**UCLA IOES Practicum Project**

# To Certify or Not to Certify: A Dive into the Tannic Underbelly of the Organic Wine Industry

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*Many thanks to Dr. Magali Delmas for her inspired role as our advisor*

## Abstract

The present study aims to evaluate the quantitative quality of organic or biodynamic (eco-certified) as compared to traditional wines in California, in order to provide information to consumers, growers, and certifying bodies in the state's wine industry. Data collection from three wine rating websites resulted in the creation of a comprehensive database of almost 70,000 wines, with details for each bottle relating to the age, type, and location of the wine. Our results show that overall the adoption of certification does not have a negative impact on wine quality as measured by wine ratings for specific groups of wines. The adoption has a positive effect of rating for wines under $40, wines from the Napa region, and wines under $40 from the Napa region. These findings hold implications for addressing the consumer information asymmetry, growers' decisions to certify, and the marketing claims of the certifying bodies themselves.

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## Section 1: **Introduction**

A growing demand for ecologically and environmentally sustainable products has created a boom in the field of green marketing, with businesses competing to successfully advertise the benefits of their eco-friendly products. The wine industry is no exception, however, little consensus exists as to whether eco-certified wines are actually better then their traditional counterparts, making winemakers hesitant to seek certification. While the literature shows that eco-certified (though not eco-labelled) wines command a price premium over traditional wines, no attempt has been made to test whether they are actually of higher quality (Delmas and Grant, 2010). This paper seeks to answer the question: does eco-certification associated with quality? The wine market is especially suited to an investigation of the connection between eco-certification and quality; unlike many products of agriculture, wine is a highly differentiated good for which quality ratings are published monthly. This allows us to control for a broad range of characteristics such as vintage, varietal, and price in order to isolate the effect of eco-certification on quality. We use data from three leading wine rating publications to assess quality for approximately 70,000 wines produced in California between 1998 and 2010.

The paper proceeds as follows: in section 2 we discuss the literature relating to eco-certification and quality in wine and other goods; in section 3 we discuss our methodology and data set; and section 4 presents our results. Section 5 concludes the paper with a discussion and proposals for future research.

## Section 2: **Review of existing literature**

### 2.1) Terminology

*2.1.1) Eco-labeling*

Eco-labels are, by definition, voluntary disclosure policies of specific products that provide proof of environmental attributes pertaining either to production or consumption (Blend and van Ravenswaay 1999). More succinctly, “an eco-label identifies environmentally preferable products based on an environmental impact

assessment of a product compared to other products in the same category" (Blend and van Ravenswaay 1997). This life cycle assessment offers an assurance to the customer of these attributes, and is often taken to indicate a higher product quality (Cason and Gangadharan 2002).

It is important to distinguish between these voluntary certifications and government-mandated labels, such as fuel efficiency ratings and hazardous materials warnings, though these labels are also seen to have an effect on overall environmental implications. For instance, mandatory labels in the electricity industry have resulted in decreased percentages of fossil fuels used within the industry, which can be interpreted to mean that increased consumer knowledge is driving industry changes (Delmas, Montes, and Shimshack 2009). Such a phenomenon bolsters the case for implementing voluntary eco-labels, as they may potentially have a similar effect industry-wise.

Another type of labeling that may confound consumer understanding of eco-labels is self-declaration by firms, in which they make various unverified claims about their products. Such claims may tout products as recyclable, compostable, or having no sulfites, but one study found that up to 50% of this type of "environmental advertising" is misleading or deceptive (Kangun, Carlson, and Grove 1991).

While numerous eco-labels exist for products as diverse as washing machines and lumber, a few pertaining to food products have become particularly well known in the United States, including the United States Department of Agriculture's Organic Certification and Fair Trade USA. We will also discuss the lesser-known biodynamic certification for comparison.

### *2.1.2) USDA Organic*

Organic agricultural products, as established by the Organic Foods Production Act of 1990, are "produced and handled without the use of synthetic chemicals," as certified by a certifying agent (USDA 1990). Organic products enjoy the benefit of being highly visible; though not all consumers are intimately familiar with the specific requirements that result in organic products, the label holds enough clout to garner the trust of most consumers (Park and Lohr 1996; van Ravenswaay 1995).

### *2.1.3) Biodynamic agriculture*

Though USDA organic is the most familiar label, consumers have shown that they are receptive to other labels, such as the Demeter biodynamic label (Demeter Association, Inc. 2010). The lesser-known biodynamic agriculture represents an emerging agricultural paradigm, which proponents view as increasingly necessary given the negative environmental externalities of current industrial agriculture (Lorand, Etling, and Yoder 1997). Considered to be the world's oldest agricultural movement, biodynamic agricultural methods may provide higher-quality products than organic methods. Though neither method uses synthetic pesticides and fertilizers, biodynamic soil is also sprayed frequently with nine different soil preparations, made up of "herbs, mineral substances and animal manures." (Demeter Association, Inc. 2010). In addition, biodynamic farming also requires crop rotation, integrated soil management, and the sourcing of all soil amendments directly from the farm's own resources.

Consumer attitudes towards biodynamic agricultural products, however, have not been well researched. Attempts to determine consumer perceptions of the label have returned results that indicate lack of knowledge regarding the label (Sirieix and Remaud 2010).

*2.1.4) Eco-Certification*

Eco-certification can be an expensive and difficult process in the wine industry, but companies complete the certification because they feel that it will improve the quality of their wines through an improved production process. By becoming eco-certified, wineries have proof they are meeting the environmental standards for management practices throughout the production process. Also, since a third-party must come and check the validity of the company's environmental performance, it gives proof of the company's credibility.

If a winery decides to switch from conventional to organic practices, costs will rise 10 to 15 percent for the first three to four years (Delmas and Grant, 2010). When companies begin to shift their practices to fit the standards for eco-certification, they have a chance to lower inefficiencies that may occur during production, helping to save costs by reducing waste. The process allows companies to switch with more ease because these certifiers already know the best available environmentally friendly practices, which help save companies money from having to research it on their own. Although costs go up and the amount of labor required increases due to the attention

to detail that is needed, it has not stopped wineries from making the switch to organic. Winemakers claim that eco-certified grapes cause an increase in wine quality since they are producing their grapes naturally. They claim that their eco-friendly practices lead to better soil and thus better vines and grapes (Delmas and Grant, 2010). A 2009 online study was given to California wineries asking what the benefits they looked for from eco-certification were. 25% responded with "improved quality of grapes/wines" as the number one motivation outside of "providing a clean environment for future generations" (Delmas and Grant, 2010). Other motivations such as "consumer demand/stakeholder relations" weren't much of a factor showing that eco-certification was done more for quality than for business purposes.

Another important aspect of becoming eco-certified is that this allows wineries to join trade associations that focus on environmental issues. These trade associations work to promote their members products and give them exposure to the public. Although wineries stated that improved wine was the number one factor for eco-certification, it also makes for a good business decision. A study done showed that involvement in trade associations that required eco-certification lead to price premiums in wine products (Rivera, 2002). Involvement in these trade associations helps to bolster a winery's reputation in the industry and also allows them to avoid any regulations from the government for negative impacts to the environment (Lenox, 2006).

Even if winemakers don't put eco-labels on their products, they can still use their eco-certification to entice stakeholders, trade associations, regulators, or NGOs to gain a positive reputation (Delmas and Grant, 2010). This is beneficial to companies who have stakeholders who wish to see improvements in environmental friendliness of the companies' products. It also gives companies greater flexibility when it comes to regulations. If regulations were to change and wineries are forced to become more environmentally conscious, eco-certified wineries would have an advantage over conventional wineries because they already took the time and costs to create an environmentally friendly manufacturing process.

## 2.2) Evidence/Methods

### *2.2.1) Anecdotal vs. Empirical Evidence*

An important distinction to make is the difference between anecdotal evidence and empirical evidence. Anecdotal evidence is used to draw conclusions in numerous

studies about whether eco-labels command price premiums that consumers are willing to pay and the case of eco-labeled wine is no exception (Delmas et al. 2009, Gallastegui et al 2002). Conclusions drawn from anecdotal evidence are inherently untrustworthy, and include conclusions drawn from household surveys where people may lie, or small scale market experiments, where respondents may not act as their true self. Empirical evidence is more important in these studies because the stated preferences of consumers (anecdotal) often differ from their actual purchasing practices, which is empirically derived from real world market trends (Blamey et al. 2000). Due to the increasing presence of eco-friendly (labeled) products, there has been a call for further insight into how much influence eco-labels actually have.

*2.2.2) Consumer Willingness to Pay*

Sales of organic foods have been on the rise worldwide, reflecting increased demand for "green" products in general (Ambec and Lanoie, 2008; Delmas and Grant, 2010). This has presented unique challenges for both consumers and producers. As credence goods, consumers cannot ascertain the environmental qualities of a "green" product simply by examining it, making informed purchasing decisions for the environmentally consciousness consumer difficult (Huang *et al*, 2008). Companies have attempted to ameliorate this problem by introducing eco-labels that succinctly signal to the consumer the environmental attributes bundled in a product. The effectiveness of an eco-label is determined by a consumer's willingness to pay (WTP) for these unseen attributes. The market for organic goods provides a perfect case study to determine whether this is the case.

Most studies on the demand for organic produce and WTP have employed a contingent valuation approach, in which consumers are asked a set of hypothetical questions about the price and quantity of organic produce they are willing to buy (Blend and Ravenswaay, 1998; Huang *et al*, 2008; Delmas and Grant, 2010). First and foremost, the contingent valuation approach to measuring WTP has serious shortcomings. While it may effectively gauge interest in or perception of organic products, it may not be reflective of actual consumer purchases. While research in this area is lacking, a study of French adults found that 80% said they favor the purchase of organic foods, whereas only 10% do so regularly (Guilloux, 2006). This might be explained by the economic "warm-glow" model of goods, which suggests that consumers may take altruistic concerns into account when purchasing products,

driven by the private satisfaction of having done so (Allouch, 2009). Essentially, consumers value the "warm-glow" feeling they get from buying certain products, leading to prices that cannot fully be explained by attributes such as quality. This has serious implications in polling and surveys, as people may consciously or subconsciously give socially desirable answers for similar reasons.

The findings suggest that consumers are indeed willing to pay a price premium for organic produce. A function of market equilibrium, these price-premiums for organic versus conventional produce can only be explained by a WTP for organic products. This has both descriptive and prescriptive implications in the discussion of eco-certification and eco-labeling as different strategies. The literature consistently notes that the effectiveness of an eco-label is largely determined by the credibility of the label and consumer willingness to pay for the extra environmental attributes. (Ambec and Lanoie, 2008; Delmas and Grant, 2010). In the case of fruits and vegetables, studies show that organic food is perceived as a healthy and environmentally friendly option, with consumers listing health concerns as the greatest consideration in their decisions (Yiridoe *et al*, 2005; Tregear *et al*, 1994). It's hardly surprising then that eco-labeled fruits and vegetables command a price premium. The USDA provides credibility to the label, and consumers are willing to pay for what is viewed as an environmentally superior, higher quality, and healthier product.

However, in the case of organic wine, a lack of knowledge about the various eco-labels (organic, made from organically grown grapes, and biodynamic), might diminish the signaling power of eco-labels (Delmas and Grant, 2010). More importantly, no clear connection exists between organically grown wine and increased health benefits (Micelli *et al*, 2003). As noted earlier, the private benefits a consumer associates with the environmental attributes of a product determine their willingness to pay a price premium. Therefore, the absence of health benefits is an impediment to eco-labels effectiveness in commanding price-premiums.

While this helps explain the absence of WTP for eco-labeled wines, it cannot by itself account for the negative influence on price. However, as noted in Delmas and Grant (2010), eco-labeled wines may be associated with lower quality. In their report, Tony Coturri from Coturri winery is quoted as saying that "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 [product] (Delmas and Grant, 2010)." A study of the

Colorado wine market goes a step further, noting “the perception of being low-quality wines is negatively affecting the likelihood that consumers pay a premium for environmentally friendly wines (Loureiro, 2003).” This may reflect an overall reluctance to buy eco-labeled products, a result of “green-washing” and credibility gaps in early green-marketing schemes (Peattie and Crane, 2005). According to an article by Paul Gleason of emagazine.com, “the slow learning curve along with public confusion over labeling quickly made organic wine synonymous with bad wine, an image it has been trying to counter ever since (Gleason).”

## Section 3: **Methodology**

In order to determine the effect of eco-certification on wine quality we study 70,000 California wines ranging in vintage from 1998 to 2010. Wine has considerable variation in quality, character, style, and flavor so it was important to analyze a large group of wines. By doing we were able to standardize the many attributes of wine such as varietal and the region where it was produced. Wine tends to be a cultural pursuit and its consumption and perception greatly differs across regions, which is why we used only California wines. Furthermore, wine is greatly varied with respect to region, variatal and appellation across California that it allows us to correct for any differences between comparable wines.

Cataloguing wines was accomplished by six students over the course of three months. The data set includes all available wines from Wine Spectator, Wine Enthusiast, and the Wine Advocate online publications from our period of interest (1998-2010). The name of the wine, the winery where it was produced, and the varietal are among the variables that were taken from the publications. Also included were vintage (year it was produced), region where the wine was produced, the number of cases produced, the price of each bottle, the appellation of the wine (smaller regions of similar geography and climate) and brief tasting notes detailing the wines attributes. Variables of primary interest include “score”, serving as a metric of overall quality of the wine, and “organic”, denoting which wines are eco-certified.

CCOF and Demeter Certification Services provided directories which included all certified wineries and vineyards. CCOF and Demeter require

standardized eco-friendly production and farming to recieve certification. A wine was considered certified if it met one or more of these parameters: 1) Certified organic by CCOF, 2) Certified biodynamic by Demeter or 3) The grapes used in wine production were acquired from a vineyard/winery that is certified CCOF organic or Demeter certified biodynamic. A "1" is placed in a column marked "all organic" if the wine satisfies one of these three guidelines; wines are marked with a "0" if otherwise. By this, our regression software is able to recognize eco-certified wines.

Each publication that we sampled employs experienced wine tasters to taste and rate wines. Because wine is such a differentiated product these few tasters provide a consistent standardized metric to assess quality.

### 3.1) Methods of the Wine Review Sites

Wine Advocate, Wine Enthusiast, and Wine Spectator each have their own method for performing their wine tastings. They all have their own point scale and their own procedures for how they grade their wines. In the following three sections, each site's method will be explained. All three sites offer information on their websites. They will be described in order of most to least transparent, but we are in no way commenting on the efficacy of each method. All three sites re-taste wines that are considered "corky" or flawed from a new bottle.

#### *3.1.1) Wine Spectator*

Wine Spectator (WS) uses a 100-point scale when grading their wines. Only the 50 to 100 point range is used. Tastings for the U.S. are held in Wine Spectator offices in Napa or New York. Wines are submitted by wineries, but WS also goes out and buys many of the wines they review.

An editor is responsible for certain wine regions each year. These editors are named "beats" and they remain in their specific region in order to become an expert in their region's wines. Other tasters may also review the same wines, but the beat of the region has the final say on the rating and description. The taster's initials are at the end of the tasting note. If there are no initials then that means the wine was rated by more than one person.

All wines are held in private rooms that are set in optimal conditions for the wines. Wines are organized into flights by varietal, appellation, or region. Each flight

consists of 20 to 30 wines and a tester tastes no more than two flights each day. Each bottle of wine is coded and bagged so that the reviewer does not know the winery or price. They may be provided the varietal, region, and vintage. Each tasting begins with a previously rated wine as a reference point. Other previously rated wines are also included to ensure consistency.

Price is not taken into consideration when rating wines. However, price may be factored into the comments after the wine is reviewed, along with any other additional comments the reviewer may have after finding out the winery and other information. Wines are also rated on how well the reviewer thinks they will age. Wines that are rated highly are continually tasted to ensure accuracy.

Barrel tastings may be performed blind or not blind. Occasionally wine tastings are done that have been set up by wineries and these are not performed blind. This is always disclosed in the article or tasting notes.

*3.1.2) Wine Advocate*

Wine Advocate (WA) also uses a 100-point scale with a range of 50 to 100. All wine tastings are done in peer-group, single blind conditions, where the same type of wines are tasted against each other and the winery is not known. Price or reputation of the winery does not affect the score in any way. The numeral rating given is a guide for the wine vis-à-vis its peer group. However, there are exceptions that are rated differently. All barrel tastings, all specific appellation tastings where at least 25 of the best estates will not submit samples for group tastings, and all wines under $25 are all rated using a different policy that is not stated on the site. The score given for a specific wine reflects the quality of the wine at its best.

Robert Parker spends three months tasting at the wineries while for the rest of the year he works 6 to 7 day weeks where he tastes and rates wine. Robert Parker has a specific “rubric” he uses to rate wines. Every wine has a base of 50 points and the remaining 50 points are divided into categories that he judges the wines on. General color and appearance merit up to 5 points. Aroma and bouquet merit up to 15 points. Flavor and finish merit up to 20 points. The overall quality and potential for further aging merits up to 10 points making the total 100 points.

*3.1.3) Wine Enthusiast*

Wine Enthusiast (WE) uses a 100-point scale with a range of 80 to 100. Wines rated below 80 are not reviewed. A tasting panel of wine critics reviews the wines with editors who are responsible for specific regions giving insider perspectives on rising wine producers. Wines are chosen from new releases and also recommendations from WE editors and other qualified tasters.

Tastings are conducted individually or in a group setting and are performed blind or "in accordance with accepted industry practices." Price is not a factor when giving scores. No further details are displayed on the site on how they perform their reviews. Ratings are a reflection of what the editors feel about a particular wine.

**3.2) Data Collection Method**

This completed dataset will prove critical to our research and it is important to note the logistical issues that arose during its construction, as well as its limitations. The main obstacle in compiling an accurate dataset from three different sources (Wine Enthusiast, Spectator, Advocate) was human error during input. Errant spelling of names of wines, incorrect input of vintage year, and incorrect input of score could potentially skew our data. In order to standardize the data and run regression statistics these errors had to be remedied manually. Microsoft excel was the program used to store our data, and by utilizing its "sort and filter" function as well as the "find and replace" tool we were able to re-check our data and mend all incorrect entries. For example, input of varietal rosé often was input as rose. Excel recognizes these as two discrete observations, when in fact they are one in the same.

Issues inputting data resulting from formatting discrepancies between our three databases also needed to be resolved. Different students were drawing data from three distinct templates, with the goal of having a standardized list of each variable (winery, vintage, region produced, score, appellation, etc.) The problem is that the different websites are formatted differently, and do not have a standardized system for defining our variables of interest. For example, the North Coast is listed as a "region" in the Wine Spectator publication but is listed as an "appellation" by Wine Enthusiast. To compare between the 3 websites' databases we had to ensure regions were listed according to a standard set of guidelines. We decided on using the regions listed in the Federal Code of Regulations for Counties. Because so many of California's wines are grown north of San Francisco, we decided to classify north coast wines based on whether they originated in Napa County, Sonoma County, or either Mendocino or

Lake Counties. Wines from north coast counties excluding those four were lumped together in the "North Coast" region. Wines from the Carneros region, which spans parts of southeast Sonoma and southwest Napa counties, were listed as "Carneros". The "Bay Area" region consists of Solano, Contra Costa, Alameda, Santa Clara, San Francisco, and San Mateo Counties. Based on information found in the most recently updated Code of Federal Regulations, we determined the boundaries of the "South Coast", "Central Coast", "Sierra Foothills", and "Central Valley" regions. We then used information of the CFR website to determine in what region each of the California's appellations should fall under. Wines produced from grapes spanning multiple regions are listed as "Other California."

Another noteworthy issue is the differences in average score between the three databases. Wine Advocate has a higher average score than Wine Spectator and Wine Advocate which makes cross comparison between databases (by score) slightly errant. However, because the deviation from average score between eco-certified wines and conventional wines remains relatively constant in all three databases, comparison between datasets is acceptable.

Our research follows in the tradition of hedonic models- decomposing the attributes (our variables) of wines to evaluate quality as a function of eco-certification. The program we used to run regression statistics is STATA statistics software. The full regression estimates the quality ("score") of wine as a function of eco-certification ("all organic") by controlling for distinct winery attributes and using longitudinal data from comparable wines. The statistical program STATA uses a log-linear specification and this model controls for varietal, appellation, region, and vintage. Previous research in this field commonly uses typical wine characteristics and specifications 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 quality (score) as a function of certification as our primary interest.

## Section 5: **Results**

In sum, the total number of wines (i.e. bottles of wine) that was analyzed was 69,944. Of these wines, 24,621 came from Wine Enthusiast, 29,354 from Wine

Spectator, and 15,968 from Wine Advocate. It should be noted that while all wines 1998 to present (2009 or 2010, depending on the website) were included for Wine Spectator and Wine Advocate, only wines from 1998 to 2005 and selected wines from 2005 to present were analyzed for Wine Enthusiast, because analysis was halted midway through.

Many different variables play a role in determining the quality of a given wine. As seen in Tables 1 and 2 (see below), we analyzed the following quantitative metrics: vintage, score, price, issue date, and number of cases produced, as well as the qualitative metrics of winery, CCOF certification, Demeter certification, all organic, varietal, appellation, and region. We find that the average score of wines tested by Wine Advocate is the highest at 90.06, followed by 87.31 for Wine Enthusiast, and 86.40 for Wine Spectator. Of the 69944 observations, 1195 are from certified vineyards either organic or biodynamic. Ninety-one are from Wine Advocate, 583 are from Wine Enthusiast, and 552 are from Wine Spectator. Referring to Table 2, approximately 1.75 percent of the nearly 70,000 wines for which data was collected are certified by either CCOF or Demeter wines.

Over 50% of wines in our data set come from Sonoma or Napa counties, with another 16% coming from the south coast region. The average price for all our observations is $39.76. The 5 most represented varietals are pinot noir, cabernet sauvignon, chardonnay, syrah, and zinfandel, respectively. Combined these varietals account for close to 70% of all our observations. The fact that so many of our wines are similar in respect to region and varietal is significant, as it allows us control for these variables in order to test our hypothesis.

For Wine Advocate, there are 47 CCOF wines, 58 Demeter wines, and 91 organic wines altogether. The minimum score for WA is 64 with the maximum 100. The average score for WA is 90.06 with a standard deviation of 3.093. For Wine Enthusiast, there are 450 CCOF wines, 175 Demeter wines, and 583 wines altogether. The minimum score for WE is 55 while the maximum was 100. The average score for WE is 87.31 with a standard deviation of 3.341. For Wine Spectator, there are 340 CCOF wines, 264 Demeter wines, and 552 total organic wines. The minimum score for WS is a 55 while the maximum score is 99. The average score for WS is 86.40 with a standard deviation of 4.122. We used the data collected regarding each of these covariates to run correlations to establish the influence each parameter might have on

our professional quality metric ("Score"). The results of those correlations are detailed here.

Table 3 shows the results of the regressions. The aggregate effect for wines is not significant from all three sites. When observing each site individually, WS is significant for all organic with a value of .60 (significance at level $p< 0.01$) while WA (.15) and WE (.15) are not significant for all organic. Table 4 shows the results of another regression that was done for wines valued at less than $40. The aggregate effect of all three sites for wines less than $40 shows significance with a value of .24 (significant at level $p< 0.1$). When observing each site individually, WS is significant with a value of .46 (significant at level $p< 0.1$), WA is significant with a value of 1.02 (significant at level $p< 0.01$), and WE is not significant with a value of 0.29.

**Table 1.** Summary statistics of data from wine ratings websites

| | Vintage | Score | Price | Issue Date* | Cases* |
|---|---|---|---|---|---|
| **Wine Advocate** | *Min: 1998 Max: 2009* ***2003.98*** ± *3.165* | *Min: 64 Max: 100* ***90.06*** ± *3.093* | *Min: 6 Max: 4377* ***61.09*** ± *104.709* | *Min: 1 Jun, 1999 Max: 1 Dec, 2010 16 Nov, 2006* ± *27861: 10: 40.881* | *Min: 100 Max: 11000* ***1940.56*** ± *2624.118* |
| **Wine Enthusiast** | *Min: 1998 Max: 2009* ***2002.39*** ± *3.258* | *Min: 45 Max: 100* ***87.31*** ± *3.341* | *Min: 4 Max: 500* ***30.43*** ± *22.532* | *Min: 1 Jan, 1999 Max: 9 Dec, 2010 16 Aug, 2006* ± *11512: 26: 42.098* | *Min: 3232 Max: 3232* ***3232*** ± *0* |
| **Wine Spectator** | *Min: 1998 Max: 2009* ***2003.59*** ± *3.184* | *Min: 55 Max: 99* ***86.40*** ± *4.122* | *Min: 2 Max: 750* ***37.09*** ± *29.096* | *Min: 1 Jan, 1999 Max: 9 Dec, 2010 16 Aug, 2006* ± *29290: 29: 01.946* | *Min: 0 Max: 2600000* ***9318.97*** ± *41192.643* |
| **Total** | *Min: 1998 Max: 2009* ***2003.26*** ± *3.272* | *Min: 45 Max: 100* ***87.55*** ± *3.907* | *Min: 0 Max: 4377* ***39.76*** ± *55.021* | *Min: 1 Jan, 1999 Max: 9 Dec, 2010 31 Jan 2007* ± *27785:58:07.923* | *Min: 0 Max: 2600000* ***9311.88*** ± *41173.429* |

*data not available for all wines

**Table 2.** Summary of statistics of data from CCOF and Demeter

| | No. of Wines | No. of Wineries | No. of CCOF | No. of Demeter | No. of All Organic | No. of Varietals | No. of Regions |
|---|---|---|---|---|---|---|---|
| **Wine Advocate** | 15968 | 1172 | 47 *(0.3%)* | 58 *(0.4%)* | 91 *(0.6%)* | 30 | 10 |
| **Wine Enthusiast** | 24621 | 2424 | 450 *(1.8%)* | 175 *(0.7%)* | 583 *(2.4%)* | 30 | 11 |
| **Wine Spectator** | 29354 | 2179 | 340 *(1.2%)* | 264 *(0.9%)* | 552 *(1.8%)* | 29 | 11 |
| **Total** | 69944 | 3243 | 837 *(1.2%)* | 497 *(0.71%)* | 1226 *(1.75%)* | 30 | 11 |

**Table 3.** Results from regressions

| | All Organic (CCOF & Demeter) |
|---|---|
| **Wine Advocate** | 0.15 |
| **Wine Enthusiast** | 0.15 |
| **Wine Spectator** | 0.60** |
| **Total** | 0.16 |

*indicates significance at level p < 0.1
**indicates significance at level p < 0.05
+ indicates significance at level p< 0.01

**Table 4.** Results from regressions, wines >$40 excluded from analysis, also Napa Only

| | All Organic < $40 | All Organic Napa Only | All Organic Napa Only < $40 |
|---|---|---|---|
| **Wine Advocate** | 1.03** | 0.16 | 1.04** |
| **Wine Enthusiast** | 0.28 | 0.15 | 0.28 |
| **Wine Spectator** | 0.46+ | 0.59** | 0.45+ |
| **Total** | 0.24+ | 0.66** | 0.94* |

*indicates significance at level p < 0.1
**indicates significance at level p < 0.05
+ indicates significance at level p< 0.01

**Table 5.** Wines from the different regions and their frequency.

| Region | Frequency | Percent of Total |
|---|---|---|
| Bay Area | 642 | 0.9 |
| Carneros | 2964 | 4.2 |
| Central Coast | 17947 | 25.7 |
| Central Valley | 979 | 1.4 |
| Mendocino/Lake Counties | 3162 | 4.5 |
| Napa | 17918 | 25.6 |
| North Coast | 521 | 0.7 |
| Other California (Blends) | 4906 | 7.0 |
| Sierra Foothills | 1589 | 2.3 |
| Sonoma | 19170 | 27.4 |
| South Coast | 145 | 0.2 |
| Total | 69943 | 100 |

**Table 6.** Wine frequency based on varietal.

| Varietals | Frequency | Percent |
|---|---|---|
| Barbera | 188 | 0.3 |
| Cabernet Blend | 251 | 0.4 |
| Cabernet Franc | 480 | 0.7 |
| Cabernet Sauvignon | 11404 | 16.3 |
| Chardonnay | 11066 | 15.8 |
| Chenin Blanc | 155 | 0.2 |
| Dessert Wine | 145 | 0.2 |
| Gewurztraminer | 269 | 0.4 |
| Grenache | 479 | 0.7 |
| Marsanne | 85 | 0.1 |
| Merlot | 4308 | 6.2 |
| Mourvedre | 202 | 0.3 |
| Other Red | 1642 | 2.3 |
| Other White | 652 | 0.9 |

| Varietals | Frequency | Percent |
|---|---|---|
| Petite Sirah | 1185 | 1.7 |
| Pinot Blanc | 219 | 0.3 |
| Pinot Gris | 720 | 1.0 |
| Pinot Noir | 12262 | 17.5 |
| Red Blend | 3084 | 4.4 |
| Riesling | 245 | 0.4 |
| Rose | 211 | 0.3 |
| Roussanne | 245 | 0.4 |
| Sangiovese | 470 | 0.7 |
| Sauvignon Blanc | 4434 | 6.3 |
| Semillon | 51 | 0.1 |
| Sparkling Wine | 496 | 0.7 |
| Syrah | 6506 | 9.3 |
| Viognier | 1134 | 1.6 |
| White Blend | 453 | 0.6 |
| Zinfandel | 6874 | 9.8 |
| Total | 69943 | 100 |

## Section 6: **Discussion**

Winemakers who choose eco-certification are motivated by two main factors: (1) that environmentally friendly farming practices- guaranteed through eco-certification- increase the longevity and sustainability of a vineyard; and (2) that these practices add to the overall health of the grapevine and produce a higher quality grape, which in turn is used to manufacture a higher quality wine (Delmas and Grant, 2010). However, there seems to be a debate between those seeking certification and the average wine consumer on the merits of eco-certified wine. While winemakers are of the opinion that certification improves the quality of wine, most wine drinkers have been found to have a negative opinion towards certified organic wine (Delmas and Grant, 2010). We sought to answer the question: Who is right? Are producers misguided in their opinion of eco-certified organic wine, or does the average wine drinker just need some evidence that organic wine merits the additional costs of certification?

Our research works to remedy this information asymmetry between producer and consumer by empirically evaluating quality of wine as a function of eco-certification. As stated previously, we used standardized quality metrics provided by three expert wine publications (Wine Enthusiast, Wine Spectator, and Wine

Advocate) for almost 70,000 wines. By cataloguing so many California wines we could control for attributes including vintage, region where they were produced, varietal, and determine whether or not our variable of interest (eco-certification status) affected the "score" (quality metric) of the wine.

Once our dataset was completed and checked for errors, we were able to run regressions to discover the link between eco-certification and quality. We found that aggregating data from all three wine publications did not yield any significant difference in quality. Individually, the Wine Spectator publication generated a positive correlation between eco-certification and quality. While the difference in quality was somewhat slight (slightly less than 1 point) it occurred over 99% of the time. Neither of the other two publications showed any significant difference in score when analyzing all of their wines.

Manipulating our data to evaluate wines that cost less than $40 we were able to find an improvement in quality for the Wine Advocate publication and the Wine Spectator publication at significant levels of confidence. $40 was chosen as the cutoff because the average price for all wines in our dataset is $39.76.

Because the production of wine is not uniform across the entire state of California, it is important to analyze wines from the most prolific wine producing regions. It was found that organic wines produced in Napa, where a quarter of the state's wine is produced, is statistically better than conventional wine grown in the same region, according to the data collected from Wine Spectator. The other two publications showed no such relationship, however when combined all three publications showed a significant improvement in quality for Napa wines less than $40 when they are eco-certified.

We note a few attributes that were found preferred or disfavored across all three publications. Cabernet blends, Cabernet Sauvignon, Chardonnay, and Sparkling Wine were found preferred by all tasters. Conversely, Cabernet Francs, Gewurtztraminer, Grenache, Marsanne, Merlot, and Pinot Gris were found to be disfavored by all tasters. Future research into the attributes that contribute to quality are needed to further our understanding of grape farming practices and resultant quality of wine. One of the most important results found is that there is no negative association between eco-certification and quality for any scenario across all three publications.

These results are important because they provide evidence to resolve the differences in producer and consumer perception of organic wine. By marketing the results of this study, eco-certifying organizations like the California Certified Organic Farmers or Demeter, USA gain credibility in their endeavor to promote environmentally friendly farming practices. Resolving the information asymmetry between consumers and producers so that both parties see merits of organic wine creates grower incentive to certify. This has potential to dramatically change the environmental standards for the entire wine industry. Specifically, the view that certified farms could produce higher quality grapes, and thus a higher quality wine through environmentally friendly farming,is reinforced.

Some limitations of our study include incomplete data sets for wines from the Wine Enthusiast website, as databasing from that site was halted. In addition, we were unable to do any qualitative analyses of some of the categories for which we gathered data, including “designation” and “description” for each bottle. Finally, because of the fact that six different people were compiling the data, there is certainly the possibility that – despite efforts to standardize methods – some amount of error is inherent.

Further studies in the correlation between quality and environmentally friendly production across regions other than California are needed to confirm these views. Further research in how to empirically and objectively determine quality of wine would be of utmost importance for further conclusions to be made.

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