THE VALUE OF ORGANIC WINES FROM TUSCANY
A HEDONIC PRICE ANALYSIS

By

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To my grandmother

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LIST OF ABBREVIATIONS

AIAB	Italian Association for Organic Agriculture
CT	Cellar Tracker
DOC	Controlled Designation of Origin
DOCG	Controlled Designation of Origin Guaranteed
EOWC	European Organic Winemaking Carta
EU	European Union
FAO	Food and Agriculture Organization
GMO	Genetically Modified Organism
ICEA	Environmental and Ethical Certification Institute
IFOAM	International Federation of Organic Agriculture Movements
IGT	Indicazione Geografica Tipica
MIPAAF	Italian Ministry of Food, Agriculture, and Forestry
NOP	National Organic Program
ORWINE	Organic Viticulture and Winemaking
PPM	Parts per Million
RP	Robert Parker
SO_2	Sulfur Dioxide
ST	Steven Tanzer
USDA	United States Department of Agriculture
WE	Wine Enthusiast
WS	Wine Spectator
WTP	Willingness To Pay

Abstract of Thesis Presented to the Graduate School
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Previous literature suggests that the price of wine is a function of its intrinsic attributes. Studies have examined the price of wines from various wine producing regions using the hedonic price model to determine the correlation between wine attributes and price. However few studies have examined the relationship between organic production or certification and price. This study examines the price premiums associated with organic production and organic certification for Tuscan red wines produced between 1999 and 2008. To do this, we modeled current Italian and US prices as a function of organic status, grape varietal, appellation of origin, vintage, and rating.

This study finds that grape varietal and vintage tend to have the most significant relationship with price. Organic status, when accounting for other relevant determinants of price, does not have any significant association with price in the Italian market. However, wines produced organically but are not certified as organic do receive a price premium in the US market. Vintage showed a significant and negative correlation with price for the 2006, 2007, and 2008 vintages.

The data were divided into price quartiles to examine the differences in effects of the variables between price classes. This analysis found that appellation and grape varietal have significant and substantial correlations with price in the highest price quartile.

CHAPTER 1
INTRODUCTION

Organic Agriculture

Organic agriculture has expanded considerably in the last decade. From 1999 to 2011, the global amount of agricultural land devoted to organic production increased from 11 millions hectares to 37 million hectares, and the market for organic products has increased from $15.2 billion to $59 billion (IFOAM EU Group, 2013). Organic agriculture is a sustainable ecosystem management practice that eliminates the use of synthetic external inputs such as pesticides, fertilizers, genetically modified organisms (GMOs), preservatives, and other synthetic additives. Organic production makes use of agronomic, biological, and mechanical methods to reach similar results as conventional agriculture. The goal of organic agriculture is to maintain long-term soil fertility, biological cycles, and biodiversity (Food and Agriculture Organization, 1999). In the European Union, 5.6% of agricultural land is under organic farming practices, while in the United States, adoption of organic agriculture is much lower, with less than 1% of cropland and pasture certified as organic (Eurostat, 2013; United States Department of Agriculture, 2013).

Organic viticulture, otherwise known as organic winemaking, became increasingly popular in the 1980's out of concern for pesticide residues in wine, however the practice of organic winemaking has benefits that are not strictly consumer driven. The organic viticulture movement has two main tenets: to increase microbial activity in the soil by avoiding the addition of synthetic substances to the soil and the general concern for overall environmental protection through reduced soil erosion and pollution. Despite its rise in popularity in the 1980's, organic viticulture is not a modern practice,

but is in fact an alternative to “conventional” viticulture, which had replaced organic viticulture in the 1950’s as a means of increasing production. France is considered the home of organic viticulture, containing half of the world’s registered wine growers and being the first government to officially recognize organic farming (Robinson, 1999). In the five top wine-producing countries in Europe (France, Italy, Spain, Germany, and Austria), the share of vineyard land under organic production is between 6.8% and 9.6%, whereas in the United States, only 3.0% of vineyard land is organic (IFOAM & FiBL, 2013).[1]

Organic Wine Policy in the US

The formation of organic wine policy in the United States began in 1990 with the passing of the National Organic Foods Act, which gave the United States Department of Agriculture (USDA) the task of establishing regulations for organic foods and products. The USDA then created the National Organics Standards Board, an advisory board which, along with the Bureau of Alcohol, Tobacco, and Firearms, drafted the regulation concerning the production and labeling of organic wine, which ultimately prohibited finished products, such as wine, from being labeled as organic. In 2000, the USDA’s National Organic Program (NOP) was established with the goal of creating guidelines for the processing and labeling of organic products, including wine. They also established the list of allowed and prohibited substances in organic products.

Included in this list is sulfur dioxide, a common additive in winemaking. It is formed from the burning of elemental sulfur in the presence of oxygen. Its use dates back hundreds of years but today its most important properties for winemaking are to

[1] These figures reflect overall grape production and are not limited to vineyards producing only wine grapes.

prevent oxidation, to prevent bacterial inoculation, and to encourage quick and clean fermentation (Robinson, 1999). Some people experience severe allergic reactions to sulfur dioxide. Consequently, in the United States, all wines must carry the phrase "contains sulfites" on the label. Other countries have similar compulsory labeling rules for sulfites, however in the European Union, this requirement does not exist. Some people believe that sulfites contribute to headaches experienced after drinking wine. However, the headaches are likely caused by histamines and amines found in the wine (Jarisch & Wantke, 1996).

In the United States, the NOP allows for wines to be labeled as organic and carry the USDA organic seal, only if they are produced from organically grown grapes, without the addition of sulfites. Total naturally occurring sulfite levels cannot exceed 20 ppm. Wines with added sulfites can be labeled as "made from organic grapes" but cannot bear the USDA organic seal on the label (Organic Consumers Association, 2014).

Organic Wine Policy in the EU

While many wines produced in the European Union were made from organically grown grapes (which fell under European organic food regulation established in 1991), regulations did not address the organic production of wine from those grapes until recently. This prohibited wine producers from being able to use the European organic logo on the label. Wines producers were only permitted to label wines with the phrase "made from organic grapes".

In Europe, many private standards for organic wine production existed, and organic wine producers, if certified, were allowed to use the logos of the private certifiers on their labels. However these private labels are not always easily

recognizable to consumers and little is often known about their standards (discussed further below). Therefore a common EU-wide regulation for organic winemaking was needed so that producers could take advantage of the more widely recognized official EU organic label. In 2004, discussions to develop these regulations began with the Organic Viticulture and Wine-Making (ORWINE) Project, which presented a set of recommendations for organic wine production. In 2009, the European Commission began work on the implementation of organic wine regulations, a process that was hampered by disagreements over sulfite use. Because wines produced without the addition of sulfur dioxide are prone to oxidation, bacterial inoculation, and therefore spoilage, organic wine producers in the EU still wanted to be able to add the compound to keep their wines from declining in quality. These disagreements caused the discussions to stall within a few months.

In 2011, the European Organic Winemaking Carta (EOWC) and the European wing of the International Federation of Organic Agriculture Movements (IFOAM-EU) helped the European Commission resume discussions, leading to an agreement on the sulfite issue and ultimately approval of the first EU organic wine regulation, allowing winemakers to use the official EU organic logo. The regulations went into effect on August 1, 2012. They allowed for different total sulfite levels based on the style of wine. Prior to the passing of the new regulations, maximum acceptable sulfite levels in conventional wines were set between 150 – 400 mg/L depending on the style of wine. The new regulations modestly reduced these levels for organic wines by 30 – 50 mg/L[2] or by roughly 7 - 35%. In addition to wines produced after August 1, 2012, wines

[2] For sulfur dioxide, the conversion rate is conveniently 1:1 for ppm to mg/L, but US and EU regulations use ppm and mg/L, respectively.

produced before that date which had not yet been bottled could also make use of the EU label as long as they met the new standards (IFOAM EU Group, 2013).

Trade of Organic Wines Between the US and EU

With widely varying definitions of what is considered organic in terms of sulfite use in winemaking, a new United States/European Union Organic Equivalence Arrangement was needed to address how organic wines produced in the US could be sold in the European Union and visa versa. This new arrangement went into effect on June 1st, 2012. "U.S. wines 'made with organic grapes' produced in accordance with the U.S. restrictions on sulfites may be sold as 'organic' wines in the EU. EU wines labeled as 'organic' in the EU may be sold in the United States as wine 'made with organic grapes' provided that the sulfite levels comply with the limits set by the U.S. National Organic Standards" (Organic Trade Association, 2014).

Organic Labeling

Organic labels signal to consumers that a product has met organic production standards, subsequently allowing producers to receive price premiums, as some consumers are willing to pay more for organic products (McCluskey & Loureiro, 2000). In order for producers to use an official organic logo, an accredited certifying agent must certify that the production and processing methods comply with the appropriate organic regulations. In the United States, products that are certified to be organic by one of the USDA's certifying agents are allowed to carry the USDA organic logo (Figure 1-1) on their labels (United States Department of Agriculture, 2000). In addition to this label, if producers want to include other logos signifying additional environmental or fair-trade attributes of a product, they can seek out supplementary certification. Producers may seek out carbon neutral certification, biodynamic certification, sustainable production

certification, or a host of other certification programs that are region or industry-specific. Standards for these programs often go above and beyond official regulations set by the USDA or other government agencies and their respective logos can be used to show that a product meets even stricter standards.

In the European Union, producers of organic products (excluding unpackaged produce and imports) are required to include the EU organic logo (Figure 1-1) on all certified organic products. European producers can opt to undergo further certification and include additional logos on products as well. Many country or industry-specific certification schemes allow for producers to use eco-labels to convey information about production practices when regulations for specific industries do not exist (as was the case for organic wine) or when those production practices meet stricter standards than those set by the European Commission (European Counsil, 2007).

Recognition and knowledge of eco-labels is an important aspect of their effectiveness. Prior to 2012 and in the absence of any EU level organic wine regulation, many private organic certification schemes and logos filled the need for certification and labeling of organic products. A recent study examined consumer knowledge of private eco-label schemes, such as Demeter (a global organic and biodynamic certifier) and ECOCERT (an organic certification organization with a presence in over 80 countries), as well as umbrella organizations like Bio Suisse (a group of over 30 individual farmers associations) (Janssen and Hamm, 2011). The study used focus groups from the Czech Republic, Denmark, Germany, the UK, and Italy. They found that Italian consumers were unaware or lacked knowledge of the prevalent ecolabel schemes in their country, with the EU logo and the Controllo Biologico (a private inspection and

certification organization) logo known by only some of the participants. Other private organic certifier logos such as Demeter, the Environmental and Ethical Certification Institute (ICEA), and the Italian Association for Organic Agriculture (AIAB) were known by very few or none of the participants.[3] Furthermore, nearly all of the Italian participants were unaware of the differences between the various eco-labels. Most participants had very little knowledge of the standards or control systems of the ecolabel schemes and many were confused about the definition of organic, organic standards, and how production was regulated. Consequently, Italian participants had no preference for one organic certification scheme over another. This study was done before the introduction of mandatory EU organic logos on organic products, so further research is needed to examine consumer knowledge of EU organic standards under the new regulations.

A B C

Figure 1-1. Certification Logos. A) USDA organic logo, B) EU organic logo, C) biodynamic logo certified by Demeter

Italian Consumers of Organic Products

There are many types of consumers of organic products, and they choose organic products to varying degrees and for a number of different reasons. In Italy, nearly 60% of the population regularly purchases organic products, either exclusively or in addition to conventional products (Pelligrini & Farinello, 2009). Studies have shown

[3] Quantitative terms were not included in this study.

that purchasers of organic products tend to be health conscious individuals with a positive attitude towards organics and a high awareness of the difference between organic and conventional products. They are generally concerned about the impact of the production processes on the environment and believe that organic products are healthier and of a higher quality. As a result, the main factors that affect a person's attitudes towards organic products are their concerns for personal health and concerns for the environmental impact of the production processes (de Magistris & Gracia, 2008; Saba & Messina, 2003, Boccaletti & Nardella, 2000). These consumers tend to be between 30-45 years of age and fall in a medium-high income bracket (Crescimanno, Ficani, & Guccione, 2001). Within the pool of reasons that people purchase organic products, personal health concerns tend to be the most important (Chinnici, D'Amico, & Pecorino, 2002; de Magistris & Gracia, 2008).

Surveys of Italian consumers have shown that some consumers are willing to pay a premium for organic products. Some organic consumers have indicated a maximum willingness to pay for organic products of 10% (Boccaletti & Nardella, 2000). Other studies have shown that some consumers are willing to pay between 20% and 40% more for organic products (Chinnici, D'Amico, & Pecorino, 2002; Pelligrini & Farinello, 2009).

In a survey of Sicilian consumers, an in-person interview was used to collect socio-demographic information about respondents and qualitative information about their purchasing behavior and perception of the quality and price of organic products (Chinnici, D'Amico, & Pecorino, 2002). They performed a cluster analysis of the data, which revealed that respondents were segmented into four clusters based on the

motivations driving their purchasing decisions: health conscious, curious, price conscious, or nostalgia. The group characterized by health consciousness displayed the most deeply rooted consumption of organic products. This group had been purchasing organic products for two years or more at the time of the survey and expressed a willingness to pay 20-30% more for organic produce than conventional produce.

A survey of Italian consumers examining attitudes, behaviors, and knowledge of organic food was conducted by the Italian Ministry of Food, Agriculture, and Forestry (MIPAAF) (Pelligrini & Farinello, 2009). They found that that those consumers who regularly purchase organic foods are willing to pay a premium of up to 40% for food produced with organic farming practices over conventional practices.

Consumers shopping at large grocery stores in Northern Italy were surveyed in a study assessing willingness to pay for pesticide-free produce. The results showed that many consumers were concerned about the health risks associated with pesticide use in fruit and vegetable production; 89% of respondents indicated that they would be willing to pay more for pesticide-free produce. However, of those willing to pay more, only 36% indicated that they would be willing to pay a premium of more than 10% and only 12% of those willing to pay more would pay a premium of 20% or above (Boccaletti & Nardella, 2000)

US Consumers of Organic Products

Many studies have been conducted to identify the typical organic consumer in the United States and their willingness to pay for organic products (Govindasamy & Italia, 1999; Lin, Smith, & Huang, 2008; Nie & Zepeda, 2008; Li, Zepeda, & Gould, 2007; Onyango, Hallman, & Bellows, 2007). These studies, mostly conducted as consumer surveys, have shown that the price premiums consumers are willing to pay

for organic products range from 10% to 60% depending on the product and the characteristics of the respondents. In general, consumers of organic products are young (<30 years of age), are either of a lower income bracket or a higher than average income bracket (a bimodal distribution), are female, and have a college level of education or higher.

Age appears to be a significant factor in the likelihood of purchasing organic products and willingness to pay a premium for organic products. Studies have found that there is a negative correlation between age and both likelihood to purchase organic products and willingness to pay a premium for them. Some studies have shown that females are more likely than males to purchase higher priced organic goods. No consistent relationship exists between education level and attitudes towards organic products (Onyango, Hallman, & Bellows, 2007; Lin, Smith, & Huang, 2008; Govindasamy & Italia, 1999).

Consumer attitudes, beliefs, and knowledge are also significant predictors of likelihood to purchase organic products and higher willingness to pay. Traits associated with higher WTP and higher likelihood of consuming organic products include higher concern for food safety, high value placed on healthiness of food, interest in cooking, specific dietary needs, higher knowledge of organic logos and processes, and shopping at specialty stores and cooperatives (Govindasamy & Italia, 1999; Lin, Smith, & Huang, 2008; Nie & Zepeda, 2008; Li, Zepeda, & Gould, 2007; Onyango, Hallman, & Bellows, 2007).

In a national telephone survey observing consumer awareness and knowledge of of GMO techniques, willingness to pay for organic labeled products, and importance of

various food characteristics, it was found that 44% of respondents were regular purchasers of organic foods (Onyango, Hallman, & Bellows, 2007). In terms of likelihood of regularly purchasing organic foods, females were 8% more likely than males, those below the age of 33 were 7% more likely than older respondents, those with college degrees were 6% more likely than those without, and those who identified as liberal in their political views were 12% more likely than those who identified as conservative. Those who said that the naturalness of a product was important or extremely important were between 13% and 35% more likely than those who said naturalness was not important to regularly purchase organic foods. Respondents who said they followed a vegetarian or vegan diet were between 8% and 20% more likely to regularly purchase organic foods than those who did not follow one of these diets. Those who placed a higher level of importance on US production of their food were 4% more likely to be regular purchasers.

In a study of consumers' willingness to pay for various fruits and vegetables, organic produce commands anywhere from a 15% to 60% price premium over conventional produce (Lin, Smith, & Huang, 2008). Higher income households were generally more likely to purchase higher priced produce than lower income households and those households with household heads below the age of 40 will generally purchase higher priced produce than those above 40 years old. This study found no significant relationship between education and willingness to pay for organic products, however smaller households tend to purchase organic products more regularly and are willing to pay higher prices for them.

A cluster analysis of US food shoppers segmented respondents into 4 categories based on shopping methods, purchasing motives, environmental knowledge/concerns, socio-demographic characteristics (Nie & Zepeda, 2008). It found that those shoppers who are the most regular purchasers of organic foods frequently shop at specialty stores, pay close attention to food labels, and place a high value on healthiness of food, food safety, freshness, and taste. They have an interest in cooking and frequently do so, they tend to follow specific dietary needs for illness or fitness related concerns, and they place little importance on brand names or food convenience. They have a high level of organic food knowledge and participate in environmentally friendly activities.

Another national study of US food shoppers analyzed regularity of organic food purchases as a function of consumer characteristics such as income, demographics, attitude and knowledge of organic products, buying behavior, and region using results from a phone and mail survey conducted by the University of Wisconsin's Study of Food Buying (Li, Zepeda, & Gould, 2007). The study found that demographic variables such as age, education, household size, and gender had little impact on the regularity of organic food purchases. The characteristics of shoppers that had the largest impact on regularity of organic food purchases had to do with attitudes and knowledge about organic products. Specifically, awareness and familiarity of the USDA organic logo was associated with a 16.7% increase in frequency of organic food purchases over those who were not familiar with the label. Those who believed that organic foods are more nutritious than conventional foods purchased organic foods with a 15.9% higher frequency than those who did not share that belief. Respondents who very much enjoy cooking purchase organic foods with a 9% higher frequency that those who do not enjoy

cooking. The study also found that consumers who shop at cooperatives and health food stores made organic food purchases with 16.3% and 28.7% higher frequency than those who did not shop at those venues, respectively.

A survey of shoppers at grocery outlets in New Jersey was used to examine the characteristics of consumers willing to pay a premium of 10% for organic products (Govindasamy & Italia, 1999). Smaller, higher-earning households (>$70,000) with a female knowledgeable of alternative agriculture as the main shopper are the most likely to pay a premium for organic foods. Specifically, males were 12% less likely than females to pay the premium. Households earning less than $30,000 annually were 16% less likely than households in the $70,000+ income bracket to pay the premium and households in the $30,000 to $49,000 income bracket were 26% less likely to pay the premium. Those under the age of 36, those between the ages of 36 and 50, and those between the ages of 51 and 65 were 52%, 38%, and 28% more likely to pay the price premium than those above 65 years old, respectively. Increased levels of education correspond to a decreased likelihood of paying the 10% premium, with those having attended college or graduate school being 18% less likely to pay the premium than those with a high school level of education. Household size also showed a negative relationship with willingness to pay. Each additional household member decreased the likelihood of paying the premium by 8%.

Organic Price Premiums

In most cases, organic production is more costly than conventional production. Greater labor inputs, lower production per unit of land, greater diversity of enterprises, the need for specialized equipment, limits to economies of scale, and incurrence of certification costs can all increase overall production costs. The higher costs are

passed on to consumers in the form of higher prices, so it is critical that consumers are able to identify organic products, are aware of the benefits associated with organic products, and are willing to pay a premium for them.

From a production standpoint, organic conversion is being considered and carried out by a growing number of wine producers. A recent survey of Italian wineries found that 17% were in the process of converting to organic production, despite the higher costs associated with production and certification and the lower productiveness of organic methods (Castellini, Mauracher, Procidano, & Sacchi, 2013).

However, the ability of certain products to command price premiums is not entirely clear, and this is certainly the case with organic wines. Studies have shown that wine consumers express positive attitudes towards organic wines and indicate that they would be willing to pay higher prices for them (Brugarolas Mollá-Bauzá, Martínez-Carrasco, Martínez-Poveda, Rico Pérez, 2005; Forbes, Cohen, Cullen, Wratten, & Fountain, 2009; Remaud, Mueller, Chvyl, & Lockshin, 2008). However, in one study of California wines in the US market (discussed in more detail in the review of literature) it was found that that the indication of organic status on a wine bottle is linked to lower market prices, whereas organic certification alone without use of organic labeling results in price premiums (Delmas & Grant, 2010).

This thesis makes use of the fact that prior to 2012, there were no official regulations concerning the labeling of organic wines in the European Union. Wines were being produced organically (according to independent certifiers) but organic winemakers were unable to advertise this in a way that consumers could easily understand. Wines could be labeled as “made from organic grapes”, but could not

contain the EU organic logo on the label. Using a hedonic price model for Tuscan red wines, this study examines whether or not organic wines were still able to command price premiums despite the lack of a uniform label. For the same bottles of wine, the relationship between price and organic status is estimated for both the US and EU wine markets. To the best of our knowledge, this is the first time that such a comparative study has been done. The results yield valuable insights for current organic wine producers, wine producers considering converting to organic growing practices, wine merchants, and policy makers.

The following chapter discusses literature relevant to this study, including consumer attitudes towards organic products and specifically organic wines, other uses of hedonic price models to examine wine prices, and the validity of using hedonic price models to study wine. Chapter three will discuss the data used for this study and the methods used to produce a hedonic price model for Tuscan wines. Chapter four will summarize the results, and chapter five will discuss conclusions drawn from the results as well as limitations to this study and areas for future investigation.

CHAPTER 2
REVIEW OF LITERATURE

General Attitudes Towards Organic Wines

Studies have been conducted to determine consumers' attitudes towards or willingness to pay for organic wines (Brugarolas Mollá-Bauzá, Martínez-Carrasco, Martínez-Poveda, & Rico Pérez, 2005; Forbes, Cohen, Cullen, Wratten, & Fountain, 2009; Remaud, Mueller, Chvyl, & Lockshin, 2008). The literature has shown that attitudes concerning organic wines are generally positive, with some consumers indicating that they would be willing to pay a premium for them, however these results differ between regions and consumer segments. Consumer knowledge and recognition of organic schemes and logos is also a barrier to organic wine acceptance.

Using a recruitment questionnaire, the ORWINE Project conducted a focus group study in Italy, France, Germany and Switzerland to identify consumers' attitudes and expectations of organic wine. This study found that participants generally had the belief that the absence of chemical additives and pesticides resulted in organic wine being healthier than non-organic wine. However, many participants also believed that organic wine did not taste as good as non-organic wine. This belief could be as a result of the absence of organic wine in specialized wine stores, which might give the impression that premium organic wines are scarce or non-existent. Participants also made suggestions regarding labeling of organic wines. One suggestion was that labels contain a list of additives that are absent in the wine making process, thereby advertising the wine's naturalness and differentiating it from conventional wines. Participants also made suggestions for strategies to regulate additive use, which included general prohibition of any additives that might be detrimental to human health,

the general prohibition of additives that affect taste and authenticity of the wine, and lower maximum levels of additives (Stolz & Schmid, 2008).

A contingent valuation study exploring Spanish wine consumers' willingness to pay for organic wine asked respondents how much more they would be willing to pay for an organic wine than a conventional wine with comparable characteristics. The authors found that respondents were willing to pay an average price premium of 17%. A lifestyle-based cluster analysis of the same data revealed a price premium range of 12-25% (Brugarolas Mollá-Bauzá, Martínez-Carrasco, Martínez-Poveda, Rico Pérez, 2005).

A study of New Zealand shoppers' analyzed attitudes regarding environmentally sustainable wines using a structured questionnaire. The authors found that 75% of respondents would prefer to drink wines made using environmentally sustainable practices, and 72% indicated an intention to purchase a sustainable wine over a conventionally grown wine. The study also found that 93% of respondents indicated a desire to see labels containing information about the environmental qualities of the wine. Among respondents, 73% indicated that they would be willing to pay more for an environmentally sustainable wine, with roughly two thirds saying they would be willing to pay a price premium of 5-11% (Forbes, Cohen, Cullen, Wratten, & Fountain, 2009).

A study of how Australian consumers value organic production practices relative to other wine traits including price, region of origin, and environmental claims (environmentally responsible and carbon neutral) used a discrete choice experiment and found that the organic attribute had the lowest level of importance, accounting for only 3% of the importance for wine choice. Price carried the highest importance with

65% while the region of origin and environmental claim carried 17% and 14% of the importance, respectively. A latent class model which segmented the respondents into groups characterized by price sensitivity, concern for the environment, preference for organics, and regional preference did not produce results that varied greatly from the overall analysis in terms of relative organic importance. The class that was characterized by environmental concern and preference for organics gave the organic claim attribute a 9% level of importance. The authors conclude that only a small segment of wine consumers (14%) in the Australian wine market are willing to pay a 22% price premium for organic wines (Remaud, Mueller, Chvyl, & Lockshin, 2008).

Wine Price Hedonic Models

It is possible to determine the relative effects of wine characteristics on the price of individual wines using hedonic price analysis. This form of analysis examines the price of a product as a function of its endogenous characteristics or attributes in a perfectly competitive market (Rosen, 1974). A common use of hedonic pricing is the estimation of the price of a home as a function of its attributes (square footage, number of rooms, neighborhood characteristics, etc.). Hedonic price analysis has been used to estimate wine price as a function of the wine's characteristics in many studies (Oczkowski, 1994; Combris, Lecocq, &Visser, 1997; Angulo, Gil, Gracia, & Sanchez, 2000; Bombrun & Sumner, 2003; Benfratello, Piacenza, & Sacchetto, 2004; Costanigro, McCluskey, & Mittelhammer, 2007; Brentari & Levaggi, 2011). However, very few studies consider the effects of organic status on price (Delmas & Grant, 2008).

Most hedonic price studies for wine have used data concerning wines from one country or one particular region and have used, in most cases, objective independent variables. These variables can be derived from the label itself, such as region of origin,

grape varietal, and vintage. Objective characteristics have been shown to be better predictors of price than sensory characteristics such as taste, aroma, tannic acidity, and body (Lecocq & Visser, 2006; Brentari & Levaggi, 2011; Benfratello, Piacenza, & Sacchetto, 2004; Combris, Lecocq, & Visser, 1997). Wine scores, such as those reported by Wine Spectator, Wine Advocate, or other wine rating sources, are also included in many hedonic price studies, as these scores are commonly indicated in retail settings. However, the impact of these scores on price varies among different studies (Bombrun & Sumner, 2003; Costanigro, McCluskey, & Mittelhammer, 2007). A critical part of Rosen's hedonic framework is the exclusion of exogenous variables in the model. Wine raters weigh all the sensory characteristics of a wine to determine the rating it is given, so rating is a function of those qualities and therefore cannot be considered an endogenous characteristic. Some studies have examined rating as a dependent variable to determine the effect of wine characteristics on rating scores. A study estimating a hedonic price model and a rating model for 519 Bordeaux wines found that sensory characteristics are responsible for the majority of variance in rating but had little impact on price. This study included both objective and subjective characteristics as variables and found that the objective characteristics made up the majority of the significant price determinants. However, results from the rating model showed the sensory characteristics made up the majority of the significant rating determinants (Combris, Lecocq, &Visser, 1997).

Oczkowski (1994) found that, in the Australian wine market, grape varietal has the largest impact on price, with an increase in price of 55% for sparkling wine, and an increase of roughly 25% for sweet white wines, Pinot Noir, and Vintage Port compared

to the average price of wines used in the study. However, this appears to be a result that is specific to Australian wines; Angulo et al. (2000) found in their hedonic price model of Spanish wines, that region of origin and vintage were the two most influential in determining price among the variables they tested. Grape varietal held no significant effect on price. Bombrun and Sumner (2003) found in their hedonic model of Californian wine prices that 72% of the price variation could be explained by objective characteristics, with the most influential being appellation and vintage. They too found that grape varietal was generally less important than other variables.

A study examining the role of quality and reputation in determining the price of wines from Bordeaux developed five price models each using different combinations of information available to consumers (Landon & Smith, 1997). The study found that a model employing individual winery reputation and collective reputation as variables was the best at determining price. The individual winery reputation variable was represented by classification derived from long-term Wine Spectator quality ratings as well as a classification of Bordeaux producers by the wine rater Robert Parker. The collective reputation variables include regional appellation designations in addition to industry determined quality classifications. Bordeaux quality classifications group producers into classes from First Growth (highest quality) to Fifth Growth (lowest quality). Producers are also designated into region-specific quality classes including St.-Emilion Premier Grand Cru Class, St.-Emilion Cru Class, Graves Cru Class, Cru Grand Bourgeois, and Cru Bourgeois. This study concludes that winery and collective reputation are the leading price determinants in the market for Bordeaux wines.

Costanigro, McCluskey, & Mittelhammer (2007) examined California and Washington red wines using a hedonic price model and found that the effects of attributes vary across price categories. In their analysis, wines were segmented into commercial, semi-premium, premium, and ultra-premium groups designated by price. In addition to a pooled price model, they performed individual analyses of each of these categories. The pooled model showed that regional appellations command price premiums over wines labeled only with the state of origin. The segmented models showed that the price effect of rating was highest in the ultra premium category and decreased in magnitude with each lower price segment. The importance of grape varietal varied across segments as well. Merlots commanded the highest price premium in the commercial segment while Cabernet Sauvignon and Pinot Noir commanded the highest price premiums in the ultra-premium segment. This study shows that the relative importance of wine attributes is not consistent across all price segments, so it can therefore be important to examine each segment individually.

Hedonic Price Models of Italian Wines

This thesis focuses on Italian wines, which make up the second largest share of wines produced behind France (FAO, 2014). The following studies specifically analyze Italian wines. Findings of these studies suggest that objective label characteristics, particularly winery and regional reputation, play a large role in determining the price of wine in Italy.

Brentari and Levaggi (2011) examined Italian wines segmented by their distribution channels and found that, in a model only including label characteristics, 78% of total price variance was explained by the variables. In a separate model including only sensory characteristics, only 35% of price variance was explained by the variables.

In a region-specific study of Barolo and Barbaresco wines from the Piedmont region of Italy, winery and region reputation were found to be more influential price determinants than the sensory characteristics, which play a smaller role in driving market prices (Benfratello, Piacenza, & Sacchetto, 2004).

Hedonic Price Models of Organic Wines

Some winemakers produce organically certified wine but choose not to put an organic certification label on the bottle, while others both certify and label their wine as organic. A study of Californian wines finds that these two strategies, while sequential and closely related, have nearly opposite price effects (Delmas & Grant, 2008). Their analysis shows that wines produced by wineries that have undergone organic certification but do not advertise their certification on their labels command a 13% price premium over conventional, non-organic wines. The inclusion of organic certification information on wine labels has an opposite price effect, reducing price by 20% below conventional, non-organic wine. The authors believe that organic certification can improve wineries' reputations through access to trade organizations and that certification results in higher quality wines. This theory is support by a second analysis of determinants of wine quality, which showed that rating scores increased with certification. They attribute the counterintuitive result pertaining to labeling to the consumer's general lack of knowledge about organic wines and organic wine labels and a belief that organic wines are of inferior quality.

Criticism of the Hedonic Price Model for Wine

The application of the hedonic price model for wine research is not without criticism. Unwin (1999) examined previous studies employing hedonic regression and suggested that the model be abandoned in future wine price studies for a number of

reasons. The paper discusses the issues of multicollinearity between independent variables, the treatment of wine ratings as an independent variable instead of being considered an endogenous variable, and the wine market being treated as purely competitive. Unwin also argues that the research is bounded by the availability of the data and that the unavailability and subsequent disregard of other potentially significant variables does not coincide with theoretical foundations. Furthermore, he argues that consumers do not have access to or fully understand the explanatory variables used in the model, and it is therefore a poor predictor of consumer behavior.

Thrane (2004) refutes Unwin's analysis by arguing that multicollinearity is a problem that is not specific to wine research, but is in fact a problem that spans many fields of statistical research and can be accounted for through the proper use of analytical tools. He discusses the methods that can be used to deal with multivariate models with endogenous variables, such as a hierarchal regression or instrumental variable procedures and shows that there is evidence that pure competition, or a similar market state, is not an unreasonable assumption for the wine market. Oczkowski (1994) found that the state of the wine market in Australia could be considered close to one of perfect competition. Thrane also believes that data-driven research is also not a trait that is specific to wine research but instead is a common problem in general hedonic price modeling. He also makes the argument that consumer knowledge and the relevance of these types of models have less to do with the methods being employed and more to do with the lack of communication between researchers and wine consumers and that consumer behavior cannot be predicted with models based on supply-oriented explanatory variables.

Information Provision

Organic wine producer's prohibition from using the EU organic logo on their wine labels before 2012 has left a gap in the provision of information on Italian wine labels prior to that year. Wine consumers tend to exhibit a high demand for information about their products, and their purchasing decisions are shaped by the provision of this information (Dimara & Skuras, 2005, Boatto, Defrancesco, & Trestini, 2011). This suggests that wine labels should provide pertinent information to consumers in order to effectively differentiate products. Information provision, particularly on the topic of environmental attributes, is an important aspect of consumer preferences and their purchasing decisions and is influential in increasing willingness to pay for organic products (Leire & Thidell, 2005, Johnston, Wessells, Donath, & Asche, 2001, Loureiro, 2003; Loureiro& Lotade, 2005, Didier & Lucie, 2008). Purchase decisions by wine consumers in particular are largely guided by label information (Thomas & Pickering, 2003).

Common findings among previous hedonic price studies (discussed above in this chapter) are that objective characteristics such as region of origin and vintage (year of production) play a large role in determining the price of wine. Winery reputation is also a highly important determinant of wine price, particularly in Italy. In general, consumers are open to the idea of organic wines, but perceptions of organic wines are still somewhat negative. While many consumers have indicated that they are willing to pay a premium for organic wines, others have expressed a belief that organic wines are of a lesser quality than conventionally produced wines. The provision of information is a critical aspect of the marketing of organics products, and wine consumers have

expressed a desire to see more informative labeling on wine labels regarding production practices and additives.

The inability of Italian producers of organic wines to label their products with widely known environmental signals may have left them unable to take advantage of the potential benefits of organic status. However, as Delmas and Grant (2008) found, it is possible that wine producers could still have reaped the benefits of organic certification without the use of the organic label. To examine if organic wine producers in Italy were commanding price premiums despite their inability to use the EU organic logo, we have performed a hedonic price analysis of Tuscan red wines including a variable for organic status. Using data for Tuscan red wines, this study examines wines from a prominent Italian wine-growing region that, to our knowledge, has never been studied using the hedonic pricing method. Our study also contributes to the limited literature on price effects of organic wine certification and it has important managerial implications for wine producers considering converting to organic production and seeking organic certification.

CHAPTER 3
DATA AND METHODS

Dataset

The dataset for our study consists of 631 individual premium red wines from 60 wineries in the Tuscany region of Italy. The dataset creation process started with a list of wines available through a premium wine wholesaler called WineTip. The list only had data on winery name, wine name/vintage, general region of origin (Tuscany, Piedmont, etc), and wholesale price. This list was missing many vintages for each wine, and did not contain retail price values, which were not only more relevant to the study, but were also available for the wines added to the dataset. Wholesale price was therefore replaced with retail price. Variables added to the dataset include rating, organic status, and current retail price in both US and Italian markets. From the original list, wines were added and removed based on availability of the necessary variables.

To obtain the current price data, grape varietal, classification/appellation of origin, and rating for wines added to the original list, we utilized the wine reference website Vinopedia.com. This site lists all online retailers offering each wine and lists the individual prices for each retailer in addition to the characteristics listed. For our dataset, we used the average current price for each wine, separately examining US retailers and Italian retailers, to give us an average current retail price for both markets.

When varietal, appellation of origin, or rating score data were not available through Vinopedia.com, other sources such as Cellartracker.com and individual producer websites were used. Organic status was obtained by referencing producer websites and by searching through a variety of organic certification databases including ICEA, Demeter, and AIAB.

Summary Statistics

Within the dataset, median wine price in the Italian market is €42.50 ($58.33) and median US price is $82.75 (€60.30).[1] Using current price has the advantage of representing actual market price paid by consumers instead of release price, which is the manufacturer's suggested retail price. Only 446 of the wines sampled have a US price in addition to the Italian price. Multiple ratings sources were included in the dataset: Robert Parker's Wine Advocate, the Wine Spectator, Steven Tanzer's International Wine Cellar, the Wine Enthusiast, and the Cellar Tracker average user score (Table 3-1).[2]

Table 3-1. Mean Price in Each Market and Mean Rating

Variable	N	Mean	Std. Dev.	Minimum	Maximum
Italian Price (€)	631	59.41	59.48	8.00	630.00
US Price ($)	446	112.21	103.74	18.00	972.00
Rating					
Average	631	91.97	2.54	83.00	98.00
Cellar Tracker	509	91.25	1.85	82.00	99.00
Wine Enthusiast	274	92.38	2.88	80.00	100.00
Steven Tanzer	280	91.29	2.21	86.00	97.00
Wine Spectator	554	91.61	2.82	83.00	100.00
Robert Parker	533	92.26	2.55	85.00	100.00

Vintages range from 1999 to 2008. The years 2000, 2002, and 2008 are the least represented, with 7.8%, 3.5% and 7.8% of the data, respectively. The other vintages are more or less evenly distributed with each representing between 9-14% of

[1] Exchange rates calculated using current rate of 1 euro = 1.37 US dollars.

[2] Rating scores are on a scale of 50-100. All wine raters follow a similar format: 96-100 is an extraordinary wine; 90-95 is an outstanding wine of superior quality; 80-89 is a good or very good wine with above average qualities; 75-79 is a mediocre or average wine with some flaws; 70-74 is a below average wine; and below 70 is a very poor wine.

the data (Table 3-2). The vintage represents the year of harvest. Wines are typically released into the market 1-2 years after harvest.

Table 3-2. Vintage Frequency

Variable	Frequency	Percent	Cumulative Freq.	Cumulative Percent
1999	57	9.03	57	9.03
2000	49	7.77	106	16.80
2001	66	10.46	172	27.26
2002	22	3.49	194	30.74
2003	71	11.25	265	42.00
2004	83	13.15	348	55.15
2005	68	10.78	416	65.93
2006	87	13.79	503	79.71
2007	79	12.52	582	92.23
2008	49	7.77	631	100.00

Many grape varietals are represented in these data, with sangiovese comprising 48.5% of the wines, other single varitals (including cabernet sauvignon, cabernet franc, merlot, and syrah) comprising 17.1%, with the remaining 34.4% being made up of various blends. Regarding appellation of origin, 34.6% of wines are classified as DOCG (controlled designation of origin guaranteed), 10.9% are classified as DOC (controlled designation of origin), and 54.5% are classified as IGT (*Indicazione Geografica Tipica*).[3] Uncertified organic wines made up 17.4% of the data and certified organic wines made up 10.6%, with the balance being conventional wines making up 72.0% of the data (Table 3-3).

[3] The Italian appellation classification system is meant to signify levels of quality that exceed the quality of wines sold as *vino da tavola*, meaning table wine. DOC represents quality wines with controlled production standards. It was considered to be awarded quite liberally and therefore did not enjoy much credibility. DOCG represents the highest quality appellations and is designated to only the finest Italian wines to identify and reward them for their superior quality. These appellations are not only controlled by strict production standards, but are also “guaranteed”. The IGT classification was established in response to the much criticized DOC/DOCG designations to represent high quality wines that did not follow the same strict production standards, particularly standards concerning allowable blending or grape varietals. Some of Italy’s most expensive and highly sought-after wines are designated as IGT (Robinson, 1999).

Table 3-3. Frequencies – Grape Varietal, Appellation of Origin, and Organic Status

Variable	Frequency	Percent	Cumulative Freq.	Cumulative %
Varietal				
Sangiovese	306	48.49	306	48.49
Blend	217	34.39	523	82.88
Other single varietal	108	17.12	631	100.00
Appellation				
DOCG	218	34.55	218	34.55
DOC	69	10.94	287	45.48
IGT	344	54.52	631	100.00
Organic status				
Conventional	454	71.95	454	71.95
Uncertified	110	17.43	564	89.38
Certified	67	10.62	631	100.00

Using SAS statistical software and following the traditional hedonic model, we have modeled both current Italian price and current US price as a function of vintage, grape varietal, appellation of origin, rating, and organic status. *Price* and *rating* were treated as continuous variables, while *grape varietal, appellation of origin, organic status*, and *vintage* were treated as discrete variables. By including a model of current US price in addition to the current Italian price, we are able to examine the differences in effects between the two markets. This allows us to determine if US consumers of Italian wines value organic wines differently than Italian consumers of the same wines.

In addition to a unified model where all 631 wines are included in the regression with the above-listed variables, a model containing interaction terms between *organic status* and *varietal, vintage*, and *appellation* is estimated, allowing us to determine if the effect of the *organic status* depends on any of the other variables. Quartile price segment models are also estimated to examine the effects of wine characteristics in different price categories. The first quartile represents the lowest priced wines in the dataset and the wine prices raise with each next quartile.

Using White's test for heteroscedasticity, the null hypothesis of no heteroscedasticity is rejected in most models. To account for heteroscedasticity, the models are estimated using a Heteroscedasticity-Consistent Covariance Matrix.

The full regression specification to model the price of wine *i* in market *j* is as follows:

$$\ln Price_{ij} = \alpha_0 + \mu \ln(Rating) + \sum_{k=2}^{3} \beta_k Organic_k + \sum_{k=2}^{3} \gamma_k Varietal_k + \sum_{k=2}^{3} \lambda_k Appellation_k + \sum_{k=2}^{10} \delta_k Vintage_k$$

For the regression specification including interaction variables, the following terms are added:

$$+ \sum_{k=2}^{3} \sum_{l=2}^{3} \theta_{kl} Organic_k * Varietal_l + \sum_{k=2}^{3} \sum_{l=2}^{3} \sigma_{kl} Organic_k * Appellation_l + \sum_{k=2}^{3} \sum_{l=2}^{10} \eta_{kl} Organic_k * Vintage_l$$

CHAPTER 4
RESULTS

Models with Individual Ratings and Average Rating

We first determine whether the overall model should include each individual rating score or just the average score. The results for the US price and Italian price models are shown in Table 4-1 and Table 4-2, respectively, where a different rating is used in each model. R-squared values for these regressions indicate that the models using average rating scores provide the best fit for both US and Italian price. Models using Cellar Tracker (CT) scores yield the lowest R-squared values for both prices, while the models using Wine Enthusiast (WE), Steven Tanzer (ST), Wine Spectator (WS), and Robert Parker (RP) explain roughly the same level of variance in log price for both markets.

Table 4-1. Effects of wine characteristics on US price with average and individual rating scores

ln(US Price)	Average	CT	WE	ST	WS	RP
Constant	-65.66**	0.90	-44.08**	-23.25**	-42.97**	-53.87**
ln(Rating)	15.53**	0.77*	10.73**	6.16**	10.49**	12.90**
Uncertified Org.	0.15**	0.17**	0.25**	0.10	0.20**	-0.03
Certified Organic	0.05	-0.04	0.04	-0.11	0.09	-0.03
Varietal Blend	0.19**	0.26**	0.34**	0.33**	0.22**	0.34**
Varietal Single	0.46**	0.70**	0.60**	0.87**	0.56**	0.75**
Appellation DOC	0.03	0.16	-0.04	0.14	0.14	0.05
Appellation IGT	-0.13*	-0.06	-0.30**	-0.16	-0.09	-0.22**
Vintage 2000	0.06	0.00	0.11	-0.08	0.12	0.01
Vintage 2001	0.02	0.16	0.26	0.08	0.03	0.01
Vintage 2002	0.26	-0.06	-0.17	0.15	0.32*	0.18
Vintage 2003	0.06	-0.12	0.16	-0.23	-0.14	0.00
Vintage 2004	-0.12	0.10	-0.06	0.09	-0.10	-0.11
Vintage 2005	-0.14	-0.26**	-0.28	-0.05	-0.26**	-0.07
Vintage 2006	-0.34**	-0.11	-0.18	-0.24	-0.28**	-0.34**
Vintage 2007	-0.42**	-0.3**	-0.40**	-0.40**	-0.34**	-0.47**
Vintage 2008	-0.43**	-0.43**	-0.46**	-0.80**	-0.34**	-0.48**
R-Squared	0.52	0.31	0.47	0.44	0.47	0.51
N	444	381	210	221	398	391

Notes: * and ** indicate significance at the 10% and 5% level, respectively.

Table 4-2. Effects of wine characteristics on Italian price with average and individual rating scores

ln(Italian Price)	Average	CT	WE	ST	WS	RP
Constant	-68.31**	0.88	-50.38**	-29.52**	-43.08**	-50.69**
ln(Rating)	15.98**	0.65	11.97**	7.41**	10.39**	12.07**
Uncertified Org.	0.00	0.10	0.10	-0.11	0.07	-0.14**
Certified Organic	-0.16**	-0.20**	-0.06	-0.29**	-0.16**	-0.25**
Varietal Blend	0.11**	0.21**	0.36**	0.24**	0.12**	0.26**
Varietal Single	0.43**	0.78**	0.59**	0.91**	0.56**	0.72**
Appellation DOC	0.09	0.15	-0.07	0.13	0.20**	0.05
Appellation IGT	-0.04	-0.02	-0.27**	-0.05	-0.01	-0.14**
Vintage 2000	0.13	-0.02	0.36**	-0.18	0.12	0.12
Vintage 2001	-0.04	-0.01	0.22	0.30*	-0.04	-0.07
Vintage 2002	0.36**	-0.04	0.20	0.07	0.24	0.30**
Vintage 2003	0.04	-0.17*	0.35**	-0.19	-0.09	-0.05
Vintage 2004	-0.17**	-0.09	-0.02	-0.02	-0.14	-0.18*
Vintage 2005	-0.12	-0.30**	-0.06	-0.06	-0.24**	-0.09
Vintage 2006	-0.32**	-0.19*	-0.07	-0.22*	-0.29**	-0.29**
Vintage 2007	-0.42**	-0.38**	-0.28**	-0.41**	-0.36**	-0.44**
Vintage 2008	-0.38**	-0.43**	-0.36**	-0.69**	-0.29**	-0.46**
R-Squared	0.50	0.29	0.48	0.44	0.44	0.46
N	629	509	274	279	554	533

Notes: * and ** indicate significance at the 10% and 5% level, respectively.

Because average rating models yield the best fit in both markets and using individual scores may introduce bias of individual rating agents, the models with average rating scores will be used for our analysis. Results from these models show that *rating* has a positive and significant correlation with both US and Italian price, with a 1% increase in *rating* associated with a 15.53% and 15.98% increase in *price*, respectively. In the US market, *uncertified organic* wines command a 15% higher price than *conventional* wines, however in the Italian market, there is no significant impact. Interestingly, the results are nearly opposite for *certified organic* wines. In the US market, *certified organic* has no significant impact on price, but in the Italian market, *certified organic* is associated with a 16% lower price than conventional wines.

There is no significant price difference between *DOC* and *DOCG* designated wines in either market, however, in the US market, *IGT* designated wine receives a 13% lower price than *DOCG* wines. In the both the US and Italian markets, the price of *single varietals* is higher than the base variety of *sangiovese* by 46% and 43% respectively. Prices of *blended varietals* are also significantly higher than *sangiovese* in both markets, commanding 19% and 11% price premiums in the US and Italy, respectively.

The impacts of *vintage* on *price* are consistently and significantly negative for the three most recent vintages in both markets. In the US market, wines from these vintages receive 34%, 42%, and 43% lower prices than the base category of *1999* for the *2006, 2007*, and *2008 vintages*, respectively. In the Italian market, these prices are 32%, 42%, and 38% lower than the base category for the same vintages, respectively. This is not surprising due to the perception that wines improve with age and therefore it would be expected that recent vintages would have lower prices than older, aged wines. However, what is surprising is that in the Italian market, wines from *2002* receive a significant premium of 36% above the base year, despite 2002 being one of the worst years for Tuscan wines in terms of quality. The 2002 vintage is the least represented year in the dataset, with only 22 wines from this year. The limited data for this year could explain these atypical results. In a bad year, only the best wines would be saved for 10 years, which could be resulting in some selection bias. Wines from *2004* are shown to receive a 17% lower price than wines from the base year, despite *2004* being considered an excellent year for the region (Parker, 2013). However, this result is less

surprising given that the base year of 1999 was also considered to be an excellent year for the region and wines from 1999 have aged five more years than 2004 wines.

Price Segmented Models

To determine if the price effects of the variables included in this study varied between less and more expensive wines, we also estimated segmented price models with the data split into quartiles. Table 4-3 and Table 4-4 show the results of US and Italian price segmented models, respectively. The last column in each table represents the full price model in each market for comparison.

Price Segmented Model in the US Market

Results from the segmented price models show that the effects of wine characteristics do vary between price categories. In the US market (Table 4-3), the price of *uncertified organic* wines is 7% higher than *conventional* wines in the second quartile but is not significantly different in the other price segments. *Certified organic* wines in the first quartile received a price that is 13% lower than *conventional* wines. *Certified organic* has no significant impact in the other segments. We see that an increase in *rating* still has a positive association in all price segments except the third quartile. The impact of a 1% increase in *rating* corresponds to a 2.74% and 2.59% increase in *price* in the first and second quartiles, respectively. The premium in the 4th quartile is much greater at 12.63%. Wines made from the *single varietals* command significantly higher prices in the second and fourth quartile with premiums of 7% and 62% above *sangiovese*, respectively, but in the third quartile the price is 11% lower than *sangiovese*. *Blended varietals* also command significantly higher prices in the second and fourth quartiles, and a significantly lower price in the third quartile.

The wines with *DOC* designation command significantly lower prices in all segments except the third. The prices of the *DOC* wines are 24%, 12%, and 46% lower than *DOCG* wines in the first, second, and fourth segments, respectively. *IGT* wines have significantly lower prices than *DOCG* in the second and fourth price segments with 6% and 47% lower prices, respectively.

Effects of *vintage* throughout the four segments are scattered and mostly insignificant, with the exception of the fourth segment, where prices of wines from *2001*, *2004, 2006, 2007*, and *2008* are significantly lower than the base year (24%, 28%, 43%, 41%, and 27%, respectively).

Table 4-3. Effects of wine characteristics on price, by price quartile, in the US market

ln(US Price)	Q1	Q2	Q3	Q4	Full
Constant	-8.50*	-7.44**	1.22	-49.71**	-65.66**
ln(Rating)	2.74**	2.59**	0.74	12.19**	15.53**
Uncertified Organic	-0.03	0.07*	0.03	-0.07	0.15**
Certified Organic	-0.13*	0.05	-0.01	-0.1	0.05
Varietal Blend	0.08	0.07**	-0.08**	0.25**	0.19**
Varietal Single	0.02	0.07**	-0.11**	0.62**	0.46**
Appellation DOC	-0.24**	-0.12**	-0.01	-0.46**	0.03
Appellation IGT	0.03	-0.06**	0.03	-0.47**	-0.13*
Vintage 2000	-0.18	-0.01	0.05	0.05	0.06
Vintage 2001	0.09	-0.03	0.04	-0.24*	0.02
Vintage 2002	-0.12	0.05	-0.04	0.23	0.26
Vintage 2003	-0.02	0.00	-0.02	-0.04	0.06
Vintage 2004	-0.06	-0.06	0.08	-0.28**	-0.12
Vintage 2005	-0.06	-0.03	0.08	-0.18	-0.14
Vintage 2006	-0.04	-0.06	0.06	-0.43**	-0.34**
Vintage 2007	-0.14	-0.08*	0.00	-0.41**	-0.42**
Vintage 2008	-0.35**	-0.09	0.04	-0.27*	-0.43**
R-Squared	0.48	0.26	0.29	0.54	0.52
N	111	112	106	115	444

Notes: * and ** indicate significance at the 10% and 5% level, respectively.

Price Segmented Model in the Italian Market

Our models of Italian wine prices segmented into quartiles (Table 4-4) yield similarly varying results. *Uncertified organic* wines receive a 23% lower price than *conventional* wines in the first quartile but receive no significant difference in the other three segments. On the other hand, *certified organic* wines receive a 7% higher price

and a 26% lower price than *conventional* wines in the second and fourth quartiles, respectively.

Table 4-4. Effects of wine characteristics on price, by price quartile, in the Italian market

ln(Italian Price)	Q1	Q2	Q3	Q4	Full
Constant	-32.06**	0.33	5.7*	-51.31**	-68.31**
ln(Rating)	7.82**	0.71*	-0.39	12.36**	15.98**
Uncertified Organic	-0.23**	0.01	-0.01	-0.07	0.00
Certified Organic	-0.01	0.07**	-0.01	-0.26*	-0.16**
Varietal Blend	0.02	-0.05**	0.04	0.17**	0.11**
Varietal Single	0.29**	0.05*	0.05	0.57**	0.43**
Appellation DOC	0.01	0.03	0.07*	-0.23**	0.09
Appellation IGT	0.00	0.04*	-0.06*	-0.36**	-0.04
Vintage 2000	0.25**	0.01	0.01	0.21	0.13
Vintage 2001	0.08	-0.04	0.04	-0.05	-0.04
Vintage 2002	0.36**	0.00	0.05	0.28	0.36**
Vintage 2003	-0.05	-0.01	0.01	0.11	0.04
Vintage 2004	-0.09	-0.02	0.04	-0.08	-0.17**
Vintage 2005	-0.01	-0.05	-0.01	0.04	-0.12
Vintage 2006	-0.06	-0.04	0.04	-0.26**	-0.32**
Vintage 2007	-0.10	-0.05	0.02	-0.20	-0.42**
Vintage 2008	-0.06	0.01	0.06	-0.23	-0.38**
R-Squared	0.45	0.22	0.15	0.46	0.50
N	134	175	161	159	629

Notes: * and ** indicate significance at the 10% and 5% level, respectively.

Rating has a significant positive association in the first, second and fourth quartiles, corresponding to a 7.82%, 0.71%, and 12.36% increase in *price* with each percentage increase in *rating*. Like the US market, the largest impact is in the fourth quartile.

Blended varietals receive 5% lower prices than *sangiovese* wines in the second quartile and 17% higher prices in the fourth quartile. Wines made from *single varietals* command significantly higher prices in all segments except the third, with premiums of 29%, 5%, and 57% over *sangiovese* wines in the first, second and fourth segments, respectively.

Appellation of origin seems to have significant impacts for the higher priced wines. *DOC* and *IGT* wines command 23% and 36% lower prices than *DOCG* wines in the fourth quartile. *DOC* wines actually receive a 7% premium over *DOCG* wines in the

third quartile, while *IGT* wines receive 4% and 6% lower prices in the second and third quartiles, respectively. Effects of *vintage* in the Italian segmented price models are largely insignificant.

Price Models with Interaction Terms

The price models with interaction terms yield similar results to those without interaction terms. Table 4-5 shows the US and Italian price models with interaction terms in the second and third column, and US and Italian price models without interaction terms in the fourth and fifth columns, respectively. Variable coefficients for the non-interacted variables are nearly identical in significance level but are slightly different in value.

Another notable difference between the Italian models is that the *certified organic* coefficient loses its significance in the interacted model, suggesting that the *single varietal* variable is driving the certified organic result in the non-interacted model. Aside from this interaction, the impact of *organic status* on *price* generally does not depend on other wine characteristics. The interaction terms show that the *2008 vintage* affects the impact of the *uncertified organic* status in both markets and the impact of the *certified organic* status on the Italian price. We also see that the interaction between *IGT* designation and the *certified organic* status in the US market has a significant positive effect on price.

Other notable differences between the US models are that the effects of all significant variables are greater in the interacted model except for *vintage*, which has lesser impacts in the interacted model. Also, the value of the coefficients for *varietal* increase and the value of coefficients for *vintage* decrease in the interacted model.

Some interactions were dropped from the model due to insufficient variation in the variables being interacted.

Table 4-5. Models of US and Italian Price Including Interaction Terms

ln(Price)	US, Int	Italian, Int	US	Italian
Constant	-65.72**	-69.48**	-65.66**	-68.31**
ln(Rating)	15.52**	16.23**	15.53**	15.98**
Uncertified Organic	0.49**	0.25	0.15**	0.00
Certified Organic	0.22	-0.14	0.05	-0.16**
Varietal Blend	0.25**	0.14**	0.19**	0.11**
Varietal Single	0.59**	0.56**	0.46**	0.43**
Appellation DOC	-0.01	0.07	0.03	0.09
Appellation IGT	-0.14**	-0.04	-0.13*	-0.04
Vintage 2000	0.06	0.14	0.06	0.13
Vintage 2001	0.00	-0.04	0.02	-0.04
Vintage 2002	0.31	0.36**	0.26	0.36**
Vintage 2003	-0.03	0.04	0.06	0.04
Vintage 2004	-0.13	-0.18*	-0.12	-0.17**
Vintage 2005	-0.06	-0.09	-0.14	-0.12
Vintage 2006	-0.30**	-0.32**	-0.34**	-0.32**
Vintage 2007	-0.31**	-0.36**	-0.42**	-0.42**
Vintage 2008	-0.27**	-0.22**	-0.43**	-0.38**
Uncertified Org.*Varietal Blend	-0.14	-0.23	0.52	0.50
Uncertified Org.*Varietal Single	-0.18	-0.45	-	-
Certified*Varietal Blend	-0.01	0.07	-	-
Certified*Varietal Single	-0.62**	-0.55**	-	-
Uncertified Org.*Appellation IGT	-0.28	0.02	-	-
Certified*Appellation DOC	0.16	-0.01	-	-
Certified*Appellation IGT	0.28*	0.05	-	-
Uncertified Org.*Vintage 2000	-0.01	-0.09	-	-
Uncertified Org.*Vintage 2001	0.14	-0.04	-	-
Uncertified Org.*Vintage 2002	-0.14	-0.01	-	-
Uncertified Org.*Vintage 2003	0.46	0.14	-	-
Uncertified Org.*Vintage 2004	0.09	0.04	-	-
Uncertified Org.*Vintage 2005	-0.25	-0.16	-	-
Uncertified Org.*Vintage 2006	-0.11	-0.07	-	-
Uncertified Org.*Vintage 2007	-0.31	-0.28	-	-
Uncertified Org.*Vintage 2008	-0.45*	-0.44*	-	-
Certified*Vintage 2000	0.12	0.10	-	-
Certified*Vintage 2001	-0.30	-	-	-
Certified*Vintage 2002	-	0.59**	-	-
Certified*Vintage 2003	-0.26	-0.10	-	-
Certified*Vintage 2004	-0.17	-0.05	-	-
Certified*Vintage 2005	-0.32	-0.02	-	-
Certified*Vintage 2006	-0.18	0.16	-	-
Certified*Vintage 2007	-0.36	0.02	-	-
Certified*Vintage 2008	-0.43	-0.29*	-	-
R-Squared	0.57	0.53	0.52	0.50
Adjusted R-Squared	0.53	0.50	0.51	0.49
N	444	629	444	629

Notes: * and ** indicate significance at the 10% and 5% level, respectively.

CHAPTER 5
DISCUSSION AND CONCLUSIONS

In order to determine the effects of organic growing practices and organic certification on the Italian and US price of Tuscan red wines, we have estimated a hedonic price model as a function of *rating, varietal, appellation of origin, vintage*, and *organic status*. Our models have produced some very interesting results.

The Italian Market

The results concerning *organic status* suggest that whether a wine is organic or not seems to have little clear and consistent association with price. When not accounting for the effects of interactions in our model, the Italian market model shows that *certified organic* wines receive a 16% lower price than *conventional* wines. However the model accounting for interaction effects shows no significant difference in price between *conventional, uncertified,* or *certified wines*, suggesting that the effects of the *certified organic* variable depend on *varietal* and *vintage*, specifically *single varietals* and the *2002* and *2008 vintages*.

The model shows that, when accounting for interaction effects, *varietal* and *vintage* have the most significant association with *price* in this market. *Blended varietals* and *single varietals* have 14% and 56% higher prices than *sangiovese*, respectively. This association between *varietal* and *price* is particularly strong for the top price quartile where *appellation* also shows a significant association with *price*. However, *appellation* is not significantly associated with *price* in the interacted model. *Vintage*, specifically the more recent vintages, has a significantly negative association with *price*, which is to be expected, as wines that are older tend to be valued higher by consumers.

The US Market

In the US market model not accounting for interaction effects, *uncertified organic* wines command 15% higher prices than *conventional* wines, yet *certified organic* wines do not command any premium over *conventional* wines. However, when accounting for interaction effects, *uncertified organic* wines command a 49% higher price than *conventional* wines while *certified organic* wines still do not command any significant price premium. Drawing comparisons to the results of Delmas and Grant (2011), we see somewhat similar results in terms of organic status. Italian wines produced organically and sold in the US market receive significant price premiums over conventional wines as long as they are not certified organic and therefore not labeled as such. It is somewhat difficult however to draw direct comparisons between the results of this study and those of Delmas and Grant, as their study went further to treat organic labeling as a separate variable altogether.

Varietal and *vintage* both have significant correlation with *price* in the US market as well. Both *single varietals* and *blended varietals* command significantly higher prices than *sangiovese* wines, with price premiums of 59% and 25%, respectively. Like the Italian models show, the association between *varietal* and *price* is greatest in the top price quartile. While *appellation* shows no significant price association in the interacted model, it does appear that *appellation* is significantly associated with *price* in the top price quartile in the US market as well. More recent vintages (*2006 – 2008*) receive significantly lower prices than the base year of *1999*, again suggesting that older wines are more highly valued by consumers.

Comparisons Between Markets and Implications

Organic status seems to have little correlation with *price* in the Italian market, whereas in the US market, *uncertified organic* wines command significantly higher prices. This should be of considerable interest to producers. Producers who sell most of their wines in domestically (in the Italian market) are not commanding the price premiums that would help offset the cost of converting to organic production or the higher cost of certifying organic production. A possible cause of this could be lack of consumer knowledge about organic practices. If consumers are unaware of the potential benefits of organic production, or are not informed that a wine is produced organically, they do not have the necessary information needed to differentiate organic wines from conventional wines. Organic wine producers would likely benefit from including information about the organic production practices on the wine label if they want to be able to command price premiums for their wines.

Those producers who sell most of their wines in the US market could certainly benefit from converting to organic production practices but should probably forgo certification since it is a costly process and does not appear to have any significant relationship with price. Organic wine producers might also benefit from forming or joining some sort of organic wine trade organization that would enable them to collectively educate consumers about organic wine.

Regardless of the market in which producers sell their wines, a common finding is that *varietal* is significantly associated with price premiums. Wines made from *single varietals* or wines that are *blended varietals* tend to receive higher prices than wines made from *sangiovese*.

The *appellation of origin* seems to have a significant price association for ultra-premium wines (wines in the top price quartile) but is of less importance for the lower priced wines.

Associations between *vintage* and *price* show that younger wines (2006 – 2008) receive significantly lower prices in both markets.

The wine *rating*, in almost all models, was positively and significantly correlated with higher wine prices, which is not an unexpected result. However what is interesting is the association of *rating* and *price* when examining the data segmented into price quartiles. We found that in both the US and Italian markets, a 1% increase in *rating* corresponded to a much higher price premium in the fourth (most expensive) quartile than in the three lesser-priced quartiles. Rating was significantly and positively correlated with price in the lowest quartile as well, but not to the same degree.

Limitations of this Study

Our study is certainly not without limitations. Our price data for both US and Italian markets came from online retailers. These prices may not accurately reflect the prices consumers are paying for wine in supermarkets or specialty wine stores, where most wine purchases are made. Furthermore, the mean price for both the US and Italian markets is considerably high, suggesting that many of the wines in our dataset are not wines purchased for casual or “everyday” consumption, but are instead either collectable wines or wines purchased for special occasions. The prices of these wines might be driven by winery name and reputation rather than the other label characteristics. The fact that consumers would ultimately have to pay shipping and packaging costs in addition to the prices used in our study further suggests that the

wines we have chosen for our dataset have additional value for consumers that are is not being captured by our models.

Most wines were available through a number of online retailers at different prices, as retailers have different markups on products. To remove some of the potential bias introduced by individual retailers, we used the average of those prices in our dataset. However some wines were only available through one or two retailers. In these cases, retailer bias could not be averaged out.

It is also worth noting that the organic status of a wine could also be considered a production variable instead of a label characteristic, particularly in the case of wine produced in the EU prior to organic labeling regulations. It might therefore be appropriate to include the organic variable in a price model that accounts for other production level characteristics, such as vineyard size, cases produced, number of employees, winery age, etc.

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BIOGRAPHICAL SKETCH

Lane Abraben was born, raised, and educated in Gainesville, Florida. He received a Bachelor of Science in Business Administration and a Master of Science in Food and Resource Economics from the University of Florida. He has also received a Master of Science in Rural Development from the University of Gent in Belgium. His interest in organic food production and his extracurricular interest in wine converged to become the basis of his master's thesis on price premiums for organic wines.