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Eco-Labeling Strategies: The Eco-Premium Puzzle in the Wine Industry

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1. Introduction

Eco-labels signal the environmental attributes of a product to consumers. The goal of eco-labels is to provide simple and easily interpretable information, and to 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, consumers spent approximately $2.2 billion on fair-trade certified products in 2006, a 42% increase over the previous year.[2] Retail sales of organic foods also increased from $3.8 billion in 1997 to $16.7 billion in 2006 (Organic Trade Association, 2006).[3] The number of eco-label programs has grown from a mere dozen worldwide in the 1990s to more than 415 programs estimated today.[4]

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, little is known about the conditions under which eco-labels can command price premiums. First, previous studies use the contingent valuation approach and are based on attitudes regarding the purchase of eco-labeled products rather than on actual purchases (Loureiro and Lotade, 2005; Leire and Thidell, 2005). Second, current literature does not elucidate the rationale and motivation of potential consumer demand for eco-labeled products. We need further research regarding these complex attitudes and actions: are consumers willing to pay for the public good (a better environment) or for other private benefits associated with certified products, such as a higher quality?

An eco-label consists of three nested steps: the adoption of environmentally friendly practices, the certification of these practices by a third party, and the labeling of the eco-certification through a label posted on the product. We argue that each of these distinct components provides

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[2] Fair Trade in Bloom**.** October 2, 2007. The New York Times

[3] The OTA 2006 Manufacturer Survey Overview available at http://www.ota.com/organic/mt.html

[4] See www.ecolabels.com

specific benefits. By assessing each step of eco-labeling, we are able to identify benefits that could be associated with the certification process independently from those associated with the actual 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 use the eco-label. The label is an additional signaling device directed towards consumers and can have a distinct effect on price.

In this paper, we undertake the first empirical test of 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 label 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 the effect of wine quality.

We use information on 13,400 wines regarding wine price, quality rating, varietals, vintage, and number of bottles produced, for the period 1998-2005. In addition, we use data on organic and biodynamic certification and labeling. We compare the benefits of eco-certification to those of eco-labeling and find these two practices have opposite impacts on the price of wine. 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. One possibility is that consumers are not familiar with the eco-certification process and negatively associate it with lower quality wine. We also theorize that eco-certification elicits price premiums. First, eco-certification allows wineries to be members of trade associations or 'clubs' that help enhance their reputation within the industry. Second, the practices associated with eco-certification can induce changes in grape and wine quality. We argue that eco-certification provides private benefits for producers and consumers beyond the label information provided about the environmental attributes of the product.

Our research contributes to the literature on information disclosure. The literature on information disclosure has shown how mandated information disclosure policies could be effective at inducing changes in organizations' behavior (Jin and Leslie, 2003; Delmas, Montes, and Shimshack, 2007). Our research shows that disclosure policies such as eco-labeling can be effective even with partial disclosure of the information. Our research also contributes to the literature on eco-labeling; while the literature emphasizes potential customer reaction to eco-labels, it does not identify how the process of eco-certification can yield changes in quality of the product that can result in a price premium. We show that eco-labeling strategies can trigger beneficial changes in the production process independently from the signal associated with the policy.

2. Literature review

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 non-labeled product (Crespi and Marett, 2005). The assumption behind eco-labels is that environmentally responsible consumers can make informed purchasing choices based on product-related environmental information (Leire and Thidell, 2005:1062). However, research shows that several elements need to be combined for an effective eco-label (Winters Lynch, 1994; Leire, 2004). These include consumer awareness, consumer acceptance (credibility/comprehension), and consumer behavior change.

Consumer awareness, understanding, and acceptance of eco-labels

First, consumers need awareness and understanding of the information provided on eco-labels. Although the objective of eco-labels is to reduce information asymmetry between the producer of green products and consumers, if eco-labels fail to communicate adequately they will not diminish the information gap between seller and buyer. For example, studies have shown that the presence of competing eco-labels has led to consumer confusion (Leire and Thidell, 2005). In

addition, if the cost of accessing this information is too high then customers will be less likely to purchase green products.

Credibility of the eco-labeling process is also important to facilitate consumer choices of green products. Eco-labels represent different realities. 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 (Ibanez and Grolleau, 2007).[5] 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; Ibanez and Grolleau, 2007).

Consumer willingness to pay for eco-labels

Once consumers have been exposed to the information provided by an eco-label, they must express preferences for eco-labeled products through their purchasing practices. The emerging empirical literature on the effectiveness of eco-labels either identifies changes in consumer awareness after exposure to the label (Loureiro and Lotade, 2005; Leire and Thidell, 2005) or asks consumers how they would change their behavior if provided with additional information through eco-labels (Loureiro, 2003; Blamey et al., 2000). 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. Research shows that positive attitudes towards eco-labels are an unreliable predictor of green behavior (Reiser and Simmons, 2005; Leire and Thidell, 2005). For example, Magnuson et al. (2001) find no relationship for Swedish consumers between positive attitudes toward organic eco-labeled products and high intention to buy these products. Eco-label effectiveness depends not only on the provision of credible and understandable information but also on the willingness of consumers to use that information.

[5] Ibanez and Grolleau (2007) suggested three dimensions that distinguish eco-labels: (i) the way the standard underlying the eco-label is defined, (ii) the way the claim is verified, and (iii) the way it is signaled to consumers.

However, we still know little about the factors that drive customers to purchase green products. Green products have been defined as "impure public good" because they yield both public and private benefits (Cornes and Sandler 1996; Ferraro et al., 2005; Kotchen, 2006). They consist of a private good, such as the pleasure of drinking coffee, 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 certification is associated with additional private benefits. For example, Magnusson et al. (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 good," "healthy," and "long shelf-life." Miles and Frewer (2001) reported that organic foods were viewed as safer 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, and Cochrane, 1995; Tregear, Dent, and McGregor, 1994; Wandel, 1994; Wandel and Bugge, 1997).

In conclusion, the literature related to the effectiveness of eco-labels shows that eco-labels that are credible and easily understood and that provide private benefits to the consumers are more likely to command a price premium than eco-labels that do not fulfill these requirements.

Eco-label versus eco-certification

While this literature emphasizes consumers' reaction to eco-labels, it does not identify whether eco-certification could yield benefits for the manufacturer outside of the signal provided by the label. This is mainly because it assumes that eco-certification equals eco-labeling, when in fact these two notions represent two related but distinct strategies. An organization could obtain a third-party eco-certification of the environmentally friendly practices it uses to manufacture or grow its products but decide not to label the certification on its products. However, an organization needs to have its products eco-certified to label them as such. Why would an organization pursue an eco-certification strategy without labeling it on its products? Could there be benefits associated with eco-certification that are independent from the signal that the label is providing to consumers?

In this paper, we analyze the effectiveness of both eco-certification and eco-labeling in the wine industry, where few of the requirements identified by the current 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 should 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 allows 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.

3. Eco-certification standards and eco-labeling in the wine industry

There are two main eco-labels in the wine industry in the United States. The first one relates to organic certification and the second one to biodynamic certification.

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. 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. Organic certifying agencies can be either State Departments of Agriculture or private certifying agencies. Regulations also prohibit practices such as genetic engineering, ionizing radiation, and using sewage sludge. Production and handling standards address crop production and livestock management requirements.

Additionally, labeling standards were created based on the percentage of organic ingredients in the product:

- "100 percent organic" labeled products must contain only organically produced ingredients and may display the USDA Organic seal.

- "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. 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.

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, while 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. A biodynamic farm is managed as a living organism and farming practices are guided by the following six principles: plant diversity, crop rotation, composting, homeopathic fertilizers, animal life, and seasonal and planetary cycles.

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.[6] To achieve Demeter certification, a vineyard must adhere to requirements concerning agronomic guidelines, greenhouse management, structural components, livestock guidelines, and post-harvest handling and processing procedures. In addition to the vineyard agricultural requirements, Demeter provides a separate set of wine-making standards with two certification alternatives for biodynamic wine:

- "Biodynamic wine," "Demeter wine," or "Demeter certified wine"
- "Wine made from Biodynamic Grapes" or "Wine made from Demeter certified grapes"

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

[6] Demeter USA Web Site. (2006). www.demeter-usa.org

conventional to an organic certified winery can add 10 to 15% in cost for the first three to four years.[7] In an article in the San Francisco Chronicle (July 1, 2004), author Tom Elkjer noted that "champagne producer Jean-Pierre Fleury once said that biodynamic farming increased his workload by 30 percent compared to conventional viticulture." Much of that increase was in "planning, organizing and preparing precisely calibrated natural treatment for [the] vineyards."[8] It is also important to note that organic or biodynamic grapes are associated with a lower yield per acre as compared to conventional grapes. The average yield per acre for conventional grapes is 5 tons for Cabernet Sauvignon and 6 tons for Chardonnay (Weber, Klonsky, and De Moura, 2003; et al., 2004a). For organic and biodynamic grapes, the average yield for all varietals is estimated at 4 tons/acre (Smith et al., 2004; Weber, Klonsky, and De Moura, 2005),[9] a 20 to 30% reduction in yield for organic and biodynamic grapes as compared to conventional grapes.

4. The value of eco-labeling

Many consumers presume that organic foods taste better and provide greater health benefits than their conventionally grown counterparts (Huang, 1991; Huang and Lin, 2007; Jolly and Norris, 1991). This is not the case with wine made from organically grown grapes.

Consumer awareness and understanding of wine eco-certification

Because 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-

[7] Silverman, Lanphar (2003), Benziger Family Winery Case Study.

[8] Thom Elkjer. 2004 "Biodynamos Cutting-edge vintners put their wines to a taste test" San Francisco Chronicle July 1, 2004.

making process.[10] 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 organic grapes because sulfites are used in the wine-making process.

A survey conducted at the University of California 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. While 66% of the respondents were familiar with "organic wine" and 39% had tasted organic wine, only 19% were familiar with the difference between organic wine and organically grown grapes.[11] 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.

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

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[9] One ton of grapes can produce 700 bottles of wine on average.

[10] Because 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 U.S. Department of Agriculture's National Organic Program, an organic wine has been defined as "a wine made from organically grown grapes and without any added sulfites."

[11] Delmas et al., 2006. Survey of wine consumers. University of California, Santa Barbara.

Private benefits associated with eco-certification

While 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. 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 health

Besides the lack of understanding of the potential benefits of sustainable practices on the quality of wine, there is still little evidence on the impact of eco-wine on health. Historically, wine was considered a necessary component of a healthy diet (Goldfinger, 2003). The presence of phenolics and tannins in grapes and wine products has dramatic effects on wine flavor, quality, and storability. These compounds can also play important roles as antioxidants and cancer preventative agents in humans. In the early 20th century, epidemiologic research reported that moderate wine drinkers had the lowest mortality rates, while heavy drinkers and abstainers had higher mortality rates. This phenomenon, originally called the "French Paradox," is due to the antioxidant effect associated with polyphenolic compounds found in red wines. Additionally, besides antioxidant properties, some components of red wine have proved to have an anticancer effect in terms of initiation, promotion, and progression of cancer cells (Miceli et al., 2003).

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) compared red table wines, controlled denomination of origin (DOC) wines, and wine made from organically grown grapes from the same region in Italy. The study concluded that antioxidant activity was 50% lower in traditional wines compared to DOC wines and the organic wine. Additionally, the study tested OTA contamination, a toxin often found in cereals, coffee, cocoa, and related food items, that has adverse effects on the immune system. OTA contamination was highly varied across the wines tested, but contamination was significantly lower in the organic wine.

Even less research has been completed on the health effects of biodynamic wine. However, a study showed that biodynamic farming methods affect vine health and grape chemistry (Reeve et al., 2005). Biodynamically grown grapes had significantly higher sugar content and notably higher total phenols than organic grapes.

The results of these studies show that both viticultural and enological practices have important influences on resulting concentrations of tannins and polyphenolics in the subsequent wine products. Further research on the influence of both viticultural and enological practices on phenolic content as it relates to wine quality and human health benefits is currently underway.

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 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. Regarding biodynamic wine, the few who had tasted it had a positive to very positive perception of the quality of the wine. But the majority of respondents expressed confusion, unjustified skepticism, or an incorrect perception of biodynamic wine. Interestingly, the majority of respondents who were not familiar with biodynamic wine associated the term with Genetically Modified Organisms or bioengineered products.

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.[12] 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. [13] The other reason is that most of these wineries think that there is a negative image associated with organic wine.

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[12] Rauber Chris, (2006) *Winemakers go organic in bottle but not on label*, San Francisco Business Times, October 22, 2006 .

[13] Wine Institute of California, Eco-friendly winemaking web page (2006), http://www.california-wine.org/webfront/base.asp?pageid=15

For example, Tony Coturri from Coturri winery has certified organic vineyards and uses no chemicals in his wine making but he doesn't 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.[14]

The environmental impacts of wine making

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.[15] However, these concerns may not be associated with the current image of the wine industry.

In conclusion, because of (i) consumers' lack of understanding of the meaning of biodynamic or organic certification and (ii) the perception that eco-certification might not be associated with increased quality or health benefits, and because (iii) 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. Hence:

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[14] *Paul Gleason* Organic Grapes, Organic Wine. The Harvest is Bountiful, but the Labeling Controversy is Still Fermenting. http://www.emagazine.com/view/?3423
Accessed on October 26, 2007

H1: Eco-labeling is not associated with price premiums in the wine industry.

5. The value of eco-certification

If eco-certification has an unclear value for consumers, why would wineries pursue it? 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 provides three main benefits. The first one is associated with an increase in the quality of the grapes and the wine, the second one pertains to learning about environmentally friendly practices through the certification process, and the third one relates to reputation benefits associated with membership in a club of certified wineries.

Eco-certification and quality

While most consumers may not associate benefits with eco-certification, wine makers seem to find some advantages related to eco-certification. 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 act as food for another 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's not rocket science.[16]

Similarly, wine maker John Williams, owner of Frog's Leap Winery in Napa Valley, pursues certification to produce better wines. According to him:

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[15] According to the California 2004 Annual Pesticide Use Report, over 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.

[16] Biodynamics in the vineyard. *The Organic Wine Journal*
http://www.organicwinejournal.com/index.php/main/more/biodynamics_in_the_vineyard/
Accessed on October 26, 2007

> 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.[17]

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.[18]

Eco-certification and learning

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.[19] 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.

Eco-certification and reputation

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

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[17] http://www.thewinenews.com/augsep00/cover.html
Accessed on October 26, 2007,.

[18] Biodynamics in the vineyard. The Organic Wine Journal
http://www.organicwinejournal.com/index.php/main/more/biodynamics_in_the_vineyard/P2/
Accessed on October 26, 2007

[19] CCOF, the main eco-certification agency in California, claims on its website 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."

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 non profit that plays the role of a trade association. It helps promote certified farmers and wineries and has a long history of helping implement organic legislation.[20] This is similar to other certification agencies providing capabilities to enhance organizations' business capabilities and markets.[21]

Scholars have shown that such trade associations could be conceptualized 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 and Prakash, 2004:235). 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 described above, we hypothesize the following:

H2: 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. While eco-certification would be associated with price premium, eco-labeling would not.

6. Methodology

In order to assess whether or not there is a price premium associated with organic and biodynamic certification, we study the price of 13,426 wines of California, spread over wine vintages from 1998 to 2005. These represent 1495 wineries, mostly from the coastal regions of the state, or about 72% of California wineries. California accounts for an estimated 90% of the

[20] As stated on the CCOF website: "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.
[21] " 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." http://www.dnvcert.com/DNV/Certification1/Resources1/Articles/Environmental/UnderstandingtheBenefi/

US wine production, making over 260 million cases annually.[22] [23] 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.[24]

Description of our variables

We include all available California wine observation, with data on varietals, regions, and appellations accessed from the Wine Spectator website database of more than 180,000 wine ratings and tasting reports. 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.[25] 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.

Table 1 provides summaries of the primary variables for these data. The release "price" is the manufacturer's suggested retail price, varying from $5 to $500 with mean price of $35.48, and is not adjusted for inflation. It may be expected to differ from actual retail price. Our regression specifications use a natural-log transformation of price. We consider this price variable to reflect the wine maker's educated expectation of market value. "Score" averages 86 with a standard deviation of 4, indicating a fairly narrow range of quality specification. All California wines are scored consistently by a single taster; this variable serves as a good proxy for overall quality. 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 representatives taste and score wine an average of 2.5 years after the vintage year. Production is measured in thousands of cases, ranging from small, vineyard-

[22] U.S. Treasury's Alcohol and Tobacco Tax and Trade division data.
[23] USDA, NASS, California field office (2005) California Agriculture Overview.
[24] Food and Agriculture Organization of the United Nations. (2005) FAOSTAT data.
[25] *Wine Spectator Online* http://www.winespectator.com/Wine/Free/Wine_Ratings/About_Tastings/0,4634,,00.html, accessed October 25, 2007.

specific, twenty-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 sorted into red wine, white wine, and other; the numbers of observations are 9377, 3902, and 147, of each type respectively. The spatial coverage of our data is 160 wine-growing appellations, such 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* (CCOF). 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 dataset, 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 these products account for 34.5% of the eco-wine observations. The average price of an eco-label wine is $37.65, a few dollars lower than a certified but unlabeled bottle averaging $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 1 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 our 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 (2001, 1994) determines the relationship of reputation to the price of premium wine controlling for varietal, vintage, region, and a professional quality metric. Others ask if these quality indicators factor in the price of wine; Combris et al. (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 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:

$$lnPrice_{its} = \varphi \cdot Eco\text{-}Label_s + \beta \cdot Cert_s + \varphi \cdot X_{its} + \alpha_i + \delta \cdot Varietal_s + \rho \cdot Appellation_s + \varepsilon_{its} \quad (2)$$

where i = *winery,* t = *vintage,* s = *wine*

Following convention in price hedonic studies, we use the log-linear specification instead of the linear specification (Thrane, 2004).[26] 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. We expect that the reputation and consumer preferences affect price differently than the practices alone.

Finally, price and quality are codetermined during the production of wine and eco-practices can affect both. Certification is costly and the price will likely be passed on to consumers. However, much of the cost of eco-certified wine is from increased labor, which may also improve the quality of wine – the special production and care could result in higher scores. We therefore estimate similar regressions of score as a function of the certification, vintage, price, issue year, and cases produced.

7. 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

[26] It should be noted that in this study the linear model yielded basically the same results as the log-linear model. Results available upon request.

willingness to pay. Various specifications in tables 3 through 6 demonstrate 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 percent change in price due to the eco-practice. Specification (1) in table 3 gives the main result: while 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.

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) suggested 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) 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.

Table 4 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 $13, $24, $33, and $50. We see that the lower-middle and upper-middle price-points are responsible for this certification/label trade-off. Tables 5 and 6 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 the specifications – in effect, the labeling of bottles seems to wash out the price premium of certification.

Tables 7 and 8 reverse the dependent variable and the quality metric *Score*. 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 demonstrated 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 7 shows *Certification* boosting score by 0.8 points, significant at the 10% level, from an average pre-certification score of 83.8. Certification becomes a stronger predictor when price is removed from the equation (3), as expected because of the positive correlation of these two variables. These findings corroborate our hypothesis that certification will affect the quality if the variability in price does not fully link with quality. Furthermore, scores are determined in a blind tasting, and therefore should preclude distinguishing the eco-labeled bottles from those certified but unlabeled (see table 8). However, a significant quality difference in the eco-labeled wineries may not be captured by price, and indeed, the labeled group is driving the certification effect on score, with a positive premium of 1.6 points.

8. 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.

In this paper, we empirically determined the price premium associated with eco-certification in the California wine industry. Consumer value of wine eco-labels due to personal benefits such as improved wine quality and better health is still unknown and research studying sustainable wine-making on wine quality and health is lacking. Also, eco-labels are relatively new and consumers do not necessarily understand the actual meaning behind the 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. Because 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.

In order 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, while we find a price premium associated with eco-certification. 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 eco-certification does not need to be directly associated with consumers' recognition of the label, as we demonstrate 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 eco-certification can lead to a higher wine quality and 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. The winery might also gain reputation and publicity; thus eco-certification broadly confers benefits that are not directly associated in the consumers' decision with specific environmental practices.

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, while 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 of environmentally friendly growing 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 more informed about the link between green practices and wine quality.

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. The manufacturing sector may elicit a similar pattern if socially responsible investors use environmental management practices as a proxy for good management.

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TABLE 1—DATA DESCRIPTION

SUMMARY STATISTICS

Observations	13,426			
Wineries	1,495			
VARIABLE	**Mean**	**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 (1000's)	8.47	33.40	0.02	1000
CERTIFIED [1]	0.023	0.151	0	1
ECO-LABEL [2]	0.008	0.091	0	1

VARIETALS [3]

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 Cert	**Cert**	**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
Tot al	13,112	314	

Notes: [1]Twenty-eight wineries are certified. [2]Sixteen wineries use eco-labels. [3]Varietal listed if representing more than 2% of the data. Other varietals in the dataset 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.

TABLE 2—DATA CORRELATION

	PRICE	*LN[PRICE]*	*VINTAGE*	*SCORE*	*ISSUE*	*CASES*	*CERT'D*
PRICE	1.00						
LN[PRICE]	0.89	1.00					
VINTAGE	0.01	0.01	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 (1000's)	-0.17	-0.28	0.01	-0.12	-0.04	1.00	
CERTIFIED	0.02	0.02	0.03	0.01	0.03	-0.01	1.00

TABLE 3—LN[PRICE] AS A FUNCTION OF CERTIFICATION AND LABELING PRACTICES

	(1)	(2)	(3)	(4) Reds	(5) Whites
ECO-LABEL	-0.200	-0.019	-0.181	-0.199	-0.080
	(2.71)**	(0.42)	(2.49)*	(2.16)*	(0.85)
CERTIFIED	0.133	0.053	0.141	0.156	0.072
	(3.17)**	(1.80)†	(3.38)**	(2.97)**	(1.54)
SCORE	0.014	0.038		0.013	0.015
	(16.51)**	(34.24)**		(12.21)**	(9.83)**
CASES (1000's)	-0.001	-0.002	-0.001	-0.002	-0.001
	(6.12)**	(7.00)**	(6.07)**	(3.80)**	(5.37)**
ISSUE YEAR	0.138	0.154	0.133	0.148	0.103
	(25.13)**	(25.91)**	(23.90)**	(20.23)**	(11.12)**
VINTAGE	-0.119	-0.124	-0.119	-0.131	-0.089
	(21.49)**	(20.91)**	(21.03)**	(17.43)**	(9.63)**
Constant	-34.500	-60.054	-24.696	-32.736	-25.188
	(10.70)**	(16.17)**	(7.56)**	(7.33)**	(5.58)**
Observations	13426	13426	13428	9376	3902
Winery, FE	Yes	No	Yes	Yes	Yes
Number of Wineries	1495		1495	1357	721
R-squared	0.51	0.61	0.50	0.40	0.46

Notes: All Models include Varietal and Appellation fixed effects.
Absolute value of Robust t statistics in parentheses.
† significant at 10%.
* significant at 5%.
** significant at 1%.

TABLE 4— LN[PRICE] AS A FUNCTION OF CERTIFICATION AND LABELING PRACTICES, QUARTILE SUBSETS

	(1)	(2)	(3)	(4)
ECO-LABEL	0.074	-0.251	-0.437	-0.133
	(0.48)	(2.40)*	(2.91)**	(0.52)
CERTIFIED	-0.088	0.189	0.267	0.067
	(0.65)	(3.14)**	(5.02)**	(0.91)
SCORE	0.008	0.011	0.014	0.012
	(4.00)**	(6.79)**	(9.09)**	(7.32)**
CASES (1000's)	-0.000	-0.003	-0.005	-0.018
	(3.88)**	(6.90)**	(9.40)**	(9.62)**
ISSUE YEAR	0.069	0.141	0.129	0.111
	(5.02)**	(15.60)**	(12.17)**	(9.87)**
VINTAGE	-0.067	-0.128	-0.114	-0.077
	(5.10)**	(13.82)**	(10.43)**	(6.86)**
Constant	-0.585	-24.544	-28.171	-67.061
	(0.08)	(4.59)**	(4.56)**	(11.60)**
Observations	2004	3988	3893	3541
Winery, FE	Yes	Yes	Yes	Yes
Number of Wineries	369	375	375	376
R-squared	0.49	0.56	0.60	0.59

Notes: All Models include Varietal and Appellation fixed effects.
Absolute value of Robust t statistics in parentheses.
† significant at 10%.
* significant at 5%.
** significant at 1%.

TABLE 5— LN[PRICE] AS A FUNCTION OF CERTIFICATION AND LABELING PRACTICES, RED WINE QUARTILE SUBSETS

	(1)	(2)	(3)	(4)
ECO-LABEL	0.140	-0.249	-0.470	0.229
	(0.50)	(1.85)†	(2.42)*	(1.67)†
CERTIFIED	-0.205	0.245	0.297	0.080
	(0.75)	(2.90)**	(4.68)**	(0.81)
SCORE	0.010	0.009	0.014	0.011
	(3.29)**	(4.72)**	(7.07)**	(5.85)**
CASES (1000's)	-0.000	-0.003	-0.005	-0.026
	(1.74)†	(5.18)**	(5.53)**	(8.70)**
ISSUE YEAR	0.075	0.158	0.153	0.120
	(3.95)**	(12.68)**	(10.55)**	(8.22)**
VINTAGE	-0.079	-0.144	-0.136	-0.084
	(4.23)**	(11.00)**	(9.08)**	(5.85)**
Constant	9.869	-25.539	-31.184	-69.223
	(0.84)	(3.31)**	(3.73)**	(8.95)**
Observations	1232	2717	2756	2671
Winery, FE	Yes	Yes	Yes	Yes
Number of Wineries	292	339	358	368
R-squared	0.46	0.48	0.50	0.45

Notes: All Models include Varietal and Appellation fixed effects.
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, WHITE WINE QUARTILE SUBSETS

	(1)	(2)	(3)	(4)
ECO-LABEL	-0.083	0.056	-0.210	-0.236
	(0.54)	(0.36)	(3.17)**	(2.84)**
CERTIFIED	0.075	-0.018	-0.004	0.159
	(1.05)	(0.23)	(0.07)	(3.82)**
SCORE	0.005	0.014	0.017	0.005
	(1.63)	(4.79)**	(5.82)**	(1.77)†
CASES (1000's)	-0.000	-0.003	-0.005	-0.014
	(2.42)*	(4.17)**	(8.31)**	(6.26)**
ISSUE YEAR	0.037	0.108	0.085	0.071
	(1.69)†	(7.40)**	(4.92)**	(3.81)**
VINTAGE	-0.035	-0.098	-0.077	-0.038
	(1.64)†	(6.65)**	(4.33)**	(2.11)*
Constant	0.214	-17.765	-13.672	-63.237
	(0.02)	(2.45)*	(1.57)	(7.97)**
Observations	748	1241	1075	838
Winery, FE	Yes	Yes	Yes	Yes
Number of Wineries	246	197	161	117
R-squared	0.44	0.60	0.58	0.53

Notes: All Models include Varietal and Appellation fixed effects.
Absolute value of Robust t statistics in parentheses.
† significant at 10%.
* significant at 5%.
** significant at 1%.

TABLE 7—SCORE AS A FUNCTION OF CERTIFICATION

	(1)	(2)	(3)	(4) Reds	(5) Whites
CERTIFIED	0.759	0.097	0.945	0.693	0.980
	(1.87)†	(0.43)	(2.40)*	(1.36)	(1.50)
LN[PRICE]	2.032	3.369		1.799	2.609
	(17.40)**	(42.48)**		(12.71)**	(10.70)**
CASES (1000's)	0.001	0.001	-0.002	0.003	-0.001
	(1.02)	(1.57)	(1.86)†	(2.18)*	(0.73)
ISSUE YEAR	-0.612	-0.825	-0.338	-0.762	-0.229
	(9.39)**	(14.30)**	(5.32)**	(8.83)**	(2.00)*
VINTAGE	0.292	0.612	0.046	0.293	0.147
	(4.50)**	(10.78)**	(0.71)	(3.37)**	(1.31)
Constant	719.537	502.916	671.223	1,019.628	240.324
	(19.23)**	(14.84)**	(17.62)**	(19.98)**	(4.16)**
Observations	13426	13426	13442	9376	3902
Winery, FE	Yes	No	Yes	Yes	Yes
Number of Wineries	1495		1495	1357	721
R-squared	0.10	0.25	0.07	0.10	0.12

Notes: All Models include Varietal and Appellation fixed effects.
Absolute value of Robust t statistics in parentheses.
† significant at 10%.
* significant at 5%.
** significant at 1%.

TABLE 8—SCORE AS A FUNCTION OF CERTIFICATION AND LABELING PRACTICES

	(1)	(2)	(3)	(4) Reds	(5) Whites
ECO-LABEL	1.622	-0.644	1.234	2.068	0.288
	(1.77)†	(1.44)	(1.37)	(1.47)	(0.23)
CERTIFIED	0.266	0.349	0.573	0.283	0.827
	(0.58)	(1.18)	(1.28)	(0.51)	(1.45)
LN[PRICE]	2.036	3.368		1.802	2.609
	(17.42)**	(42.47)**		(12.73)**	(10.68)**
CASES (1000's)	0.001	0.001	-0.002	0.003	-0.001
	(1.00)	(1.58)	(1.87)†	(2.17)*	(0.73)
ISSUE YEAR	-0.614	-0.824	-0.339	-0.764	-0.229
	(9.42)**	(14.28)**	(5.33)**	(8.85)**	(2.01)*
VINTAGE	0.293	0.612	0.045	0.293	0.147
	(4.50)**	(10.77)**	(0.71)	(3.37)**	(1.31)
Constant	722.994	502.054	673.803	1,023.040	240.941
	(19.31)**	(14.81)**	(17.68)**	(20.02)**	(4.18)**
Observations	13426	13426	13442	9376	3902
Winery, FE	Yes	No	Yes	Yes	Yes
Number of Wineries	1495		1495	1357	721
R-squared	0.10	0.25	0.07	0.10	0.12

Notes: All Models include Varietal and Appellation fixed effects. Absolute value of Robust t statistics in parentheses. † significant at 10% * significant at 5%.** significant at 1%.

FIGURE 1—PRICE AS A FUNCTION OF VINTAGE, ISSUE YEAR, AND CERTIFICATION