine how each sector is distinctly affected. We unravel the eco-premium effect by separating the label practices from the certification. As hypothesized earlier, we expect that the reputation and consumer preferences affect price differently than the practices alone.

Finally, we estimate the effect of certification on quality. We therefore estimate similar regressions of score as a function of the certification, vintage, issue year, and cases produced.

Results

We first estimate the effect of the eco-certification of grapes on the price as the indirect price premium and distinguish the eco-label variable coefficient as the direct consumer change in willingness to pay. Various specifications in Tables 3 through 7 illustrate the important distinctions between effects of green practices, certification, and labeling.

In Table 1, Model (1) is the full model and also includes winery fixed effects. In Model (2), we remove the winery fixed effects, and in Model (3), we remove the variable score. We conjecture that the certification variable will have a positive price impact due to the summary statistics and the theory of price premiums; however, eco-labeling may lower price. We expect *Score* (a proxy for quality) and *Age* (as measured by Issue Year) to also be positive and significant, each *ceteris paribus*. *Cases* should be negative and significant, reflecting increasing returns to scale in capital investment. A younger wine as given by *Vintage* should also decrease price (Thrane, 2004).

The partial effect of these variables on price is interpreted as the percentage change in price due to the eco-practice. Specification (1) in Table 3 gives the main result: although certifying the wine increases the price by 13%, including an eco-label reduces the price by 20%. Certification is statistically significant in regression Specification (2), which does not control for winery fixed effects but at a lower effect; the major change here is that Score now functions as a proxy for winery reputation, too.

Table 3. Ln[Price] as a Function of Certification and Labeling Practices

	(1)	(2)	(3)	(4) Reds	(5) Whites
Eco-label	–0.200 (2.71)***	–0.019 (0.42)	–0.181 (2.49)**	–0.199 (2.16)**	–0.080 (0.85)
Certified	0.133 (3.17)***	0.053 (1.80)*	0.141 (3.38)***	0.156 (2.97)***	0.072 (1.54)
Score	0.014 (16.51)***	0.038 (34.24)***		0.013 (12.21)***	0.015 (9.83)***
Cases (1,000s)	–0.001 (6.12)***	–0.002 (7.00)***	–0.001 (6.07)***	–0.002 (3.80)***	–0.001 (5.37)***
Issue year	0.138 (25.13)***	0.154 (25.91)***	0.133 (23.90)***	0.148 (20.23)***	0.103 (11.12)***
Vintage	–0.119 (21.49)***	–0.124 (20.91)***	–0.119 (21.03)***	–0.131 (17.43)***	–0.089 (9.63)***
Observations	13,426	13,426	13,428	9,376	3,902
Winery, FE	Yes	No	Yes	Yes	Yes
Number of wineries	1,495		1,495	1,357	721
R^2	.51	.61	.50	.40	.46

Note: All models include varietal and appellation fixed effects. (1) also includes winery fixed effects whereas (2) excludes these dummies variables; (3) excludes score from the regression; (4) and (5) are the same as (1) but split the regression into two subsets of red and white wines, respectively. Absolute value of robust *t* statistics in parentheses.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

All other effects are highly significant, and the coefficients are consistent with previous results in the wine hedonic price literature and our hypotheses. Many varietals are also statistically distinct in price although the coefficients are not displayed. Although most previous studies have included both red and white wine simultaneously in their analyses, Thrane (2004) suggests analyzing white and red wines separately because the effects of a set of attributes on wine prices may differ for red and white wines. Following his suggestion, Models (4) and (5) in Table 3 give the results with separate price equations for red wine and white wine. The results show that the eco-premium is driven by red wines, with a certification premium of 11.7%. The certification and labeling coefficients are larger and more significant for red wines than in the full equations. We do not find a significant price premium for eco-practices in white wines.

We use winery unobserved fixed effects to control for constant managerial skills that cannot be measured; however, we do observe differences between the groups in the covariates. And even after conditioning on other covariates such as size and location, we may still be concerned that the control and treatment groups are different in the "choice" to certify in a way that correlates with the error—a self-selection bias. However, because we have many years of data prior to being certified, we can construct a powerful falsification test, as is typical, by constructing a fake "certification" variables before the wineries are truly certified. Given the noncertified wineries are good controls for the trend of wine prices, conditional on covariates, one should find a zero treatment effect in such a falsification test, suggesting that a nonzero postcertification effect was not an artifact of the model specification. Using this design, we created a dummy for preemptive behavior of certified wineries. If there was selection bias and unobserved differences that drives the cert/labeling price premium, we would expect the lagged dummies to be significant and to change the other treatment coefficients. Our results, presented in Table 4, show that the dummy variables Eco-label (lag) and Certified (lag) are not significant. This indicates no selection bias, and therefore all tables should remain interpreted as is.

Table 5 separates the data into quartile subsets by winery. We used average wine price of a winery over the data period when creating the quartiles to keep the panel data intact. The mean quartile prices are US$13, US$24, US$33, and US$50. We see that the lower-middle and upper-middle price points are responsible for this certification/label trade-off. Tables 6 and 7 further delineate the data into red and white quartile subsets, showing the effects within these broad varietal categories. We tested the linear combination of Eco-label plus Certified as equal to zero and could not reject this hypothesis for any of

Table 4. Ln[Price] as a Function of Certification and Labeling Practices *With* Preemptive Behaviors

	(1)	(2)	(3)	(4) Reds	(5) Whites
Eco-label	−0.185 (2.54)*	−0.060 (1.19)	−0.168 (2.33)*	−0.184 (2.01)*	−0.061 (0.67)
Certified	0.124 (2.94)**	0.079 (2.36)*	0.130 (3.11)**	0.145 (2.78)**	0.062 (1.35)
Eco-label (lag)	−0.089 (1.31)	0.116 (1.40)	−0.097 (1.41)	−0.081 (0.96)	−0.119 (1.53)
Certified (lag)	0.024 (0.53)	−0.062 (1.20)	0.035 (0.77)	0.042 (0.79)	0.006 (0.12)
Score	0.014 (16.09)**	0.039 (33.96)**		0.013 (11.83)**	0.015 (9.68)**
Cases (1,000s)	−0.001 (6.12)**	−0.002 (7.02)**	−0.001 (6.07)**	−0.002 (3.80)**	−0.001 (5.43)**
Issue year	0.142 (25.73)**	0.159 (26.59)**	0.137 (24.49)**	0.151 (20.57)**	0.107 (11.46)**
Observations	13,426	13,426	13,428	9,376	3,902
Winery, FE	Yes	No	Yes	Yes	Yes
Number of wineries	1,495		1,495	1,357	721
R^2	.51	.61	.50	.40	.47

Note: All models include vintage, varietal, and appellation fixed effects. Absolute value of Robust *t* statistics in parentheses.
* significant at 5%
** significant at 1%

Table 5. Ln[Price] as a Function of Certification and Labeling Practices, Quartile Subsets

	(1)	(2)	(3)	(4)
Eco-label	0.074 (0.48)	–0.251 (2.40)**	–0.437 (2.91)***	–0.133 (0.52)
Certified	–0.088 (0.65)	0.189 (3.14)***	0.267 (5.02)***	0.067 (0.91)
Score	0.008 (4.00)***	0.011 (6.79)***	0.014 (9.09)***	0.012 (7.32)***
Cases (1,000s)	–0.000 (3.88)***	–0.003 (6.90)***	–0.005 (9.40)***	–0.018 (9.62)***
Issue year	0.069 (5.02)***	0.141 (15.60)***	0.129 (12.17)***	0.111 (9.87)***
Vintage	–0.067 (5.10)***	–0.128 (13.82)***	–0.114 (10.43)***	–0.077 (6.86)***
Observations	2,004	3,988	3,893	3,541
Winery, FE	Yes	Yes	Yes	Yes
Number of wineries	369	375	375	376
R^2	.49	.56	.60	.59

Note: All models include varietal and appellation fixed effects. (1) is the lowest price quartile, split by average price of all releases by winery over all years; (2) represents lower-middle quartile, (3) represents upper-middle quartile, and (4) gives highest price quartile. Absolute value of Robust *t* statistics in parentheses.

*Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 6. Ln[Price] as a Function of Certification and Labeling Practices, *Red* Wine Quartile Subsets

	(1)	(2)	(3)	(4)
Eco-label	0.140 (0.50)	–0.249 (1.85)*	–0.470 (2.42)**	0.229 (1.67)*
Certified	–0.205 (0.75)	0.245 (2.90)***	0.297 (4.68)***	0.080 (0.81)
Score	0.010 (3.29)***	0.009 (4.72)***	0.014 (7.07)***	0.011 (5.85)***
Cases (1,000s)	–0.000 (1.74)*	–0.003 (5.18)***	–0.005 (5.53)***	–0.026 (8.70)***
Issue Year	0.075 (3.95)***	0.158 (12.68)***	0.153 (10.55)***	0.120 (8.22)***
Vintage	–0.079 (4.23)***	–0.144 (11.00)***	–0.136 (9.08)***	–0.084 (5.85)***
Observations	1,232	2,717	2,756	2,671
Winery, FE	Yes	Yes	Yes	Yes
Number of wineries	292	339	358	368
R^2.46	.48	.50	.45	

Note: All models include varietal and appellation fixed effects. Columns are defined as in Table 5, but results include only red wine subset. Absolute value of Robust *t* statistics are in parentheses.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 7. Ln[Price] as a Function of Certification and Labeling Practices, *White* Wine Quartile Subsets

	(1)	(2)	(3)	(4)
Eco-label	–0.083 (0.54)	0.056 (0.36)	–0.210 (3.17)***	–0.236 (2.84)***
Certified	0.075 (1.05)	–0.018 (0.23)	–0.004 (0.07)	0.159 (3.82)***
Score	0.005 (1.63)	0.014 (4.79)***	0.017 (5.82)***	0.005 (1.77)*
Cases (1,000s)	–0.000 (2.42)**	–0.003 (4.17)***	–0.005 (8.31)***	–0.014 (6.26)***
Issue year	0.037 (1.69)*	0.108 (7.40)***	0.085 (4.92)***	0.071 (3.81)***
Vintage	–0.035 (1.64)*	–0.098 (6.65)***	–0.077 (4.33)***	–0.038 (2.11)**
Observations	748	1,241	1,075	838
Winery, FE	Yes	Yes	Yes	Yes
Number of wineries	246	197	161	117
R^2	.44	.60	.58	.53

Note: All models include varietal and appellation fixed effects. Columns are defined as in Table 5, but results include only white wine subset. Absolute value of Robust *t* statistics are in parentheses.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

Table 8. Score as a Function of Certification

	(1)	(2) Reds	(3) Whites
Certified	0.945 (2.40)**	0.932 (1.85)*	1.099 (1.75)*
Cases (1,000s)	–0.002 (1.86)*	–0.000 (0.24)	–0.005 (2.57)**
Issue year	–0.338 (5.32)***	–0.501 (6.00)***	0.041 (0.36)
Vintage	0.046 (0.71)	0.050 (0.60)	–0.089 (0.80)
Observations	13,442	9,390	3,904
Winery, FE	Yes	Yes	Yes
Number of wineries	1,495	1,357	721
R^2	.07	.08	.08

Note: All models include varietal and appellation fixed effects. (1) also including winery fixed effects; (2) and (3) are the same as (1) but split the regression into two subsets of red and white wines, respectively. Absolute value of Robust *t* statistics are in parentheses.
*Significant at 10%. **Significant at 5%. ***Significant at 1%.

the specifications—in effect, the labeling of bottles seems to wash out the price premium of certification.

Table 8 presents results with Score as the dependent variable. Now we interpret the coefficient of certification as the point change due to the eco-characteristics. Score is not well captured by these data, as illustrated by the many insignificant variables and low R^2 values, and seems to be determined instead from *je ne sais quoi* unobservables of the taster's palate. The full specification in Table 8 (model 1) shows Certification boosting score by 0.9 points, significant at the 5% level, from an average precertification score of 83.8. These findings corroborate our hypothesis that certification affects the quality of wine as measured by the *Wine Spectator* scores.

Discussion and Conclusion

Eco-labels provide information about the environmental characteristics of a product. Eco-labels are effective if consumers are willing to pay a price premium for green products which are costlier to produce. If consumers are not willing to pay a premium for an eco-label why should an organization still seek certification? Are there other benefits associated with the certification process? We investigated this question in the wine industry, where many wineries obtain eco-certification but do not label it on their wine bottle.

We empirically determined the price premium associated with eco-certification in the California wine industry. Consumer valuations of wine eco-labels due to personal benefits such as improved wine quality and better

health are still unknown and research studying the effects of sustainable wine making on wine quality and health is lacking. Also, eco-labels are relatively new, and consumers do not necessarily understand the meaning of different labels. More specifically, some consumers are still confused about the difference between wine made out of organically grown grapes and organic wine, which does not use sulfite in the process of making the wine. Organic wine, unlike wine made out of organically grown grapes, could be less stable over time and therefore of a potentially lower quality. As there is little awareness and understanding of eco-certification in the wine industry, one might wonder whether there is a price premium associated with eco-labeling.

To tease out the benefits associated with the label from those associated with certification, we introduced a variable representing third-party eco-certification and another variable representing the inclusion of this certification on the wine label. We tested the effect of these two variables on the price of wine.

Our results show that eco-labeling has a negative impact on prices in the wine industry, although there is a price premium associated with eco-certification. Overall, certifying wine increases the price by 13%, yet including an eco-label reduces the price by 20%, confirming the negative connotation consumers apply to "green wine." The premium puzzle for this luxury good is driven by certification rather than its label, a confounding result not previously documented. The negative result associated with eco-labeling can be explained by the lack of understanding of the eco-certification process. Our findings support and enhance what certified wine-makers have been saying: wine must first pass muster in quality and some consumers stigmatize organic wine, dismissing it as an inferior product. Yet, one question remains as to why would some wineries label eco-certification on their bottle. Anecdotal evidence indicates that those who do are proud of their efforts toward sustainability and want to communicate these to their customers. Further research should investigate this question in greater details.

Yet eco-certification does not need to be directly associated with consumers' recognition of the label, as we show with the investigation of other potential benefits associated with certification. We theorize that certification can provide reputation benefits via clubs or trade associations. We also suspect that grapes' eco-certification can lead to a higher wine quality, and therefore we provided a second set of regressions of wine characteristics on the scores attributed by the *Wine Spectator*. The results indicate that wine quality increases with eco-certification. Thus eco-certification broadly confers benefits that are not directly associated in the consumers' decision with specific environmental practices.

Using the context of wine, we have identified a mechanism that could lead producers to seek eco-certification independently from its label. This mechanism had not been identified in the previous literature on eco-labels. It is possible that the difference between eco-certification and eco-labeling benefits will fade over time as consumers become better informed about the link between green practices and wine quality. However, evidence in other contexts shows that managers are often reluctant to adopt eco-labels because they fear this could damage their environmental or quality reputation (Darnall, 2008). Government and trade associations can still play an important role in increasing the credibility and communication of eco-labeling programs (Rivera, 2002).

Our study contributes to the literature on information disclosure policies. This literature has highlighted the potential for information disclosure policies can effectively achieve their policy goals especially when information they produce becomes embedded in the everyday routines of both consumers and producers (Weil et al., 2006). By bringing the findings of the policy and management literature on eco-certification to the context of eco-labeling, we are able to describe the mechanisms that can lead producers to seek eco-certification to increase the quality of their products.

Finally, our research has important managerial implications. It shows that firms can analyze their eco-labeling strategies as sequential and identify benefits and costs related to eco-certification separately from those associated with eco-labeling. Firms can therefore evaluate the cost and benefits of adopting such strategies independently.

Our study also contributes to the emerging empirical literature on the effectiveness of eco-labels. This literature either identifies changes in consumer awareness after exposure to the label (Leire & Thidell, 2005; Loureiro & Lotade, 2005) or asks consumers how they would change their behavior if provided with additional information through eco-labels (Blamey et al., 2000; Loureiro, 2003). However, survey respondents tend to overestimate their willingness to pay for environmental attributes, and awareness of those attributes does not automatically translate into changes in purchasing behavior. Research shows that positive attitudes toward eco-labels are an unreliable predictor of green purchasing behavior (Leire & Thidell, 2005; Magnusson et al., 2001; Reiser & Simmons, 2005). By using wine prices, our study attempts to overcome some of the methodological limitations of previous studies.

Our research is not without limitations. First, our measure of quality is imperfect. The *Wine Spectator* ratings we used may reflect a specific set of preferences. While *Wine Spectator* scores are widely used by wine consumers, further research could compare our results to other existing ratings. Second,

although we argued that there are benefits associated with green practices, we were not able to identify the adoption of green practices independently from certification. Further research could survey wine makers who are not certified to identify whether some of them have also adopted environmentally friendly growing practices.

Other industries may be adopting mechanisms that relate eco-certification to an increase in quality. We hypothesize that similar patterns could be at work for other agricultural products such as coffee because the conditions may be similar to those identified for grape growing. Evidence from Costa Rica suggests that this might be the case (Muschler, 2001). Such patterns could also be present in the construction sector. Studies show that building that are built according to the Leadership in Energy and Environment (LEED) green building standard might have higher performance than conventional buildings: they are more durable and more energy efficient (Von Paumgartten, 2003). The manufacturing sector may also elicit a similar pattern if socially responsible investors use environmental management practices as a proxy for good management (Chatterji, Levine & Toffel, 2009).

Our research has important policy implications beyond the wine industry for the design of effective eco-labels. Although previous literature has highlighted the importance of effective communication for successful eco-labels, we argue that eco-labels can be associated with changes in production processes that would lead to superior products. Corporations and policy makers and should favor eco-labels that bundle public good attributes (the environment) to increased private benefits (higher quality or better health).

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Notes

1. Ibanez and Grolleau (2008) suggest three dimensions that distinguish eco-labels: (a) the way the standard underlying the eco-label is defined, (b) the way the claim is verified, and (c) the way it is signaled to consumers. Kirchhoff (2000) distinguishes *endogenous* labeling issued by the company itself from *exogenous* or third-party labeling provided by an independent labeling authority.
2. The U.S. National Organic Standards law was passed in 2001. Regulations require organic products and operations to be certified by a U.S. Department of Agriculture (USDA)–accredited entity to assure consumers that products marketed as organic meet consistent, uniform minimum standards.
3. The principal display panel can list up to three organic ingredients or food groups; however, the USDA seal cannot be used anywhere on the package.
4. To achieve Demeter certification, a vineyard must adhere to requirements concerning agronomic guidelines, greenhouse management, structural components, livestock guidelines, and postharvest handling and processing procedures. See Demeter USA Web site: www.demeter-usa.org (2006).
5. As wine harvesting and production requires specific handling and processing methods, the USDA developed explicit regulations regarding sulfite use for organic wine and other alcoholic beverages. Sulfites are a natural byproduct of fermentation and are often added to wine for preservation purposes. Added sulfites are prohibited in 100% organic wines and in organic wines (95% organic) and are regulated by 7 CFR 205.605 in wines made with organic ingredients. According to the USDA's National Organic Program, an *organic wine* has been defined as "a wine made from organically grown grapes and without any added sulfites."
6. Before being presented with any information about biodynamic farming practices, individuals were asked what word came to mind about "wine from biodynamically grown grapes." Among the respondents who had never heard of wine from biodynamically grown grapes, the single most common response was related to genetic engineering or genetic modification of the grapes (Delmas, 2008).
7. Some initial research has studied the different health effects of traditional wine versus organic wine, though in general there has not been much research completed on the topic. Some studies have concluded that there is no discernable difference, but others have yielded opposing results (Miceli et al., 2003).
8. According to the California 2004 Annual Pesticide Use Report, more than 23.5 million pounds of pesticides were applied to wine grapes. Pesticides degrade the air quality depending on the chemicals used and method of application. They also affect the soil and water quality when leaching through the soil to bodies of water.

9. The list of motivations was randomized.
10. California Certified Organic Farmers (CCOF), the main eco-certification agency in California, claims on its Web site the following benefits associated with certification: "Learning about practices. It is possible to adopt green practices without certification and it is possible to obtain the same level of greenness. However, the certification process can help an organization learn about the practices."
11. As stated on the CCOF Web site, "With over 30 years of experience and integrity, CCOF is your best ally for: organic certification, Trade Support, Marketing assistance and PR support, Political advocacy and Consumer education about organic products." See http://www.ccof.org/certification.php (accessed December 7, 2007).
12. "During audits, certification bodies focus on conformance with the standard and overall effectiveness of the system. Increasingly, they are using their considerable expertise and capabilities to enhance an organization's business advantage—expertise and capabilities which are missing from self-declaration" (Thornton, 2000, p 100).
13. U.S. Treasury's Alcohol and Tobacco Tax and Trade division data, and USDA, NASS, California field office (2005) California Agriculture Overview.
14. Details are available on request from the authors.
15. It should be noted that in this study, the linear model yielded basically the same results as the log-linear model. Results are available on request from the authors.

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