HEDONIC PRICE ANALYSIS OF COOL CLIMATE WINES IN SELECTED REGIONS

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Jennifer Leigh Ritchie

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COMMITTEE MEMBERSHIP

TITLE:	Hedonic Price Analysis of Cool Climate Wines in Selected Regions
AUTHOR:	Jennifer Leigh Ritchie
DATE SUBMITTED:	August 2011
COMMITTEE CHAIR:	Christiane Schroeter, Ph.D., Cal Poly San Luis Obispo
COMMITTEE MEMBER:	Jennifer James, Ph.D., Cal Poly San Luis Obispo
COMMITTEE MEMBER:	Bradley Rickard, Ph.D., Cornell University

ABSTRACT

Hedonic Price Analysis of Cool Climates Wines in Selected Regions

Jennifer Leigh Ritchie

Many economists have estimated hedonic price models for wine. The price of wine is thought to represent the various characteristics that differentiate each bottle, assuming that the majority of consumers use price as a signal of quality. The objective of this paper is to identify and examine what factors impact cool climate wine varietals by region based on various attributes. It uses two datasets, one from the *Wine Spectator* and the other from *Beverages and More*, an outlet of a liquor store chain in San Luis Obispo, California. The analysis aims to determine which variables impact the price of wine and by what magnitude. Variables include variety, region, quality ratings by price category, number of cases and gallons produced, vintage, alcohol content, cork type, and various label attributes.

This study is unique as hedonic price analysis is used as an extension of a unique product category. Past literature has shown a growing interest in cool climate wine production and that cool climate regions are preferred to other regions.

This study examines an emerging varietal, Riesling, in addition to other popular varieties including Chardonnay, Sauvignon Blanc and Pinot Noir. As Riesling thrives in cooler climates, it is becoming an increasingly popular variety among both producers and consumers.

Unlike other studies that tend to incorporate mostly New World regions, this study is expanded to include more regions and other attributes that may be important

when making wine purchasing decisions. It also considers the possibility that there is a consumer demand difference between Old World and New World cool climate regions. Specifically for both red and white varietals, New World wines have increased in volume sales, whereas Old World wines volume sales have decreased. In addition, many economists have estimated hedonic price functions using expert scores. However, this study is unique to others as it expands the use of quality ratings by including interaction terms to express both wine-quality and price-quality relationships.

The study confirms the results of previous literature, concluding that the majority of all variables identified significantly influence the price of wine. Previous economic and statistic research related to wine focuses on topics that are important for warm climate wines, while issues concerning cool climate wines are understudied. Thus, there is a need for research that focuses exclusively on cool climate wines.

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Chapter 1

INTRODUCTION

Overall, total wine sales in the United States slowed considerably in 2008 following six consecutive years of strong volume and value growth (GMID 2010e). Despite the economic slowdown, wine volume sales and value growth still managed respectable annual gains. Global wine sales accounted for $256.4 billion. In addition, U.S. wine sales increased by four percent and were valued at $34.5 billion. Old World countries, primarily in Western Europe, remain as the dominant market for wine consumption, accounting for almost half of both total volume and total sales. As Old World wines lead the way in terms of volume, New World wine, particularly from the United States, is quickly gaining market share. Its rapid emergence occurred due to its dynamic offerings. As consumers look for simplified decision-making options, convenience and value for money, New World wines are becoming increasingly more popular (GMID 2010e).

Although U.S. wine is becoming more popular, the U.S. wine industry has already experienced three significant changes due to the current economic situation. First, consumers began to substitute high-priced import bottles for lower-priced domestic bottles. Secondly, there has been a significant decrease in the purchases of wine bottles priced $20 or above, and a substantial increase in the purchase of wine bottles below $6 (Scott 2009). Lastly, with the greatest influence being price, the market for New World wines has expanded.

The industry is also seeing an evolution of the typical wine consumer; the new consumer is younger and not as concerned with established wine traditions. American wine consumers are now becoming more adventurous and are more willing to explore new wines. “Yuppies” are more willing to try varietal wines such as Pinot Grigio, Riesling and Pinot Noir as these varieties have become more fashionable in the United States. In addition, the growing trend of health awareness has attracted many new wine consumers, especially of red wine, due to its perceived health benefits (GMID 2010d).

With many more consumers willing to try new wines, U.S. wine consumption has continued to increase. It is predicted that the U.S. wine industry will overtake Italy as the world’s biggest wine consumer by 2012 (GMID 2010f). Overall, most of the wine consumed in the United States is produced domestically, with 90 percent produced in California (GMID 2010d). In regards to specific cool climate varietals, Chardonnay, Riesling, Sauvignon Blanc, and Pinot Noir contributed greatly to overall wine sales. From 2005 to 2010, sales of Riesling increased from 3.0 to 5.7 percent and Pinot Noir increased from 3.1 percent to 5.0 percent. Sauvignon Blanc and Chardonnay varietals remained steady at approximately 7.0 percent and 50.0 percent, respectively (GMID 2010d).

California has become the fourth leading wine producer in the world. California ranks behind Old World production countries France, Italy and Spain (Wine Institute 2008). An important influence on the expansion of New World wines is the success of commercial vinifera vineyards in cool climate regions, which has allowed the entrance of new emerging varietal wines in the market.

Wine production has recently started to expand into cooler districts such as New York and Canada. New York viticulturists found that modifying varieties would allow new varieties of higher quality to now be grown in New York. In Canada, grape growers realized that if they bred grapes that were disease-resistant and cold tolerant, they could create improved hybrids and grow grapes that were subject to fewer disease problems. Furthermore, they found that the same varieties that could be grown in warm climate regions could now be grown in new locations (Jackson and Schuster 1987). With wine quality improving in cooler regions, U.S. wine production increased while shifting the focus from Old World to New World wines. Wine is grown in each of the contiguous 48 states, which has fuelled an interest in many cool climate wine varietals, most notably Riesling. Riesling is an example of a new emerging variety that is growing in popularity, quenching the thirst of many wine consumers (Wine Institute 2009a).

From wine grape acreage to the annual crush to total sales, a new crop of varietal wines including Riesling, Pinot Grigio and Pinot Noir have experienced the most growth in the percent of total volume sales between 2004 and 2009 (Wine Institute 2009a). Riesling is important to evaluate as total sales increased by more than 50 percent during the time period 2004 to 2009, and because it is a new varietal quickly emerging into the market.

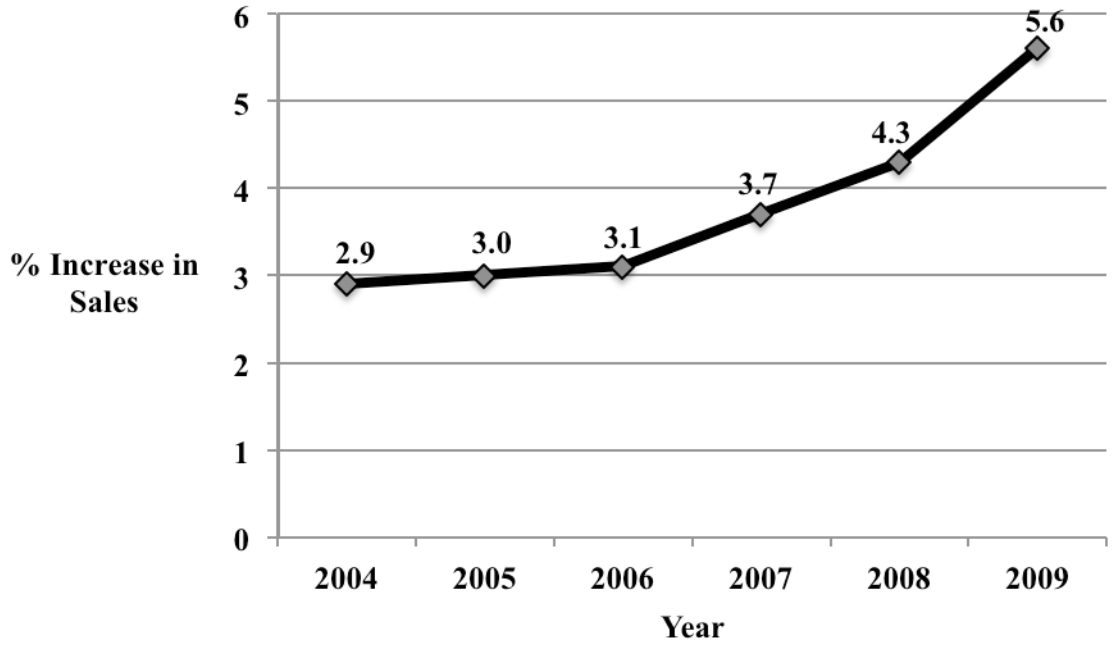

Figure 1: Percentage Dollar Increase in U.S. Riesling Sales from 2004-2009
Source: Wine-USA Industry Report-Global Market Information Database 2009

Riesling originated in the Rhine region of Germany in 1435, where production expanded into the Alsace region of France in 1477. In the late 19th century, German immigrants brought Riesling vines into the United States, where New York was one of the earliest producers of Rieslings. California production began in California by 1857, followed by Washington in 1871. Many years later in the early 1970s, Riesling was planted in New Zealand and Canada. As Riesling thrives in cooler climates, its production continues to expand into new regions and gain popularity among consumers (Jackson and Schuster 1987).

Riesling is known for its high acidity and flowery aromas that tend to thrive in cooler wine regions, making them an ideal variety to be grown in both New York and

Canada. It is known to greatly express the terroir[1] of where it is grown but maintains the characteristics that identify it and separate it from other varieties. It can be used to make a wide range of wines from dry to mildly sweet, to sweet and is often used in the production of sparkling wines (Wine Institute 2010a). Riesling has increased in popularity among both consumers and producers due to its ability to adapt to cool climates and have a wide range of possible uses.

In California, Riesling, commonly known as a late harvest "ice wine," is often referred to as White Riesling. It is among some of the most prized and age-worthy wines in the world. There has been an apparent increase in California Riesling production with acreage planted increasing from 1,510 acres in 2000 to 3,693 acres in 2009. It is grown in some of the most prevalent wine producing regions in California. The top five California counties for Riesling acreage include Monterey, 2,234 acres; Santa Barbara, 241 acres; San Luis Obispo, 179 acres; San Joaquin, 160 acres; and Napa, 154 acres (Wine Institute 2010a). Monterey County is California's top Riesling wine growing region with more than 60 percent of total production.

In addition to the increase of Riesling production in California, Riesling continues to gain popularity in the global wine market, as production expands in key production regions. As of 2004, Riesling was estimated to be the world's 20th most-grown variety and its production was predicted to continue to flourish. However, in terms of importance for quality white wines, it is included in the top three varieties with Chardonnay and Sauvignon Blanc. Riesling is the most grown variety in Germany, accounting for 20.8

[1] "Terroir" meaning the wines speak of geographic specificity, of different soils, climates and grape varieties; these attributes may be reflected in the different wine styles characterized by their distinct flavors and aromas (Blythman 2005).

percent of total wine grape production and 52,380 acres in 2006, and France with 21.9 percent of total wine grape production and 8,300 in 2006 (German Wine Institute 2008). Riesling plantings in the U.S. have more than doubled this decade, from 1,500 acres to 3,100 acres. Washington State's Riesling acreage increased from 1,900 acres in 1999 to more than 4,000 acres in 2006. New York, which had just less than 500 acres in 2001, now has in excess of 1,000 acres in production (Asimov 2009). There are also significant plantings of Riesling in Austria, New Zealand, Canada and New York.

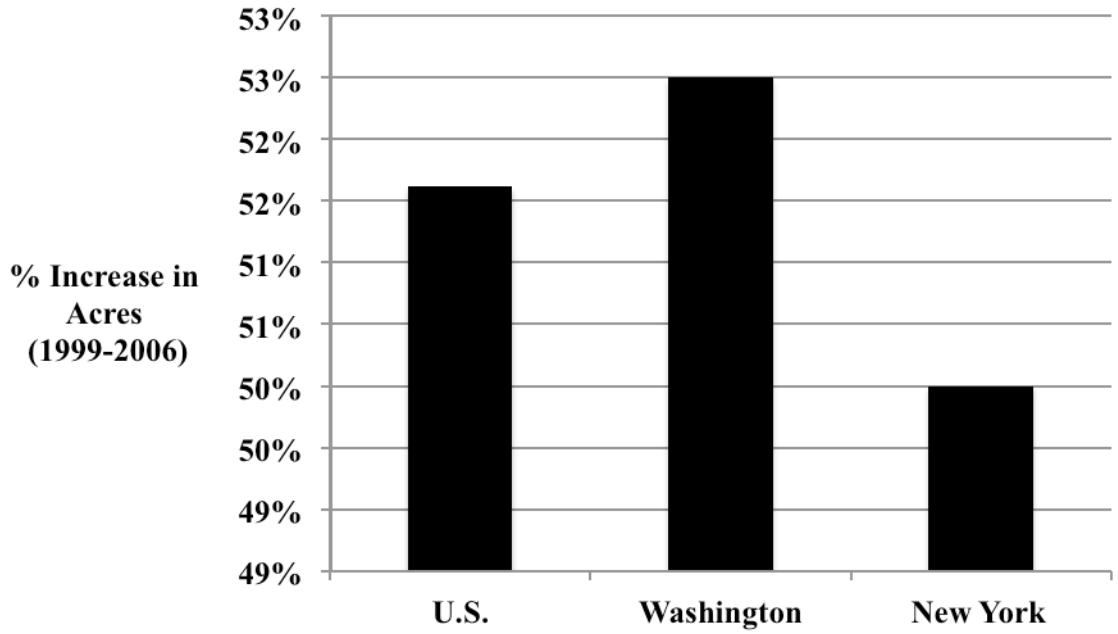

Figure 2: Percentage Increase in U.S. Riesling Production from 1999 to 2006

Problem Statement

What affects the prices of cool climate wines?

Hypotheses

- The attributes indicated in the hedonic price model, including region of origin, will have a statistically significant effect on the price of cool climate wines.
- Cool region variables will have an impact on price: β's $\neq 0$.
- Variables for Old World regions will have a different impact on price in comparison to New World region variables.

Objectives

1. To analyze the cool climate wine varietal, Riesling, by region: California, Oregon, Washington, New York, Canada, Austria, France, Germany and New Zealand.
2. To determine what factors impact the cool climate wine varietal, Riesling by region based on various attributes.
3. To determine what factors impact the cool climate wine varietals Chardonnay, Riesling/Sauvignon Blanc and Pinot Noir based on various attributes for the California region.

Significance of Study

Although wine sales increased between 2008 and 2009, it was at a much slower rate due to consumers substituting higher priced bottles of wine for less expensive bottles. During 2009, California wineries shipped 467.7 million gallons of California wine to the U.S. market, which was slightly higher than in 2008. However, as many wine consumers began purchasing lower-priced wines, the estimated retail value was down three percent

from 2008. Less expensive wines, priced up to $7 for a 750-milliliter bottle, accounted for much of the growth seen in 2009 (“Wine and Spirits” 2010).

The issue of consumers trading down to cheaper wines has affected many wineries, especially those who were reliant on restaurant sales. When ordering drinks at a restaurant or bar, consumers are more likely to purchase cheaper bottles or order wine by the glass. In addition, many more consumers are dining at home, which has increased wine sales in U.S. food stores by two percent (Birchall 2009). In U.S. supermarkets, wines priced up to $7 per bottle increased by two percent, accounting for 72 percent of sales. Higher priced wines also grew in volume; $7-$10 bottle wines increased by three percent, $10-$14 wines grew by seven percent and bottles priced at $14 or more increased by two percent (“Wine and Spirits” 2010).

In addition, trends for pricing of individual brands have been identified that are somewhat representative of the market. Consumers are substituting high-priced import bottles for lower-priced domestic brands (Scott 2009). The lack of strong brand equity within the wine industry has helped make trading down easier. Premium varietals at $18.50 and above, as well as wine offerings under $3.99, have both lost market share to the rest of the price points. Between 2007 and 2009, the largest growth was 38.6 percent in the $4 to $9.49 price range, followed by 19.9 percent growth in the $9.50 to $13.49 range (GMID 2010a). Higher end brands experience less of an emphasis, and a greater focus is centered on brands consumers already know.

As consumption of New World wines increases, demand for New World wines will increase. Cool climate regions will help U.S. wine producers meet this growing demand. Cool climate wine quality has continuously improved and many new medium-to

small-scale wine producers are winning the attention of consumers with high *Wine Spectator* scores for their respective wines. Many of these producers are in California, but there are a growing number of cool climate wine producers in Oregon, Washington, and New York State. Furthermore, cool climate wines is an area with very little research and there is a need to define and study the price-quality relationship.

With the economic uncertainty and increasing competitive pressures, it is important to understand consumer-purchasing decisions. Wine is consumed primarily for hedonic consumption utility (Neeley, Min and Kennett-Hensel 2010). Many factors influence a consumer's decision to purchase wine, but price remains a key determinant. Therefore, it is important to evaluate the factors that influence the price of wine. Price is one of the strongest indicators for quality, and is impacted primarily by brand name and country of origin (Heslop, Cray and Armenakyan 2010). In order to address the relationship between wine and its associated price, the development of a solid empirical framework to study prices for cool climate wines is needed.

This study is similar to Costanigro, McCluskey, and Mittelhammer (2007), as it incorporates many of the same variables but utilizes two different datasets to evaluate the regional impact on the price of cool climate varietals Riesling, Sauvignon Blanc, Chardonnay and Pinot Noir, in addition to other variables. It expands by broadening the region of origin variable to analyze not only the California and Washington regions, but also regions of Oregon, New York, Canada, Austria, France, Germany and New Zealand. In addition, it expanded the study to incorporate additional attributes that previous research has found to significantly impact the price of wine.

Chapter 2

REVIEW OF LITERATURE

U.S. Wine Consumption Trends

As of 2009, U.S. consumer expenditure on alcoholic beverages has increased by 5.6 percent, reaching $110.4 billion. In that year, 54 percent of total expenditures were spent on beer, 24 percent on spirits and 22 percent on wine. Although the U.S. wine industry saw a small drop in wine expenditure due to the current economy, the industry is expected to quickly recover, as demand for wine continues to rise (GMID 2010f).

The growth in wine sales has recently resulted from the increased purchases of mid-priced wines, as consumers trade down to cheaper wines. At the same time, producers of expensive wine varieties were leaving grapes to rot on the vine in order to keep supply in line with the reduced demand. Overall, the economic struggles have affected the sales of premium brands, but total wine sales have continued to progressively grow (GMID 2010d).

Evolving Wine Consumer

Barber et al. (2006 and 2008) identify the evolving wine consumer as an important factor in the growth of wine consumption. Today, wine consumers are causing the wine industry to rethink the traditional stereotype of a wine drinker. Not only because

a larger population of wine consumers are young, but also because they bring a unique set of tastes and lifestyle choices (Barber, Almanza, and Donovan 2006; Barber, Dodd, and Ghiselli 2008). A key target demographic of consumers in their twenties have emerged alongside the traditional 35-year-old and over wine drinkers. Older wine drinkers are more concerned with the established wine traditions. On the other hand, the young, new generation of consumers are more likely to select their wines based on new packaging formats, and cheaper, eye-catching labels (GMID 2010d).

Branding strategies for New World suppliers are dramatically different in style from traditional approaches of Old World vintners. Wine producers have begun to adapt to the changing wine consumer by designing fresh, new labels and shifting business towards online marketing. New World supplier approaches reflect their desire to appeal to new, younger, less sophisticated wine buyers with smaller disposable incomes. As the wine industry shifts focus to a younger generation with lower budgets, it creates an increase in demand for more affordable wines (Heslop, Cray and Armenakyan 2010). At the same time, the wine industry is able to continue to market towards multiple groups reaching a wider range of wine consumers and expanding its target market.

In regards to red and white wine consumption trends, it is likely that wine consumers started drinking whatever was available, popular and fashionable at the time that they first started drinking wine. Regardless of what these consumers began drinking, survey results claimed all ages indicated that the top wines they are consuming now include dry red wines, dry white wines and champagne (Olsen, Thach, and Nowak 2007).

Wine's Health Benefits

Health awareness has also been increasing across the world. As people are more focused on trying to obtain a healthier lifestyle, wine consumption has increased among all generations. Older generations will continue to drink wine. With the perceived benefit of increased life expectancy, it may be likely that a greater number of individuals from the older generations will also begin consuming wine. Younger generations have also moved away from beer and spirits as their main alcoholic drink, consuming more wine as it has fewer calories and a greater nutritional value ("United States Wine…" 2005). Red wine grew even more popular with its perceived health benefits; many consumers have linked its consumption to helping battle dementia and to helping maintain a healthy heart (GMID 2010d).

Local Wine Demand

The "locavore movement" has become extremely popular across the United States, especially since 2008. It focuses on sustainability and food miles. "Food miles" is the distance the goods travel from farm-to-plate or farm-to-market. It regards issues that are usually overwhelmingly supported by environmentalists who argue that the carbon footprint of local products is far lower than those transported from around the world (Lewis 2008). This movement has increased demand for local goods causing many stores to begin stocking their shelves with local products, making it easier for small producers to approach the chain and to meet this consumer demand.

Locally-produced goods are beginning to become a popular item among many consumers. The number of wine businesses in the U.S. has doubled in three years roughly from 1,800 in 2001 to 3,500 in 2004. Most of this growth has come from states outside of California, such as Virginia, Ohio, Texas, Florida, and New York. This will allow wineries to reach a broader range of consumers seeking out high quality, locally grown products ("United States Wine…" 2005).

With a slow economy, many people are becoming more interested in purchasing products that are homegrown as it eliminates the transportation costs. Consumers are also beginning to be concerned about traceability, meaning they like to know where the products they purchase are originating. They also like to support their own local companies during the poor economic times. According to the 2010 National Restaurant Association survey, locally produced wine and beer is the fifth hottest trend on restaurant menus. Among all trends found in the survey, local sourcing seemed to be the central theme ("Alcohol Trends Top…" 2010).

Fox Run Vineyards in New York is a perfect example of a winery pushing the importance of buying local. Legislation in New York, known as the "Wine Industry and Liquor Store Revitalization Act", was proposed in 2009 to encourage local purchasing of New York wines and to allow New York to be more competitive in the wine market. Each local sale in the wine industry benefits not only the local winery but also everything from agriculture to advertising, to packaging, bottles and tourism ("Wine Industry and…" 2010).

Increasing At Home Consumption

Wine consumption has increased in the U.S. and drinking wine at home or with meals has become more common for Americans. The current economic climate has caused an overall decrease in on-trade consumption with more consumers eating at home rather than spending money dining at restaurants. Cheap table wines are benefiting from this as the brands consumers purchase to drink at home are comparatively cheaper than those offered at "on-trade" locales (GMID 2010a).

Wineries reliant on restaurant sales found their sales decreased by six to nine percent because more consumers dined at home and business travel was less frequent. As a result, wine sales from all production sources in U.S. food stores grew in volume by two percent in 2009. Wines priced $7 or less were the most popular in U.S. food stores by volume, increasing by two percent and accounting for 72 percent of the sales quantity. Higher priced wines also increased, $7 to $10 by three percent, $10 to $14 wines by seven percent, and $14 and over wines were up two percent (Wine Institute 2009b). Restaurants mark up wine prices by two to three times the retail price, resulting in more wine consumers foregoing the wine while dining out and increasing their wine purchases at local stores.

Change in Cool Climate Wine Consumption

From 1971 to 2005, there has been a significant change in the per-capita wine consumption in cool climate countries. From 1971 to 1975, approximately 21 liters per

capita were consumed in Germany. This value increased to 24 liters per capita during 2001 and 2005. In New Zealand, per capita consumption was at a low of four liters per capita from 1971-2005, but increased to 18 liters per capita from 2001 to 2005. In Canada, per capita consumption was five liters per capita during 1971 to 1975. Per capita consumption also increased in Canada but at a slower rater than New Zealand. In the time period from 2001 to 2005, Canada's wine consumption per capita had raised to 10 liters per capita. Lastly, the U.S. per capita consumption had the smallest change over the time period. From 1971 to 1975, per capita consumption was six liters per person and only increased to eight liters per capita during the time period 2001 to 2005 (Brunke, Rickard, and Schroeter 2010).

U.S. Production Trends: Old World vs. New World

Winemaking began approximately 8,000 years ago, but oenology has only become a true art in the last several hundred years. California wine growing began in 1769 when Franciscan monks planted California's first wine grapes, known as the mission variety, at their 21 missions. In September 1772, the first California vintage was made and since then immigrants have continued to bring their cultures and winemaking skills with them. Italians and Germans were the first to contribute to the success of the California wine industry, which is today a leader in wine quality and production (Wine Institute 2010b).

Traditionally, wine production existed between the 30th and 50th parallels in both the Northern and Southern hemispheres (Shaw 1999). Traditional, also referred as Old

World, wine was produced essentially from family or co-operative run vineyards. The wines produced were unique and diverse, always variable in quality. The wines had terroir, meaning they were greatly influenced by geographic specificity, of different soils, climates and grape varieties. It shows the relationship between the characteristics of an agricultural product (quality, taste, and style) and its geographic origin (Leeuwen and Seguin 2006). The Old World wines were primarily grown in regions of France, Italy, Germany and Spain (Felzenzstein, Hibbert, and Vong 2004).

Today, wine production exists outside of these geographical boundaries; commercial wine production now takes place in 70 different countries, including Canada, UK and Denmark. There have also been instances of new or non-traditional varieties being grown in regions where they could not be grown before (Brunke, Rickard, and Schroeter 2010). Now, there is a new, homogenous, internationalized wine style referred to as New World wines. New World wine regions typically are from Chile, California, Australia, South Africa and New Zealand (Felzenzstein, Hibbert, and Vong 2004). Producers are generating fast-maturing, easy-drinking wines that can be targeted to any age consumers.

Focusing specifically on the change of red and white wine production, the share of German Red and White wine production was examined from 1980 to 2008. In 1980, Germany was producing 90 percent white wine and only 10 percent red wine. By 2003, Germany was producing 66 percent white wine and 34 percent red wine. As of 2008, Germany was producing 61 percent white wine and 39 percent red wine (Brunke, Rickard, and Schroeter 2010). The data represents the increasing production of red wines in cool climate regions and the decreasing production of white wines. The expansion of

red wines in cool climate regions could be related to their ability to now grow varieties that they could never have grown before, or to its newly perceived health benefits.

Natural Growing Factors of Cool Climate Wines

According to Pool (2000), "the most fundamental and irreversible decision in the life of a vineyard is the choice of site." In warm regions a site may be selected based on its cost, proximity to markets, labor supply or availability of water (Pool 2000). Those decisions will influence the profitability of the vineyard. The same factors need to be considered in cold temperature regions such as New York or Ontario, Canada. However, in these regions it is still important to identify a site where the vine can grow, mature and flourish.

When searching for a vineyard site, there are several factors that vineyard managers need to consider. They need a growing season of sufficient length meaning the season must be long enough for the fruit and the vegetative parts of the vine to mature. Thus, during this season, there must also be enough sunlight hours to ensure a sufficient supply of carbohydrates produced by photosynthesis for the fruit and vine to mature. A steady water supply is also needed to allow the vines to grow properly. In cool climate regions, vines are commonly not irrigated making it important that the site selected have soil that retains enough water in the root zone to provide water to the vine between rains. The three key factors of site evaluation are climate, soils and topography (Ashmall et al. 2009; Martinson 2009; Shaw 2005).

Climate is one of the most critical concerns for grape growers. Winter freezes, spring breezes and summer heat may limit the vine's productivity, quality and overall survival. Climate can be broke down into three subsections: macroclimate, mescoclimate and microclimate (Weiss 2005). Each influence grapes differently and have a profound effect on the end product. Macroclimate refers to the climate of the greater region. It is a large-scale climate pattern that is characterized by three variables including frost-free days, heat units and winter low temperature (Martinson 2009). A study by Leeuwen and Seguin (2006) found that mescoclimate is the relatively consistent climate at a local area on a scale of a few to several miles. It is the climate of the exact site or area in question and is sometimes regarded as the climatic variability within a wine-growing region. Understanding the mescoclimate in cool regions such as New York and Canada is also important because it can be difficult to achieve grape ripeness in these regions. Growers must understand their site's mescoclimate in order to best determine how to plant the vines and maximize sunlight in order to promote growth and get grapes ripe in time for harvest.

Lastly, microclimate directly surrounds the cluster of grapes and is the only climate that can be directly manipulated by the viticulturist (Weiss 2005). Canopy management, trellis system design, row orientation and aspect, as well as varietal are all included when managing the microclimate in a vineyard. Over the past decade, the search to link the right grapes with right microclimate has been like a new gold rush in California (Basu 1985; Leeuwen and Seguin 2006).

In addition, choice of varietal to be planted depends on climate. Ideal climates for the production of high quality red wine can be represented by California's Sonoma and

Napa Valleys, southeastern Australia and southwestern France where the temperature is warmer, whereas those regions for high quality white wines fall in cooler parts. Wines of the best quality are usually produced in the hot years of the coolest regions whereas the warm regions in the cool years produce higher quality wines. The most frequent deviations from optimum conditions for maturing fruit occur in the coolest regions (Shaw 1999).

The Pinot Noir grape provides an example of a varietal whose quality is often comprised due to planting in the wrong area given its high sensitivity to climate. California growers in the 1970s and 1980s were determined to grow French wines so they began to plant the grapes in warm areas that were famous for producing high quality wines, such as Napa Valley. During this time, the Pinot Noir wines were very poor quality. It was not until the 1990s that winemakers realized that these areas were not suitable for Pinot Noir and that this variety would thrive in cooler regions (Basu 1985; Brown 2004; Streeter 2009). On the other hand, the highest quality Cabernet Sauvignon wines come from grapes grown in warmer regions that span from intermediate to hot climates (Jones et al. 2005).

Ultimately, the success of a vineyard is highly dependent on climate. As wine production expands, the wine industry must recognize the many direct impacts that will occur from climate change. Changes occurring from the direct effects of increased warmth include the ability to grow different varieties, drought or heavy rainfall, and rising sea levels. Rising sea levels are expected to create flooding or result in significant mescoclimate influences, especially in New Zealand, and have the possibility of creating a subduction of earthquakes in regions of Oregon and Washington (Tate 2001).

Ashenfelter and Storchmann (2010) used a hedonic price model to estimate the economic effects of climate change on the Mosel Valley Vineyards in Germany. Although this study had a different focus than the research used for this paper, its aim was to analyze wine production in a cool climate region. The study concluded that vineyard and grape prices increase more than proportionally with ripeness. Therefore, it is estimated that a three degree Celsius increase in temperature would more than double the value of the vineyard, while a one degree Celsius increase would raise prices by more than 20 percent. Results indicated that vineyard quality is dependent on solar energy absorption, meaning that climate change that leads to warmer temperatures will lead to higher quality wines and prices (Ashenfelter and Storchmann 2010).

With increasing climate temperatures, previously perfect mescoclimates for wine grape production may no longer be most suited for production. The increasing sea level will destroy some terroirs and alter others, and the altered fertilization effects of rising carbon dioxide levels will change the ideal soil mix for individual cultivars. In order to maintain current wine quality, wine producers will face many challenges. Consumer tastes will probably be expected to evolve with the climate, not necessarily for the better or for the worse, but for the different (Tate 2001).

New Cool Climate Regions and Wine Quality

It has been understood that certain grapes do better in certain regions. For example, White Riesling grows better in Germany's wine region while Gamay grows

better in Beaujolais. For some time now, wine connoisseurs have wondered why the same grapes grown in different regions produce wines that vary greatly in taste (Basu 1985).

The path to success for commercial vinifera vineyards in cool climate regions, such as New York, has been long expensive, frustrating and controversial. Plant pathologists have worked hard to figure out which organisms were causing the diseases and have developed fungicides to help control disease. Viticulturists have also developed knowledge of the varieties and learned to adopt and adapt cultural practices, which will improve fruit maturity, disease resistance, vine maturity, winter hardiness and the ability to tolerate winter cold damage (Pool 2000).

In recent years, many new varieties have been established by the crossing of American species and Vitis vinifera. These Franco-American hybrids are specifically bred to combine good agronomic characteristics with high yields, good quality, weather and disease tolerance, and early season ripening (Jackson and Schuster 1987). The varietal wines developed are named after the predominant or exclusive grape variety from which they are made and allow grapes to be grown successfully in cool climate regions.

Overall, the ability for the key varieties to mature in each region depends greatly on the climate, slope, elevation, soil type and proximity to water. Key varieties such as Pinot Noir, Chardonnay, Sylvaner, Seyval Blanch, Muller-Thurgau and Siegerrebe flourish in warm years, while Cabernet Sauvignon, Riesling, and Merlot grapes have difficulty reaching full maturity, resulting in lighter wines that are high in acidity. The success of large-scale viticulture in these cool climate regions depends greatly on the favorable combinations of site factors and the winemaker's ability to choose the varieties that are best suited to the unique growing area (Shaw 1999).

New York

New York is one of the most important wine producing states in the United States outside of California, even with its cool climate. The number of wineries has grown from nine wineries in 1976 to 273 wineries in 2009. In addition, the number of employees employed in each winery has also grown. New York is now ranked as America's third top grape and wine producer, behind California and Washington (USDA 2007). As New York wine and grape production continues to expand and increase its influence on the American economy, New York can contribute its growing success to their viticulturists and oenologists who found that modifying varieties would allow these newer adapted varieties to be grown in New York. Warm, humid summers characterize many eastern areas and the native vines, which evolved under conditions, can now survive, where in the past plant material suitable would have suffered from disease. Today, the modern grower uses American rootstocks with new technology to control pests and disease (Jackson and Schuster 1987).

Not all areas in New York are suited for grape production due to the region's varied climate and topography. In order for successful vineyards to be established, it is important to take a close look at the macroclimate and mescoclimate (Martinson 2010). It seems that growers have begun to understand this concept as grape acreage and total grape production has increased in New York regions.

New York has three major macroclimates. The first is the Lake Erie region in Western and Central New York. It is the largest production area with 20,000 acres of grapes, with over 90 percent of production being Concord variety for bulk wine or juice.

This region tends to accumulate more heat units than the Finger Lakes region making it the most popular region for grape production in New York (Martinson 2009).

The Finger Lakes region, which has a mid-Atlantic climate surrounds New York City, Long Island and the lower Hudson Valley. This region has been the center for wine production since the 1860s. It has 9,000 acres under production with over 30 varieties, making it the most diverse production area in New York. It includes 60 percent of Labrusca types, 25 percent hybrids and 15 percent of Vitis vinifera. This region is moderated by the Atlantic Ocean providing more mild autumns and winters allowing for ripening of longer season varieties like Merlot (Martinson 2009).

Lastly, the Long Island area has a New England Regional climate encompassing the mid-to upper Hudson River Valley and the Lake Champlain Valley. This area is the newest production region with 2,500 acres of almost exclusively Vitis vinifera cultivars. This region is much more like continental climates in the Midwest. With less influence from the major bodies of water, the area is more likely to suffer from sudden temperature changes. The remaining production area is centered on the Lake Ontario plain, and the lower Hudson Valley. Since 2000, cold climate varieties have been planted in regions of New York and other non-traditional growing areas (Martinson 2009).

Canada

With this newer interest of expanding wine production into new and cooler areas of the world, it is important to consider the factors that contribute to the quality in these cooler districts. It is important that Canadian grape growers breed grapes with disease

resistance and cold tolerance since they receive heavy rain and have soils heavy in clay content. To produce better quality wines, they choose Vinifera grapes and new, improved hybrids as they are subject to fewer disease problems.

Grape production has always been recognized as an important economic activity in Canada, but only recently has this industry gained national and international recognition as a producer of quality wines. The quality improvement has been supported by plantings of new high quality Vitis vinifera grapes such as Chardonnay, Riesling, Merlot and Pinot Noir ("The Canadian Wine…" 2009). With the increasing knowledge of wine grape production in cool climate regions, Canada's wine grape production increased from 694 acres in 1996 to 1,380 acres in 2006. In addition, wine sales in Ontario have more than tripled to almost $2 billion, growing from 2.5 million liters in the 1996-1997 fiscal year to 9.9 million liters in the 2006-2007 fiscal year ("The Canadian Wine…" 2009).

The main viticulture regions in Canada include the Niagara region, Ontario and smaller wine producing regions of Pelee Island and Lake Erie North Shore. Due to the favorable climates and topographies, these regions have evolved in the last 20 years, continuing to grow and expand in acreage, and becoming well-established viticulture areas that are well known for large scale commercial production of wines (Shaw 1999 and 2005).

Popular Cool Climate Grape Varietals

Some of the most popular grape varieties in cool climate regions include Pinot Noir, Chardonnay, Riesling and Sauvignon Blanc (Jackson and Schuster 1987). Some variations in the growing characteristics exist due to factors such as climate, soils, plant clones, pests and diseases and virus infection.

Pinot Noir is a premium quality black grape from the Burgundy and Champagne regions of France. It is also popular in other cool areas in Europe and in the United States. Color often develops early with this variety, sometimes before it is ripe leaving the berries with insufficient color in some warmer climates (Jackson and Schuster 1987).

Chardonnay is a premium-quality white grape variety of many districts in central Europe. It is becoming extremely popular as clones have been developed to ripen in climates as cool as England. Sauvignon, commonly known as Sauvignon Blanc, from central Europe is capable of producing wines of fine quality, dry or sweet, that has strong varietal character (Jackson and Schuster 1987).

Production Scale

The introduction of new technologies such as automated machinery and increases in average farm size has had a positive effect on profit levels. Within the last five years, many farms have seen a decrease in yields, primarily due to water scarcity. However, global demand for wine was affected by lower consumer economic confidence and tight

credit conditions, thus increased the demand for cheaper wines. Therefore, future profitability in the wine grape industry depends on producers' ability to achieve economies of scale, lowering long run average costs. Cost of production, including irrigation and fertilizer application is expected to increase as well as grape prices. It will be more difficult for small vineyards to remain profitable. Companies producing at economies of scale will be able to produce in large enough quantities that the cost of producing additional outputs will decrease. In order for companies to achieve economies of scale, it is likely that there will be some consolidation of vineyards (Bryant 2010).

However to provide some protection to small wine producers, the company can receive production credits depending upon its size of production. The amount of small domestic producer credit a company may use depends upon the amount of wine produced each calendar year. For example, if production is 150,000 gallons or less, the company can receive $0.90 per gallon on the first 100,000 gallons produced. However, as production increases, the amount of credit available decreases (TTB 2010).

Unlike many other food-beverage industries, the wine market structure remains fragmented and diversified. Large-scale acquisitions of wine brands are unlikely in the short term, but may be needed for some wine businesses to survive. However, the global market remains highly fragmented and competitive due to the lack of a strong brand presence in many markets. In addition, in the current economic climate and lack of available credit mean that acquisitions will be limited to companies, which have high levels of cash. Some companies, which grew through acquisition, have over leveraged themselves in doing that. Many smaller companies also over leveraged as they attempted to survive during difficult transition conditions. Oversupply issues in some markets are

putting pressure on American wine producers. It is likely that some producers will first try to eliminate underperforming brands before trying to merge with other producers to better manage the current economic climate (GMID 2010c).

Hedonic Price Analyses

There are countless studies that have analyzed the relationship between prices and product attributes through hedonic price models. The earliest recognized application in agricultural economics originated with the pioneering work of Waugh (1928), who studied the relationship between vegetable prices and qualities. The results provided practical value, particularly to the vegetable producers, who intended to discover consumers' valuation for specific product attributes (Waugh 1928; Combris, Lecocq, and Visser 1997; Costanigro, McCluskey and Goemans 2010; Yoo, Florkowski, and Carew 2011). After Waugh's application, a study by Rosen (1974) was developed. His findings made him famous, as he is believed to have established the theoretical foundation of hedonic price analysis. Rosen's results suggest that consumers pay an implicit price for each quality attribute of a given good, and the sum of these implicit prices translates into the observed market price (Rosen 1974; Yoo, Florkowski, and Carew 2011). If the estimated implicit price is not significantly different from zero, then the characteristic is not valued by consumers or the characteristic is not considered relevant in association with the product (Combris, Lecocq, and Visser 1997).

The hedonic price model is a useful approach using regression analysis of the price on the characteristics of a product to study the price-quality relationship of a

product. This approach is commonly adopted by economists to value bundled product attributes that are not marketed individually and is based on the idea that in a market with perfect information and product differentiation, equilibrium prices will depend on differences in product attributes, ceteris paribus (Combris, Lecocq, and Visser 1997; Costanigro, McCluskey and Goemans 2010).

All products are valued by consumers for their utility generating attributes; therefore, potential consumers consider all of these attributes before making their product-purchasing decisions. This suggests that quality has an influence on a product's price. Overall, hedonic price studies have been motivated by two main concerns: to identify implicit prices of attributes and to examine welfare impacts by analyzing the structure of demand for attributes (Steiner 2002). The most common use of hedonic price analysis deals with the first concern, trying to identify and estimate implicit prices of attributes of a good and its influence on the product's overall price.

A main limitation of hedonic price analysis is the identification problem, which is present for supply and demand functions derived from hedonic price functions. Implicit prices may not only reflect consumer preferences but also factors that determine production. In order to solve this problem, it is important to consider distinguishing supply and demand factors (Rosen 1974; Schamel 2009).

In the 1990s, the hedonic pricing technique was used to analyze price-quality relationships in the wine industry. Wine is a highly differentiated product, making it an appropriate candidate for hedonic price analysis. Early studies included Nerlove (1995) who used a hedonic price function to estimate implicit prices using Swedish data. He argued that the use of a standard hedonic regression is not appropriate because the

Swedish market is not competitive and that the market prices and product characteristics can be taken as exogenous to the Swedish consumers. On the other hand, Oczkowski (1994) applied the model to Australian table wine, and considered both objective and easily observable characteristics (such as vintage, region and grape variety), but failed to include sensory characteristics. He concluded that the price of wine is essentially determined by the objective characteristics of the bottle, including attributes that are easily identifiable and identically perceived by all consumers. Therefore, differences in price levels between bottles of wine should reflect differences in wine characteristics, not differences in purchase circumstances.

Following conventional models, it is assumed that a bundle of quality attributes defines any bottle of wine. Consumer willingness to pay is a function of that bundle of wine quality attributes. Since hedonic price analysis relates the price of a good to its utility-generating characteristics, any quantitative or qualitative variable that affects consumer utility may be included in the function.

The hedonic model is the best method for evaluation in this study because the regression will give results based on unbiased factual variables from the equation. Hedonic models are commodity-specific, as each commodity has its own set of relevant attributes. Variables chosen are those thought to be important in influencing the price on the commodity, in this case wine. Those variables express the implicit values of wine quality characteristics that consumers are willing to pay (Florkowski, Carew, and He 2008).

Determinants of Wine Prices

Wine prices can be determined from numerous factors including award level, quality, variety, vintage and geographic origin. All variables help determine the quality of the wine, thus influencing the overall price of the wine. Most variables can be separated into two groups. The quality, grape variety, region or country of origin, and vintage all determine the "use value" of the wine and are considered the utility function of the consumer. The other category, which includes the retailer and resale variables, does not have any bearing on this use value but still affects the price. A consumer's willingness-to-pay would be determined by the attributes in the first group of variables (Steiner 2002).

Grape Variety

Grape variety is an important factor when determining the price of wine (Troncoso and Aguirre 2006; Guillermo, Brummer, and Troncoso 2008; Schamel 2009). Steiner (2002) found that when comparing grape varieties to color, Riesling is valued higher than Chardonnay. Since Riesling is a classical grape from Germany and France, the high valuation is most likely associated with demand spurred by those countries. Steiner (2002) found that popular red varietals have a highly positive impact on the price for Pinot Noir (+25.7 percent) relative to Cabernet Sauvignon (+7.3 percent).

Geographic Origin

Research indicates mixed results regarding the influence of geographic origin on the price of wine. Numerous studies determined that origin of wine significantly affected the price of wine (Steiner 2002 and 2004; Troncoso and Aguirre 2006; Schamel 2009). These results suggest that consumers attach more value when the wine has a specific location of origin on the label. However, other studies concluded that the origin of wine had no significant price effect (Nerlove 1995; Guillermo, Brummer, and Troncoso 2008). In particular, Troncoso and Aguirre (2006) results showed that cool climate regions are preferred to other regions.

Steiner (2002) found geographic origin significantly affects price. The study first looked at country-of-origin and found French wines achieve the greatest impact on price (+12.3 percent). It was surprising to see that Sonoma Valley (-16.74 percent) had a negative impact on price (Steiner 2002). The Sonoma Valley is a well-known classic wine-producing region that has a good reputation for their quality wine. Steiner (2002) suggests an asymmetry between one of the most classical New World wine producers, Australia, and the most classical Old World producer, France. Overall, the results indicate that grape varieties are more important in the choice of New World wines, whereas regional origins are valued more in Old World wines (Steiner 2002).

In addition, the reputation of producers and regions greatly affects a consumers' willingness to pay, although those price premiums could be small (Schamel 2002; Troncoso and Aguirre 2006; Guillermo, Brummer, and Troncoso 2008). Many wine prices vary greatly despite having very similar attributes. For example, Napa Valley

wines typically sell at higher prices than other wines of comparable sensory quality of other regions. Since consumers are uncertain or do not have sufficient information about the overall quality of the wine they are purchasing, they are willing to pay a higher price for a reputable wine from a well-known region and/or producer. However, Nerlove (1995) determined that the origin of wine had no significant influence on the price of wine.

Few studies have used hedonic price analysis to explore the price-quality relationships among cool climate wine regions. Schamel and Anderson (2003) examined these relationships for Australia and New Zealand wines. Results indicated strong upward trends for newly developing ultra-premium cool climate regions, with average price premiums up 31 percent in comparison to other regions. On the other hand, by the mid 1990s, wines of warm climate irrigated regions became heavily discounted.

Quality Ratings

Combris, Lecocq, and Visser (1997 and 2000) explored the effect of sensory evaluations on price by using a hedonic model for Bordeaux and Burgundy wines using data from an independent panel of tasters. Both studies included information on both label and sensorial characteristics, but resulted in different findings. The Bordeaux study concluded that objective attributes were better indicators of price variations compared to sensorial attributes, while the Burgundy study found that the sensorial attributes were somewhat relevant. Conclusions gave an unclear understanding of sensorial wine characteristics effect on wine prices. The authors explain these opposite influences to the

existence of imperfect information and the high transaction costs associated with acquiring knowledge of sensorial variables. As it is expensive to obtain information about the sensory characteristics, consumers may decide to make their wine choice primarily on the basis of objective characteristics, explaining the absence of almost all sensorial characteristics in the hedonic price function (Combris, Lecocq, and Visser 1997 and 2000). On the other hand, Landon and Smith (1997) included wine reputation as an explanatory variable for price variation, concluding that long-term reputation is superior to short-term quality factors in consumers' valuation of wine.

Past literature (Oczkowski 1994; Landon and Smith 1997; Schamel and Anderson 2003) indicates that ratings by specialized magazines are significant and should be included while modeling wine prices. Sensory characteristics are commonly found to have a non-significant impact on price. This shows the difficulty in isolating the effect of each chemical on the smell and flavor. Only a minute amount of purchasers are wine connoisseurs. In this case, expert ratings act as a signal of quality to the consumer. It is uncertain whether these ratings influence prices because they are good indicators for quality or because of their marketing effect. Oczkowski (2001) concluded that tasting scores are only representations of quality, and uses factor analysis and two-stage ordinary least squares to correct measurement error. Schamel and Anderson (2003), on the other hand, find no evidence of this problem.

There are more than 15,000 wines from a wide array of regions that are reviewed each year by Wine Spectator (San Francisco) editors in blind tastings. All ratings are based on a 100-point scale. Finished wines, reviewed from a bottle in blind tastings are given a single score, in addition to a score as a range that indicates a preliminary score

based on a barrel tasting of an unfinished wine. The following represents the 100 point scale used: 95-100, classic: a great wine; 90-94, outstanding: a wine of superior character and style; 85-89, very good: a wine with special qualities; 80-84, good: a solid, well-made wine; 75-79, mediocre: a drinkable wine that may have minor flaws; and 50-74, not recommended (Wine Spectator 2010). Research indicates that with the new technology advancements of wine grape production in cool climate regions, the Wine Spectator scores of cool climate wines have increased.

Vintage

Many hedonic studies incorporated vintage into their models because aging has been found to have a positive impact on price (Di Vittorio and Ginsburgh 1995; Steiner 2002; Schamel 2002, 2009; Troncoso and Aguirre 2006; Guillermo, Brummer, and Troncoso 2008; Carew and Florkowski 2010). Di Vittorio and Ginsburgh (1995) determined that vintage increased wine prices by approximately 3.7 percent per year of age, while Troncoso and Aguirre (2006) predicted 5.6 percent. Steiner (2002) claimed that the increasing valuation of older vintages reflects both interest rate differentials, as well as cost of storage. In addition, Carew and Florkowski (2010) found that older vintages (1991 or older) and newer vintages are positively associated with wine prices, indicating consumers associate the vintage year with wine quality.

Alcohol Content

The use of alcohol content percentage as a relevant attribute has often been forgotten in many hedonic price studies (Oczkowski 1994, 2001). Some have attempted to quantify the effect of the wine's alcohol content on price or other measures of consumer assessment of wine quality, but the majority of studies have found these effects to be not significant. Comrbis, Lecocq and Visser (1997) found that a variable for "excess alcohol" had a statistically significant negative effect on price, yet a very small effect on quality ratings. On the other hand, Thrane (2004) found that the alcohol percentage did make a statistically significant positive impact on price, indicating a one percent increase in alcohol content resulted in a three percent increase in price.

Label

Research indicates that the information on the label has a great influence on the price of wine (Guillermo, Brummer, and Troncoso 2008; Carew and Florkowski 2010). Guillermo, Brummer, and Troncoso (2008) define the quality categories that appear on the label of a bottle of wine as the special descriptors. These categories include, but are not limited to, Selection, High, Reserve, and Grand Reserve. The word "consignment" is also added on the label indicating the quantity of cases made. Adding consignment to the bottle should add reputation to the wine, but may decrease price if higher quantities are placed in the market. This could be a result from excess supply situations. Guillermo, Brummer, and Troncoso (2008) showed that consignment had a negative relationship

with price, although only slightly significant. With one additional case placed in the market, the price would decrease by 0.0005 percent. This would mean 10,000 cases of wine would be needed to reduce the price by 5 percent.

Results indicate that labeling practices and wine labeling choices might be more influential on price than expert opinions, medals awarded, and vintage. An effective label indicating the consignment, the vineyard of origin, and the description of quality (Selection, High, Reserve, or Grand Reserve) of the wine could add as much as US $15.60 to the retail price to the reference price of US $21.49 per bottle (Guillermo, Brummer, and Troncoso 2008; Carew and Florkowski 2010).

Chapter 3

METHODOLOGY

Procedures for Data Collection

The wine market provides a unique opportunity to analyze the relationship among price, reputation and quality. First, blind quality ratings by experts, exogenous to prices, are available by specialized magazines. Second, objective characteristics of wine that can be easily evaluated in the store are relatively the same on all wine labels. However, wine prices vary across a wide range, suggesting that reputation effects play a superior role in price determination. Lastly, multiple names are often used to identify each wine, each having its own reputation. For example, the winery name relates to the skills of the winemaker and the production region identifies groups of wineries with similar terroir, which both exogenously influence the quality of wine (Costanigro, McCluskey, and Goemans 2010).

There are numerous writers and critics that score wines on a popular basis, but two of the most well-known include the Robert Parker and *Wine Spectator* scores. Both are based on a 100-point scale, with explanations comparable (Robert Parker 2011). *Wine Spectator* includes the following in their description of the tasting process: "Bottles are coded and bagged, and all capsules and corks are removed…No information about the winery or the price of the wine is available to the tasters while they are tasting." Moreover, *Wine Spectator* only publishes the rating of a particular bottle of wine only

once (Wine Spectator 2010). This study uses *Wine Spectator* scores as an unbiased measure of wine quality (Costanigro, McCluskey, and Goemans 2010).

In order to evaluate the impact of region on price, two different data sets were collected. Both data sets focus on cool climate regions and varietals that are most commonly grown in these areas. The first data set is based on *Wine Spectator* data and consisted of 2,809 observations. This analysis aims to predict which attributes influence the price of Riesling. It provided prices for the varietal, Riesling, for primary wine producing regions. The price used is the wine's release price since the retail price was not available. In some cases, the same wines for different vintages are included in the sample. There were 537 different wine producers among the 2,809 observations. The largest number of observations coming from a single producer was 80, with the remaining producers accounting for 1 to 50 wines of the total sample. The attributes analyzed are displayed in the table below.

Table 1: Description of Attributes for *Wine Spectator* Data

Wine Spectator	Attributes	Description
Dependent Variable	Release price	Price per bottle at the date it was released to market
Origin	Regions	California, Oregon, Washington, New York, Canada, Austria, France, Germany and New Zealand
Production Year	Vintage	1997-2009
Quality Descriptor	WS Score	Scores ranged between 67-100
Quality Descriptor by Price Categories	WS Score by Price Segmentation	WS scores by four price categories commercial (less than $13), semi premium ($13-$21), premium ($21-$40) and ultra premium (greater than $40)
Producer Size	Number of Cases of Riesling Produced	1-669,400 cases
	Number of Gallons of Riesling Produced	Production scale of 150,000 gallons or less, 150,000-250,000 gallons or 250,000 gallons or more
Label Attributes	Estate	If the term "estate" was indicated on the bottle
	Vineyard	If the term "vineyard" was indicated on the bottle
	Reserve	If the term "reserve was indicated on the bottle

Due to the incorporation of countries France, Germany and Austria in the model, the study required further research into the variables estate, vineyard and reserve. Research provided relatable terms to these U.S. label attributes. Terms and descriptions used for data collection are provided in Table 2.

Table 2: Terms and Descriptions of Label Attributes

English Term	Austrian Term	French Term	German Term	Description
Estate	Schloss, Domaine	Domaine, Chateau	Schloss, Kloster, Domaine, QbA	Wine made and bottled at the same domaine estate or chateau where the grapes were grown
Vineyard	Addition of –er, Lagen	Cru, Vignoble	Addition of –er, Lagen	The name of the vineyard
Reserve	Qualitaetswein (QmP)	Cuvee, Hommage	Qualitaetswein (QmP)	Special indicator of quality

Source: Vine, R. 1997. *Wine Appreciation, Second Edition*. John Wiley and Sons, Inc.

The second data set was collected from the outlet of a liquor store chain located in San Luis Obispo, California, *Beverages and More*. This data set was used to estimate a varietal-based pricing strategy for California wines, and consisted of 395 different wines. Additional attributes were examined, as more information was accessible. The retail price was used instead of the release price, and no discounted sales prices were included. Although, the study was limited to the wines being sold in one retail location, it is assumed that the prices are representative of those across all retail outlets in California. The attributes analyzed are presented in Table 3.

Table 3: Description of Attributes for *Beverages & More* Data

Beverages and More	Attributes	Description
Dependent Variable	Retail Price	Indicated retail price, no sale prices used
Varietals	Variety	Chardonnay, Riesling/Sauvignon Blanc, and Pinot Noir
Origin	California Wine Regions	Napa, Sonoma, Bay Area/Central Coast and Mendocino
Varietal by Origin	Variety by California Wine Regions	Chardonnay from Napa, Sonoma, Bay Area/Central Coast and Mendocino; Riesling/Sauvignon Blanc from Napa, Sonoma, Bay Area/Central Coast and Mendocino; and Pinot Noir from Napa, Sonoma, Bay Area/Central Coast and Mendocino
Price Categories	Price Segmented into four categories	Commercial Wines, Semi-Premium Wines, Premium Wines and Ultra Premiums Wines
Alcohol Content	Percent of Alcohol	Alcohol Content percentage, more than 14% Alcohol, and Premium Wines with more than 14% alcohol
Cork	Cork Type	Natural/Synthetic vs. Screw Cap
Label Attributes	Production Method	Organic/Sustainable or Conventional
	Ownership Structure	Corporate or Family Owned
	Quality Descriptors	Selection, High, Reserve, Gran Reserve, and Consignment
	Graphic Label Style	Image or Plain Text

Procedures for Data Analysis

After the data was collected, the two data sets were entered and organized into separate SPSS spreadsheets. With this program, a statistical regression analysis was used to analyze the data. In the regression selection, a binary numbering system, known as dummy variables was utilized for regression analysis. Data input is coded as "1" if the

bottle does have a certain characteristic or "0" if the bottle does not have that certain characteristic.

The statistical analysis performed included the examination of the number of observations, t-statistic, and p-value to determine if there were strong or weak correlations in the values. Significant variables included the positive and negative coefficients showing a response to the intercept or base value being regressed. For example, a p-value indicates whether there is a significant impact on the dependent variable. A p-value less than 0.1 indicates a greater than 90% confidence interval of explanation between independent and dependent variables. The p-value can also be significant at the 95% and 99% confidence intervals, if the p-value is less than 0.05 and 0.01, respectively. The closer the p-value is to zero, the more significant the p-value will be for the analysis and the stronger the correlation will be with the price of the qualitative characteristic being analyzed. It will evaluate the correlation between the independent variables to the dependent variable, which is price per bottle in this research (Studenmund 2005).

The R-squared value given in the output indicates the percentage of variation of the dependent variable that has been explained by the variation in the independent variables. The closer this value is to one, the greater the amount of variation is explained by the model. Lastly, the regression results provided coefficient estimates which measure the relative impact on the dependent variable and the unit price evaluated at the sample means in relation to the given attributes or explanatory variables (Steiner 2009).

The Specification of the Empirical Model

To determine what characteristics influence price, a conventional form of hedonic price analysis was performed. First, it was assumed that consumer preferences are based on the attributes of the wine. This would indicate that two bottles of identical wines should have the same price. Conversely, if one of the bottles had a specific attribute valued by consumers, then the difference in price between these two bottles should represent the consumers' willingness to pay for that specific attribute (Rosen 1974). This study suggests that each bottle of wine contains a bundle of attributes, represented by a vector z, resulting in an implicit price function. This function, P (z) is an equilibrium price relationship that considers both the demand and supply of various attributes defined as:

$$P(z) = f(z_1, z_{2\ldots}z_n)$$

In addition, it is presumed that all consumers' have made utility-maximizing choices in their wine purchases, given a specific budget constraint. The marginal willingness to pay for a bottle of wine is described as the derivative of the hedonic price function with respect to each wine attribute; with the left hand side of the equation represents the marginal implicit value for z_i.

$$\partial P / \partial z_i = P_i = [(\partial U / \partial z_i) / (\partial U / \partial x)] \; \forall \; i$$

Next, the appropriate functional form was determined for both datasets. Unfortunately, in the development for hedonic pricing models, there has been little theoretical guidance regarding which functional form is best. This study used the natural log-linear form, as previous research by Nerlove (1995), Schamel (2002 and 2009),

Costanigro, McCluskey, and Mittelhammer (2007) and Guillermo, Brummer and Troncoso (2008). Given that there are two data sets, the data was evaluated in separate equations to examine possible regional and varietal impacts.

The equations for the analysis of the *Wine Spectator* data were:

(1) $\ln(P_i) = \beta_0 + \beta_1 California + \beta_2 Oregon + \beta_3 Washington + \beta_4 NewYork + \beta_5 Canada + \beta_6 Austria + \beta_7 France + \beta_8 Germany + \beta_9 NewZealand + \beta_{10\text{-}21} Vintage_{1997\text{-}2009} + \beta_{22} Estate + \beta_{23} Vineyard + \beta_{24} Reserve$

(2) $\ln(P_i) = \beta_0 + \beta_1 California + \beta_2 Oregon + \beta_3 Washington + \beta_4 NewYork + \beta_5 Canada + \beta_6 Austria + \beta_7 France + \beta_8 Germany + \beta_9 NewZealand + \beta_{10} CommCO + \beta_{11} CommVG + \beta_{12} CommGMN + \beta_{13} SemiCO + \beta_{14} SemiVG + \beta_{15} SemiGMN + \beta_{16} PremCO + \beta_{17} PremVG + \beta_{18} PremGMN + \beta_{19} UltraCO + \beta_{20} UltraVG + \beta_{21} UltraGMN + \beta_{22} \ln(Cases\ Produced) + \beta_{23} 150{,}000GalorLess + \beta_{24} 150\text{-}250{,}000Gal + \beta_{25} 250{,}000GalorMore$

(3) $\ln (P_i) = \beta_0 + \beta_1 California + \beta_2 Oregon + \beta_3 Washington + \beta_4 NewYork + \beta_5 Canada + \beta_6 Austria + \beta_7 France + \beta_8 Germany + \beta_9 NewZealand + \beta_{10} CommCO + \beta_{11} CommVG + \beta_{12} CommGMN + \beta_{13} SemiCO + \beta_{14} SemiVG + \beta_{15} SemiGMN + \beta_{16} PremCO + \beta_{17} PremVG + \beta_{18} PremGMN + \beta_{19} UltraCO + \beta_{20} UltraVG + \beta_{21} UltraGMN + \beta_{22} \ln (Cases\ Produced) + \beta_{23} 150{,}000GalorLess + \beta_{24} 150\text{-}250{,}000Gal + \beta_{25} 250{,}000GalorMore + \beta_{26\text{-}37} Vintage_{1997\text{-}2009} + \beta_{38} Estate + \beta_{39} Vinyeard + \beta_{40} Reserve$

for i =1, 2, 3....n, where n = the number of observations, where independent variables included are shown in Table 4.

Table 4: Description of Variables Used in *Wine Spectator* Model

Variable	Description
Region	Wine produced in California, Oregon, Washington, New York, Canada, Austria, France, Germany and New Zealand
CommCO	Commercial wines (<$13)receiving Classic-Outstanding *Wine Spectator* scores (90-100 points)
CommVG	Commercial wines (<$13) receiving Very Good *Wine Spectator* scores (85-89 points)
CommGMN	Commercial wines (<$13) receiving Good-Mediocre-Not Recommended *Wine Spectator* scores (50-84)
SemiCO	Semi-Premium wines ($13≥$21) receiving Classic-Outstanding *Wine Spectator* scores (90-100 points)
SemiVG	Semi-Premium wines ($13≥$21) receiving Very Good *Wine Spectator* scores (85-89 points)
SemiGMN	Semi-Premium wines ($13≥$21) receiving Good-Mediocre-Not Recommended *Wine Spectator* scores (50-84 points)
PremCO	Premium wines ($21≥$40) receiving Classic-Outstanding *Wine Spectator* scores (90-100 points)
PremVG	Premium wines ($21≥$40) receiving Very Good *Wine Spectator* scores (85-89 points)
PremGMN	Premium wines ($21≥$40) receiving Good-Mediocre-Not Recommended *Wine Spectator* scores (50-84 points)
UltraCO	Ultra-Premium wines (>$40) receiving Classic-Outstanding *Wine Spectator* scores (90-100 points)

Table 4: Description of Variables Used in *Wine Spectator* Model Cont.

Variable	Description
UltraVG	Ultra-Premium wines (>$40) receiving Very Good *Wine Spectator* scores (85-89 points)
UltraGMN	Ultra-Premium wines (>$40) receiving Good-Mediocre-Not Recommended *Wine Spectator* scores (50-84 points)
ln (Cases Produced)	Natural log of the number of cases produced
150,000GalorLess	Production of 150,000 gallons or less
150-250,000Gal	Production of 150-250,000 gallons
250,000GalorMore	Production of 250,000 gallons or more
Vintage	Dummy variable for vintages 1997-2009
Estate	Indicating Estate on the label
Vineyard	Indicating Vineyard on the label
Reserve	Indicating Reserve on the label

The equation for the analysis of *Beverages and More* data was:

(4) $\ln(P_i) = \beta_0 + \beta_1 Chardonnay + \beta 2 Riesling/SauvBlanc + \beta_3 PinotNoir + \beta_4 Napa + \beta_5 Sonoma + \beta_6 Bay/CC + \beta_7 Mendocino + \beta_8 ChardonnayNapa + \beta_9 ChardonnaySonoma + \beta_{10} ChardonnayBay/CC + \beta_{11} ChardonnayMendocino + \beta_{12} Riesling/SauvBlancNapa + \beta_{13} Riesling/SauvBlancSonoma + \beta_{14} Riesling/SauvBlancBay/CC\ \beta_{15} Riesling/SauvBlancMendocino + \beta_{16} PinotNoirNapa + \beta_{17} PinotNoirSonoma + \beta_{18} PinotNoirBay/CC + \beta_{19} PinotNoirMendocino + \beta_{20} Commercial + \beta_{21} SemiPremium + \beta_{22} Premium + \beta_{23} UltraPremium + \beta_{24} AC\% + \beta_{25}\ AC14\%orLess + \beta_{26}\ ACMorethan14\% + \beta_{27} PremiumWithACMorethan14\% + \beta_{28} CorkType + \beta_{29} ProdMethod + \beta_{30} Ownership + \beta_{31} QualityDescriptors + \beta_{32} LabelImage$

for i =1, 2, 3....n, where n = the number of observations, where independent variables included are shown in Table 5.

Table 5: Description of Variables Used in *Beverages & More* Data

Variable	Description
Varietal	Wine varietals Chardonnay, Riesling/Sauvignon Blanc, and Pinot Noir
Region	Wines produced in California regions including Napa, Sonoma, Bay Area/Central Coast and Mendocino
Varietal by Region	Interaction terms for each varietal by each region
Commercial	Commercial wines earning prices below $13
SemiPremium	Semi-Premium wines earning prices between $13-$21
Premium	Premium wines earning prices between $21-$40
UltraPremium	Ultra-Premium wines earning prices greater than $40
AC%	Percentage of Alcohol Content
AC14%orLess	Wines containing alcohol content of 14% or less
ACMorethan14%	Wines containing alcohol content of more than 14%
PremiumWithACMorethan14%	Premium wines containing alcohol content of more than 14%
CorkType	CorkType: Natural/Synthetic vs. Screw Cap
ProdMethod	Production Method: Organic/Sustainable vs. Conventional
Ownership	Ownership Structure: Family vs. Corporate
QualityDescriptors	Selection, High, Reserve, Grand Reserve or Consignment
LabelImage	Image on label or plain text

In these types of studies, endogeneity problems are likely to occur. Therefore, it is important to examine price and *Wine Spectator* score variables. If the price is set after the quality ratings are released, it is possible that variations in price could be due to retailer markups in response to high *Wine Spectator* ratings. Like the study performed by Costanigro, McCluskey, and Goemans (2010), this study used the suggested retail price from the winery for each wine at the time it was released. The price data was collected by the *Wine Spectator* prior to tasting, eliminating the endogeneity problem. This increases the chances of high-priced wines receiving higher ratings. Therefore, it is important to recognize that *Wine Spectator* ratings are the result of a blind tasting process, with no price information available to the reviewers at the time of tasting.

Another issue is the use of expert ratings, such as the *Wine Spectator* ratings, as an unbiased measurement of quality. These ratings cause us to assume that consumers' quality assessment of wine is consistent with the reviewers of the *Wine Spectator*. Even though we have no reason to doubt this assumption, there is a chance that the preferences of the wine experts are different than the general wine consumer. This study followed this assumption, relying on past studies that confirmed expert scores are positively correlated with wine prices independently of the specific countries, magazines or experts (Landon and Smith 1997; Schamel and Anderson 2003; Costanigro, McCluskey, and Mittelhammer 2007; Costanigro, McCluskey, and Goemans 2010).

Assumptions and Limitations

The prices collected from *Wine Spectator Online* could act as a limitation because the data has been gathered from only one source, and is based on trusting the tasters and editors. In addition, subjective attributes such as labeling graphic elements were not used in the first dataset because it was not available on the *Wine Spectator* website. Attributes, such as colors, texts, graphics, and other label indicators, might be difficult to use in an unbiased regression. However, in the second dataset, with data collected from *Beverages and More*, labeling attributes were used. Evaluating the two different datasets helps distinguish the impact of various regions and label attributes on the cool climate wine varietals.

Chapter 4

DEVELOPMENT OF THE STUDY

Description of the Data

In order to evaluate cool climate wines, two different data sets were used. The first was collected from the *Wine Spectator* Digital Database, and included 2,809 observations. The second dataset included 395 observations that were gathered from the outlet of a liquor store chain located in San Luis Obispo, California, *Beverages and More*. Once all information was collected, the variables were coded for further testing and analysis.

Table 6: Variable Coding for *Wine Spectator* and *Beverages & More* Data

Variable Category	Variable Name	Description	*Wine Spectator*	*Beverages and More*
Region	**California**		1 = if production region is California, else = 0	
	Oregon		1 = if production region is Oregon, else = 0	
	Washington		1 = if production region is Washington, else = 0	
	New York		1 = if production region is New York, else = 0	
	Canada		1 = if production region is Canada, else = 0	
	Austria		1 = if production region is Austria, else = 0	
	France		1 = if production region is France, else = 0	
	Germany		1 = if production region is Germany, else = 0	
	New Zealand		1 = if production region is New Zealand, else = 0	
California Wine Regions	**California**	Sonoma		1 = if production region is Sonoma, else = 0
		Napa		1 = if production region is Napa, else = 0
		Bay Area/Central Coast		1 = if production region is Bay Area/Central Coast, else = 0
		Mendocino		1 = if production region is Mendocino, else = 0
Quality Descriptor	**Commercial Classic Outstanding Wines**		1= if price category is commercial and WS score falls in category of classic outstanding, else = 0	
	Commercial Very Good Wines		1= if price category is commercial and WS score falls in category of very good, else = 0	
	Commercial Good-Mediocre-Not Recommended Wines		1= if price category is commercial and WS score falls in category of good-mediocre-not recommended, else = 0	
	Semi Premium Classic Outstanding Wines		1= if price category is semi premium and WS score falls in category of classic outstanding, else = 0	
	Semi Premium Very Good Wines		1= if price category is semi premium and WS score falls in category of very good, else = 0	
	Semi Premium Good-Mediocre-Not Recommended Wines		1= if price category is semi premium and WS score falls in category of good-mediocre-not recommended, else = 0	
	Premium Classic Outstanding Wines		1= if price category is premium and WS score falls in category of classic outstanding, else = 0	

Table 6: Variable Coding for *Wine Spectator* and *Beverages & More* Data

Variable Category	Variable Name	Description	*Wine Spectator*	*Beverages and More*
Quality Descriptor Cont.	**Premium Very Good Wines**		1= if price category is premium and WS score falls in category of very good, else = 0	
	Premium Good-Mediocre-Not Recommended Wines		1= if price category is premium and WS score falls in category of good-mediocre-not recommended, else = 0	
	Ultra Premium Classic Outstanding Wines		1= if price category is ultra premium and WS score falls in category of classic outstanding, else = 0	
	Ultra Premium Very Good Wines		1= if price category is ultra premium and WS score falls in category of very good, else = 0	
	Ultra Premium Good-Mediocre-Not Recommended Wines		1= if price category is ultra premium and WS score falls in category of good-mediocre-not recommended, else = 0	
Producer Size	**# Cases Produced**		ln (total cases produced)	
	150,000 gallons or less		1 = if number of gallons produced is 150,000 or less, else = 0	
	150,000-250,000 gallons		1 = if number of gallons produced is between 150,000-250,000, else = 0	
	250,000 gallons ore more		1 = if number of gallons produced is more than 250,000, else = 0	
Production Year	**Vintage**	2009	1 = if production year is 2009, else = 0	
		2008	1 = if production year is 2008, else = 0	
		2007	1 = if production year is 2007, else = 0	
		2006	1 = if production year is 2006, else = 0	
		2005	1 = if production year is 2005, else = 0	
		2004	1 = if production year is 2004, else = 0	
		2003	1 = if production year is 2003, else = 0	
		2002	1 = if production year is 2002, else = 0	
		2001	1 = if production year is 2001, else = 0	
		2000	1 = if production year is 2000, else = 0	
		1999	1 = if production year is 1999, else = 0	
		1998	1 = if production year is 1998, else = 0	
		1997	1 = if production year is 1997, else = 0	
Variety	**Chardonnay**			1 = if varietal Chardonnay, else = 0

Table 6: Variable Coding for *Wine Spectator* and *Beverages & More* Data

Variable Category	Variable Name	Description	*Wine Spectator*	*Beverages and More*
Variety Cont.	**Riesling/Sauvignon Blanc**			1 = if varietal Riesling/Sauvignon Blanc, else = 0
	Pinot Noir			1 = if varietal Pinot Noir, else = 0
Variety by Region	**Napa Chardonnay**			1 = if varietal Chardonnay and from Napa region, else = 0
	Sonoma Chardonnay			1 = if varietal Chardonnay and from Sonoma region, else = 0
	Bay Area/CC Chardonnay			1 = if varietal Chardonnay and from Bay/CC region, else = 0
	Mendocino Chardonnay			1 = if varietal Chardonnay and from Mendocino region, else = 0
	Napa Riesling/Sauvignon Blanc			1 = if varietal Ries/SB and from Napa region, else = 0
	Sonoma Riesling/Sauvignon Blanc			1 = if varietal Ries/SB and from Sonoma region, else = 0
	Bay Area/CC Riesling/Sauvignon Blanc			1 = if varietal Ries/SB and from Bay/CC region, else = 0
	Mendocino Riesling/Sauvignon Blanc			1 = if varietal Ries/SB and from Mendocino region, else = 0
	Napa Pinot Noir			1 = if varietal Pinot Noir and from Napa region, else = 0
	Sonoma Pinot Noir			1 = if varietal Pinot Noir and from Sonoma region, else = 0
	Bay Area/CC Pinot Noir			1 = if varietal Pinot Noir and from Bay/CC region, else = 0
	Mendocino Pinot Noir			1 = if varietal Pinot Noir and from Mendocino region, else = 0
Price Categories	**Commercial Wines**			1 = Commercial if wine priced below $13, else = 0
	Semi Premium Wines			1= Semi Premium if wine priced between $13-$21, else = 0

Table 6: Variable Coding for *Wine Spectator* and *Beverages & More* Data

Variable Category	Variable Name	Description	*Wine Spectator*	*Beverages and More*
Price Categories Cont.	**Premium Wines**			1 = Premium if wines priced between $21-$40, else = 0
	Ultra Premium Wines			1 = Ultra Premium if wines priced above $40, else = 0
Alcohol Percentage	**Alcohol Content**			Percentage of Alcohol Content
	Alcohol Content of 14% or less			1= if Alcohol Content is 14% or less, else = 0
	Alcohol Content of more than 14%			1 = if Alcohol Content is more than 14%, else = 0
	Premium Wines with Alcohol Content of more than 14%			1 = if Premium Wine consisting of more than 14% alcohol content, else = 0
Cork	**Cork Type**	Natural/Synthetic vs. Screw Cap		1 = if cork is Natural/Synthetic, 0 = if Screw Cap
Label Attributes	**Production Method**	Organic/Sustainable vs. Conventional		1 = if produced Organically, 0 = if Conventional
	Ownership Structure	Corporate or Family-Owned		1 = if Corporate-owned, 0 = if Family-Owned
	Quality Descriptors	High, Selection, Reserve, Grand Reserve or Consignment		1 = if Quality Descriptor is indicated, 0 = if not
	Label Image	Image or Plain Text		1 = if there is an image on the label, 0 = if no image
	Estate		1 = if bottle indicates “estate”, 0 = if not	
	Vineyard		1 = if bottle indicates “vineyard”, 0 = if not	
	Reserve		1 = if bottle indicates “reserve”, 0 = if not	

Wine Spectator

First, the *Wine Spectator* dataset was examined, starting with examining the distribution of wines by price. For better comparison and generalizations, all prices of wine were adjusted to 2001 values by a Consumer Price Index for alcohol.

Following Costanigro, McCluskey and Mittelhammer (2007), price breakpoints identified four price categories. The first category was commercial wines, priced below $13, followed by semi-premium wines priced between $13 and $21, premium wines priced between $21 and $40, and ultra-premium wines priced greater than $40. Given that this study is using the same dataset, analysis for price categories follows the price categories specified by the team of previous researchers. The sample sizes associated with these market segments are 527, 890, 827 and 1,077 observations, respectively. Results are displayed in Figure 3 below.

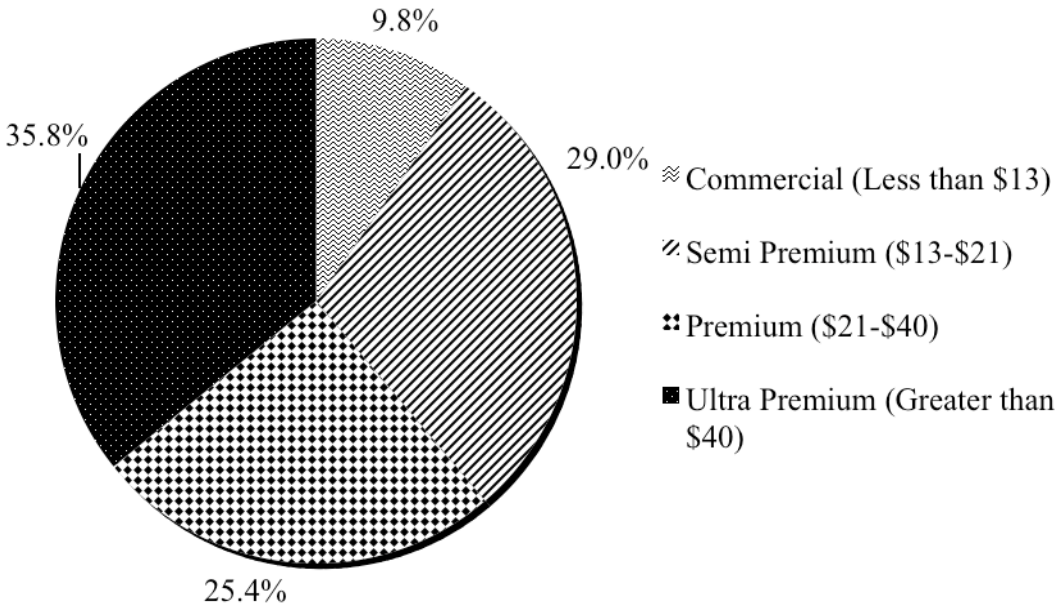

Figure 3: Riesling Price Distribution (n = 2,809)

Figure 4 shows the frequency of wines collected by region including California, Oregon, Washington, New York, Canada, Austria, France, Germany and New Zealand. The majority of the wines examined, 23.5 percent, were from Germany, followed by regions Austria, New York and France.

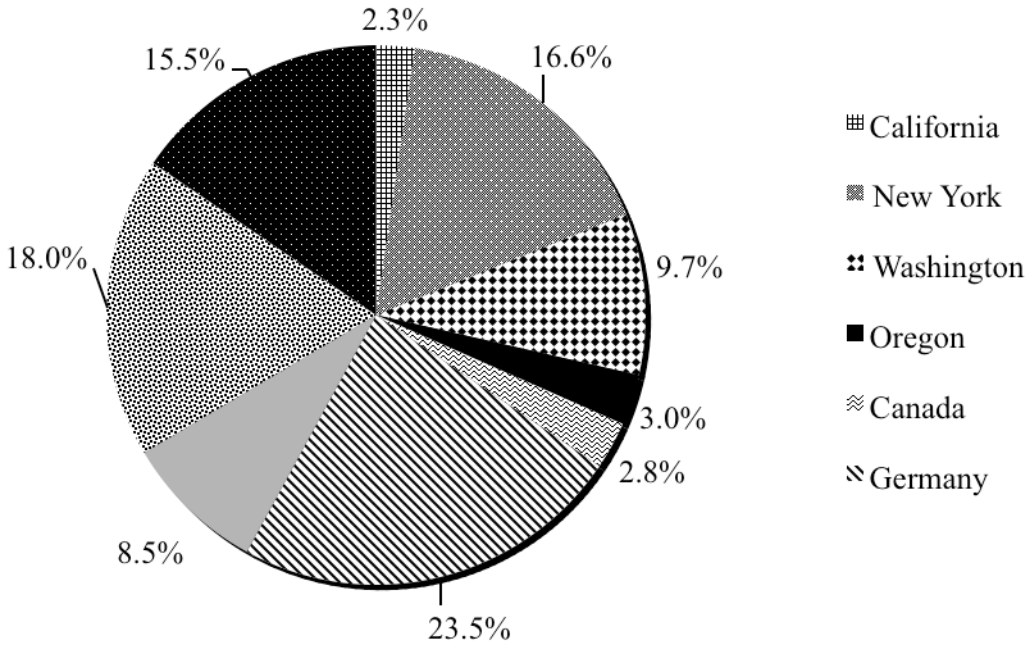

Figure 4: Frequency of Wines by Region (n=2,809)

Figure 5 shows the majority of the wines, 43.6 percent, received *Wine Spectator* scores between 85 and 89, indicating that they were "very good" wines. Due to the small amount of observations in other quality categories, this study combined classic and outstanding scores, as well as good, mediocre and not recommended to ensure a better distribution. Figure 6 displays the three quality categories of wines earning scores belonging in the following categories: classic and outstanding (40.9 percent), very good (43.6 percent), and good, mediocre, and not recommended (15.5 percent).

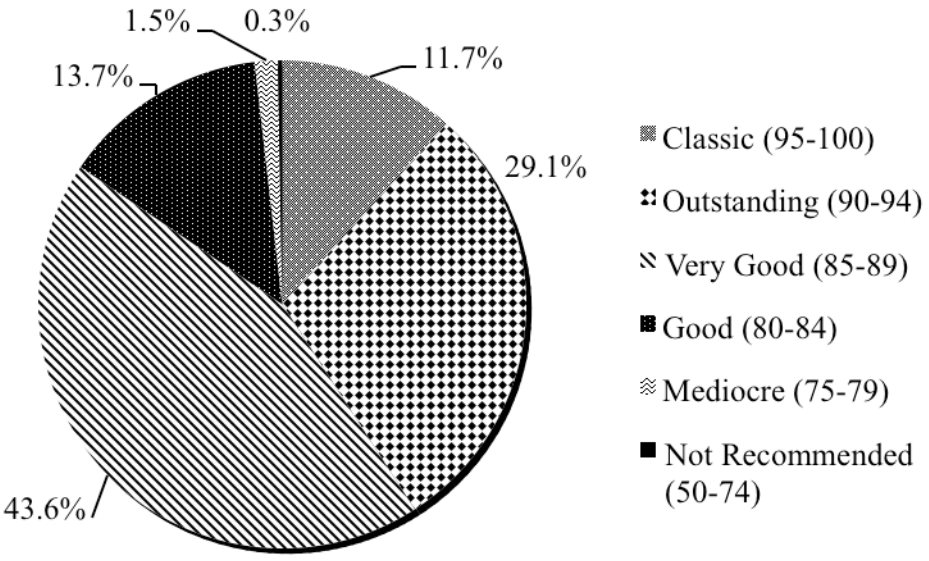

Figure 5: Frequency of *Wine Spectator* Scores Containing All Categories (n=2,809)

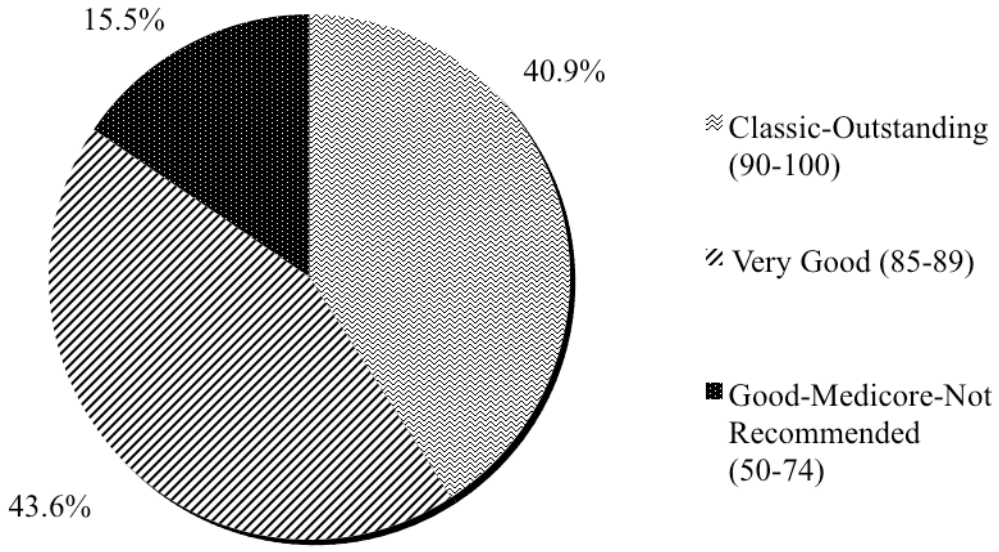

Figure 6: Frequency of *Wine Spectator* Scores by Selected Categories (n=2,809)

To further analyze the importance of reputation and quality associated with *Wine Spectator* scores, the *Wine Spectator* scores were examined by region for the three quality categories Classic-Outstanding, Very Good, and Good-Mediocre-Not Recommended. Figure 7 portrays how quality varies between regions, with Germany earning the most classic-outstanding scores for its production of Riesling.

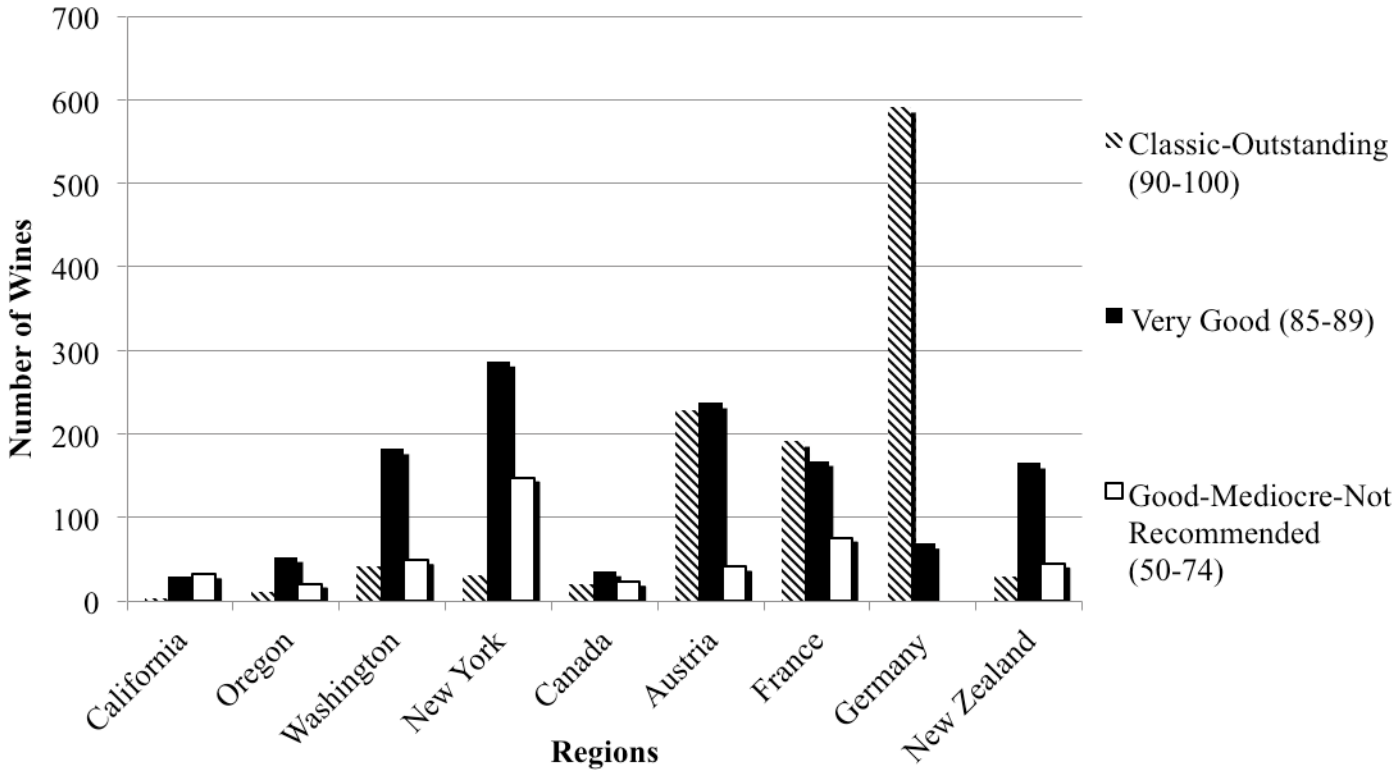

Figure 7: Comparison of *Wine Spectator* Scores by Region (n=2,809)

Figure 8 portrays the distribution of wines by price and by quality categories. It displays the distribution of commercial wines ($13 or less), semi-premium wines ($13-$21), premium wines ($21-$40), and ultra-premium wines ($40 or more) by quality categories classic-outstanding (scoring points between 90-100), very good (85-89), and good-mediocre-not recommended (50-74). The figure shows that the largest category,

containing 29.1 percent of the wines, were ultra-premium and earned classic-outstanding scores, followed by semi-premium wines earning very good scores and premium wines earning very good scores, 19.7 percent and 12.5 percent, respectively.

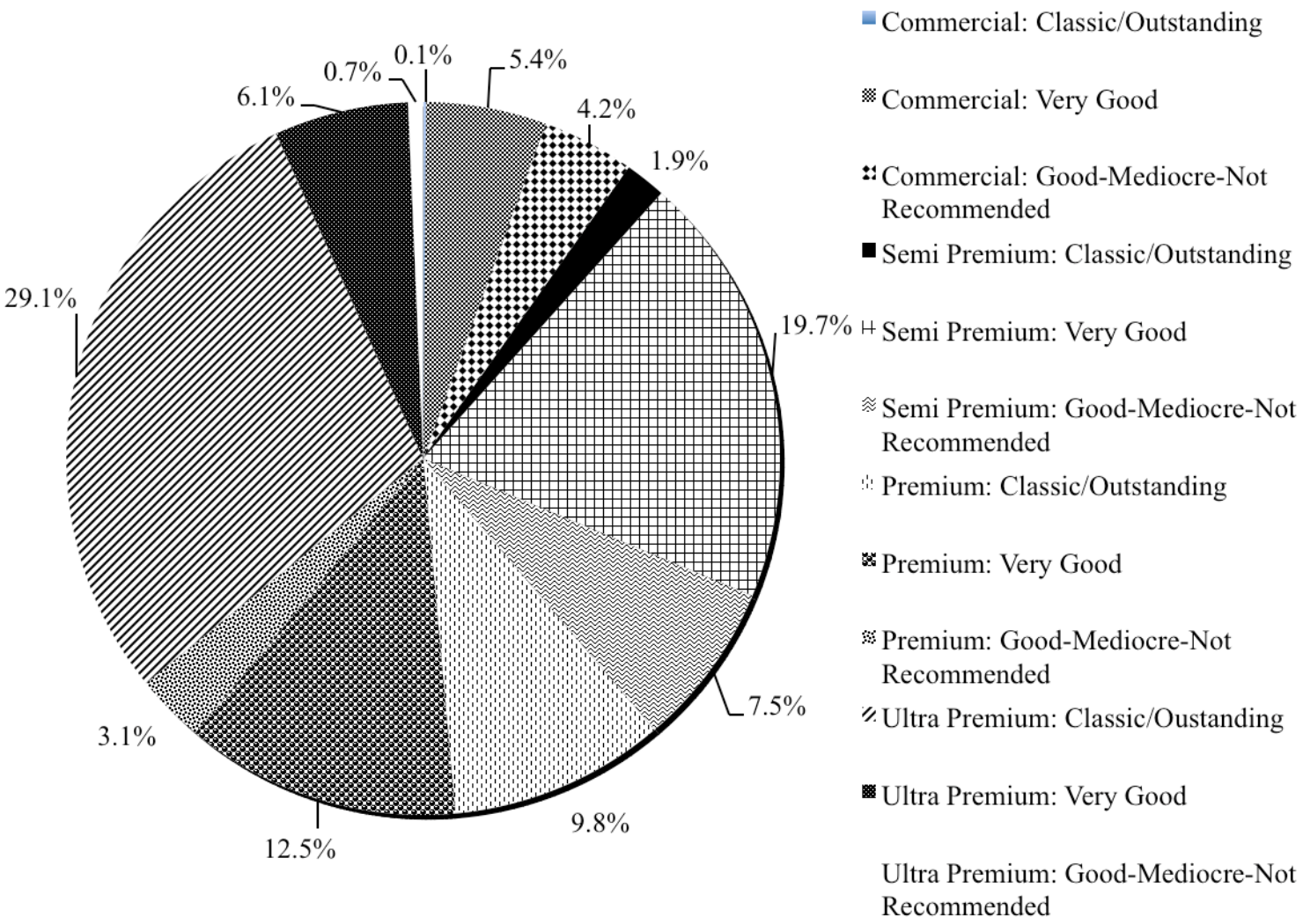

Figure 8: Comparison of *Wine Spectator* Scores by Price Category (n=2,809)

Figures 9 and 10 further express the relationship between price and quality. The relationship was examined by using the price adjusted by CPI as well as the natural log of the price adjusted by CPI. It is apparent in Figure 10 that there is a linear trend,

representing a positive relationship, suggesting that as the wine price increases, the wine's quality also increases.

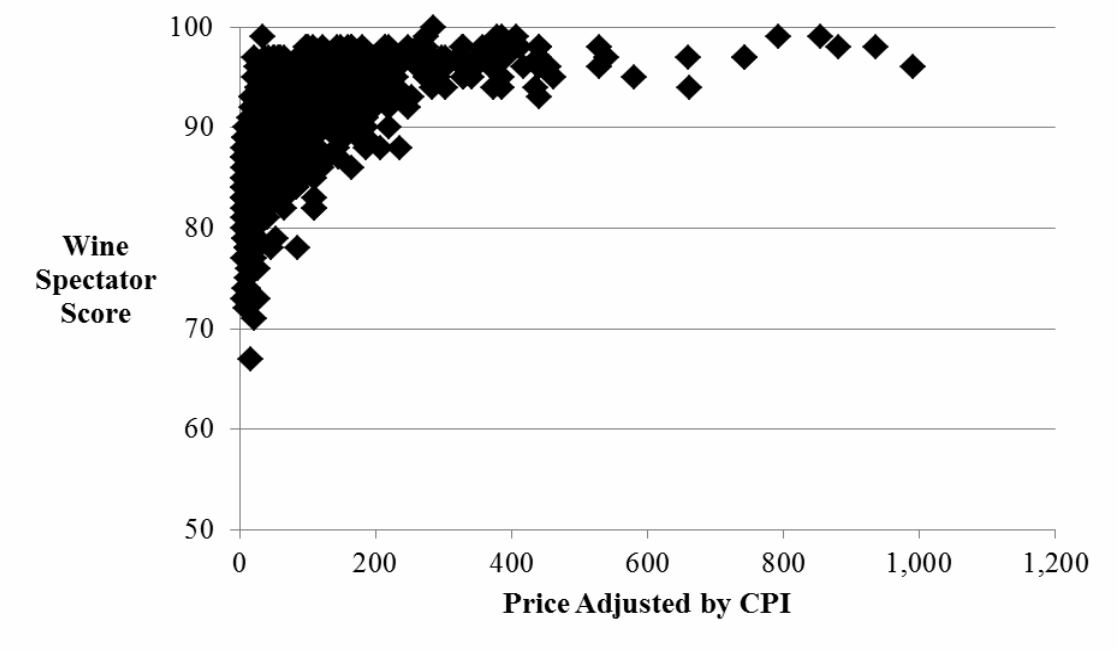

Figure 9: Plot of *Wine Spectator* Score against Price Adjusted by CPI (n=2,809)

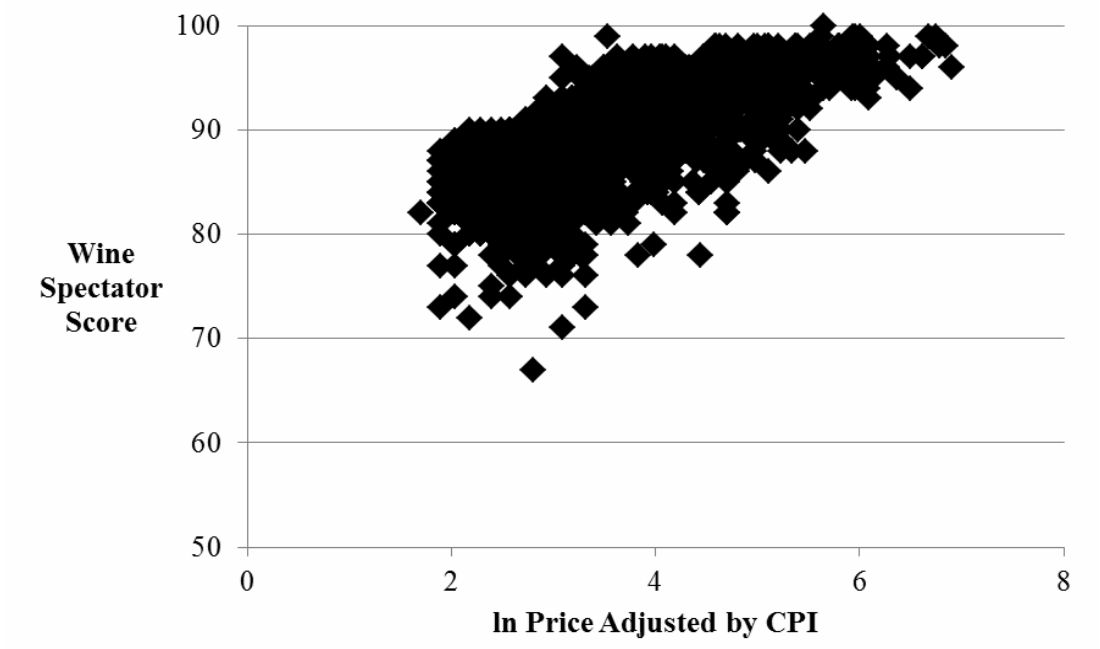

Figure 10: Plot of *Wine Spectator* Score against ln Price Adjusted by CPI (n=2,809)

The wines in the sample mainly fall between the $20 and $80 range, but have a long-tailed distribution. The plot of number of cases produced against price adjusted by CPI, seen in Figure 11, is unclear and does not provide adequate results. The study's findings are better approximated using a double log function, shown in Figure 12. These results mirror the findings of the study by Nerlove (1995) that used a double log function to explain the influence of the amount of liters sold on price.

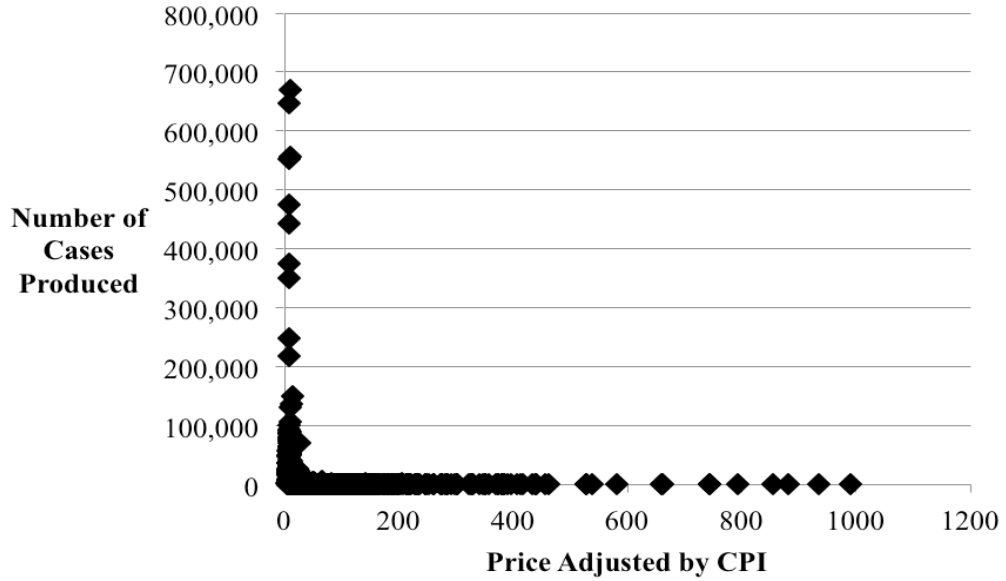

Figure 11: Plot of Number of Cases Produced against Price Adjusted by CPI (n=2,809)

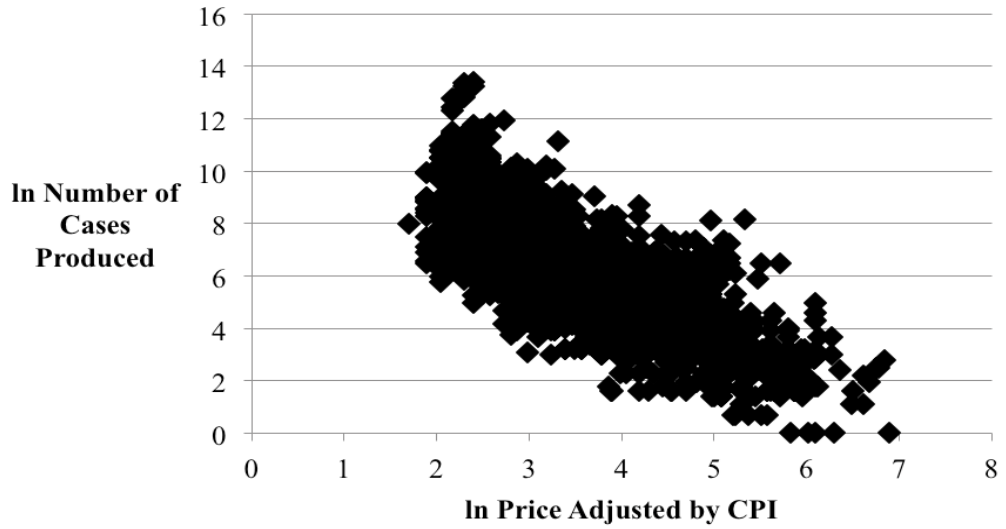

Figure 12: Plot of ln Number of Cases Produced against ln Price Adjusted by CPI (n=2,809)

Figure 13 further examines the frequency of wines by production. Instead of analyzing the number of cases produced, this figure takes into account the number of gallons produced. It aims to put wine observations into the following production categories: 150,000 gallons or less, 150,000-250,000 gallons, and 250,000 gallons or more. It is evident that the majority, 98.7 percent, of the observations is produced in the category of 150,000 gallons or less.

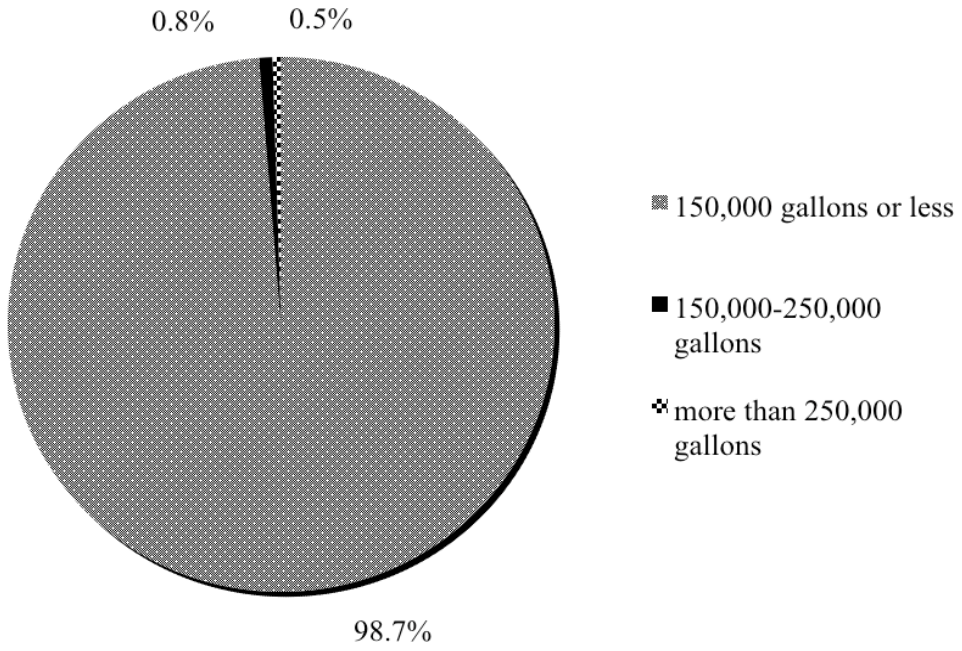

Figure 13: Riesling Production by Number of Gallons Produced (n=2,809)

Figure 14 displays the frequency of wines by vintage, including production years between 1997 and 2009.

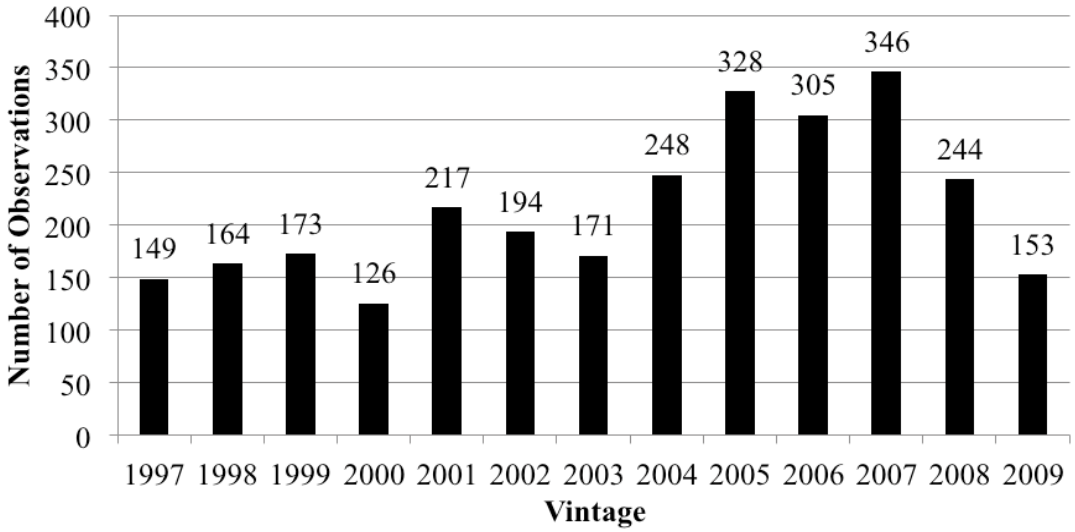

Figure 14: Riesling Vintage Distribution (n=2,809)

At least one of the three label attributes estate, vineyard and reserve were indicated on 57.5 percent of the wine labels. Figure 15 shows that "Vineyard" was the most commonly used label attribute, with 29.7 percent of wines specifying the vineyard in which the grapes were grown. Figure 16 shows that of all regions, German wines most commonly indicated "vineyard" on the label 56.8 percent of the time, followed by other European countries, France and Austria using the term "vineyard" on 17.2 percent and 12.7 percent of the collected wines, respectively.

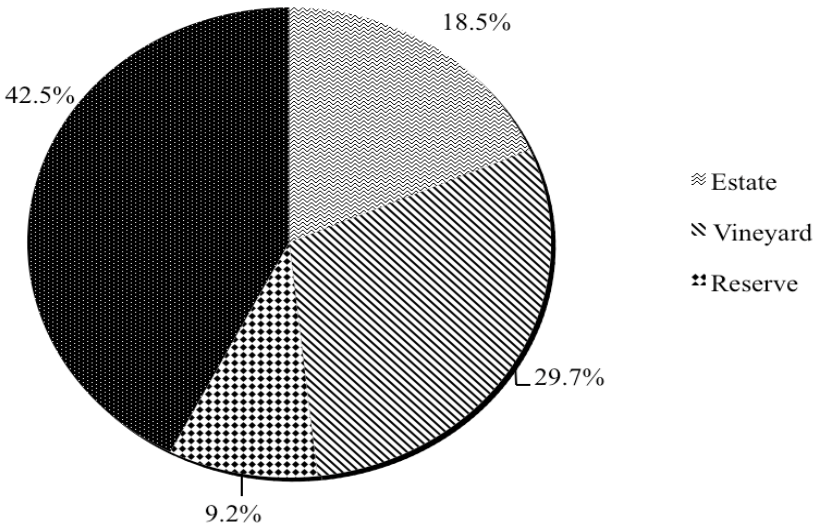

Figure 15: Frequency of Label Indicators Estate, Vineyard, and Reserve (n=2,809)

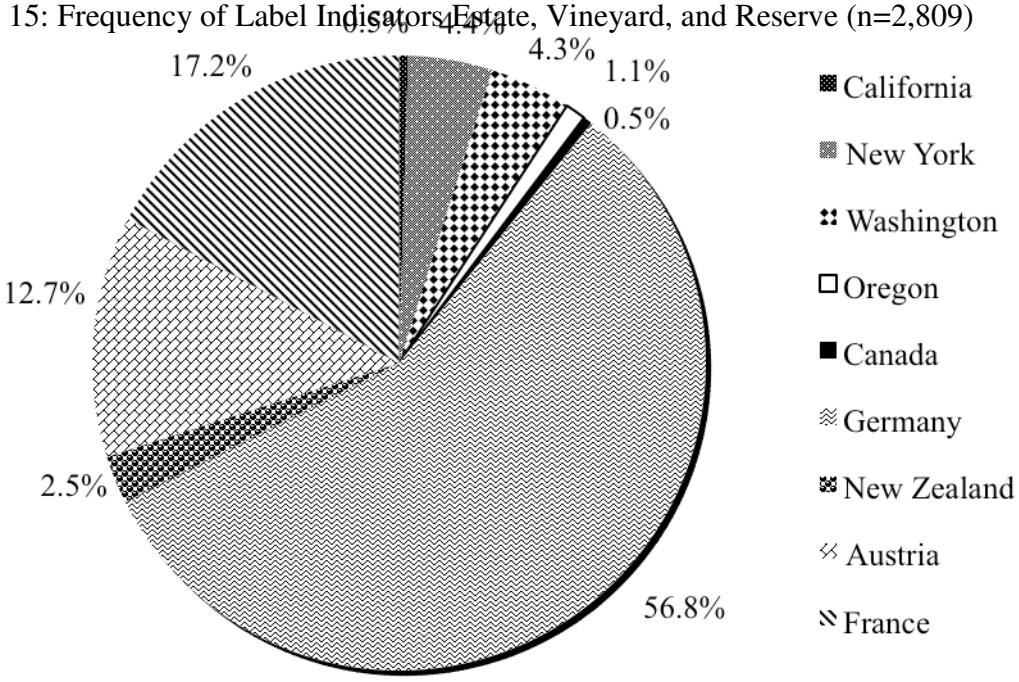

Figure 16: Frequency of "Vineyard" Indicated by Region (n=2,809)

Table 7 provides the descriptive statistics of the *Wine Spectator* data, including the definition, frequency and average price of each variable.

Table 7: Descriptive Statistics of the *Wine Spectator* Data

Variable Name	Definition	Number of Obs. (N = 2,809)	Frequency & Average Price for each specific category
Price			
Real Price	Release Price	2,809	($46.67)
CPI Adjusted	Price adjusted by 2001 CPI index for alcohol	2,809	($51.41)
Ln CPI Adjusted	Natural log of price after adjusted for CPI	2,809	($3.47)
Region			
California	Wines from California	65	0.023 ($27.04)
Oregon	Wines from Oregon	85	0.030 ($19.18)
Washington	Wines from Washington	272	0.097 ($25.36)
New York	Wines from New York	466	0.166 ($24.31)
Canada	Wines from Canada	80	0.028 ($68.52)
Austria	Wines from Austria	507	0.180 ($41.56)
France	Wines from France	435	0.155 ($43.10)
Germany	Wines from Germany	660	0.235 ($110.28)
New Zealand	Wines from New Zealand	239	0.085 ($19.69)
Quality Descriptor by Price Category			
Commercial: Classic-Outstanding	Wines that are priced below $13 and earned *Wine Spectator* scores between 90-100	4	0.001 ($10.46)
Commercial: Very Good	Wines that are priced below $13 and earned *Wine Spectator* scores between 85-89	153	0.054 ($9.92)
Commercial: Good-Mediocre-Not Recommended	Wines that are priced below $13 and earned *Wine Spectator* scores between 50-74	118	0.042 ($9.86)
Semi Premium: Classic-Outstanding	Wines that are priced between $13-$21 and earned *Wine Spectator* scores between 90-100	52	0.019 ($18.34)

Table 7: Descriptive Statistics of the *Wine Spectator* Data Cont.

Variable Name	Definition	Number of Obs. (N = 2,809)	Frequency & Average Price for each specific category
Semi Premium: Very Good	Wines that are priced between $13-$21 and earned *Wine Spectator* scores between 85-89	552	0.197 ($16.69)
Semi Premium: Good-Mediocre-Not Recommended	Wines that are priced between $13-$21 and earned *Wine Spectator* scores between 50-74	210	0.075 ($16.12)
Premium: Classic-Outstanding	Wines that are priced between $21-$40 and earned *Wine Spectator* scores between 90-100	275	0.098 ($30.43)
Premium: Very Good	Wines that are priced between $21-$40 and earned *Wine Spectator* scores between 85-89	350	0.125 ($28.71)
Premium: Good-Mediocre-Not Recommended	Wines that are priced between $21-$40 and earned *Wine Spectator* scores between 50-74	88	0.031 ($26.08)
Ultra Premium: Classic-Outstanding	Wines that are priced above $40 and earned *Wine Spectator* scores between 90-100	817	0.291 ($116.10)
Ultra Premium: Very Good	Wines that are priced above $40 and earned *Wine Spectator* scores between 85-89	171	0.061 ($66.12)
Ultra Premium: Good-Mediocre-Not Recommended	Wines that are priced above $40 and earned *Wine Spectator* scores between 50-74	19	0.007 ($66.02)
Producer Size			
ln (# of cases produced)	Number of cases produced	2,809	6.161 ($51.41)
150,000 gallons or less	Production of 150,000 gallons or less	2,773	0.987 ($51.93)
150,000-250,000 gallons	Production of 150,000-250,000 gallons	22	0.008 ($10.91)
250,000 gallons or more	Production of 250,000 gallons or more	14	0.005 ($10.70)

Table 7: Descriptive Statistics of the *Wine Spectator* Data Cont.

Variable Name	Definition	Number of Obs. (N = 2,809)	Frequency & Average Price for each specific category
Vintage			
2009	Wine production year is 2009	153	0.054 ($31.52)
2008	Wine production year is 2008	244	0.087 ($38.04)
2007	Wine production year is 2007	346	0.123 ($53.82)
2006	Wine production year is 2006	305	0.109 ($46.90)
2005	Wine production year is 2005	328	0.117 ($74.07)
2004	Wine production year is 2004	248	0.088 ($46.24)
2003	Wine production year is 2003	171	0.061 ($80.81)
2002	Wine production year is 2002	194	0.069 ($70.27)
2001	Wine production year is 2001	217	0.077 ($45.52)
2000	Wine production year is 2000	126	0.045 ($38.46)
1999	Wine production year is 1999	173	0.062 ($49.20)
1998	Wine production year is 1998	164	0.058 ($37.48)
1997	Wine production year is 1997	140	0.050 ($34.09)
Label Attributes	The term “estate” is indicated on the bottle	521	0.185 ($46.63)
	The term “vineyard” is indicated on the bottle	835	0.297 ($78.71)
	The term “reserve” is indicated on the bottle	259	0.092 ($42.26)

Beverages and More

The second dataset, based on wine data collected at Beverages and More, a local retail store examined not only Riesling, but also varietals Sauvignon Blanc, Chardonnay and Pinot Noir. Again following Costanigro, McCluskey and Mittelhammer (2007), four price categories were identified including commercial wines priced below $13, semi-premium wines priced between $13 and $21, premium wines priced between $21 and $40, and ultra premium wines priced greater than $40. The sample sizes associated with these market segments are 109, 182, 98 and 6 observations, respectively. These results are displayed in Figure 17 below.

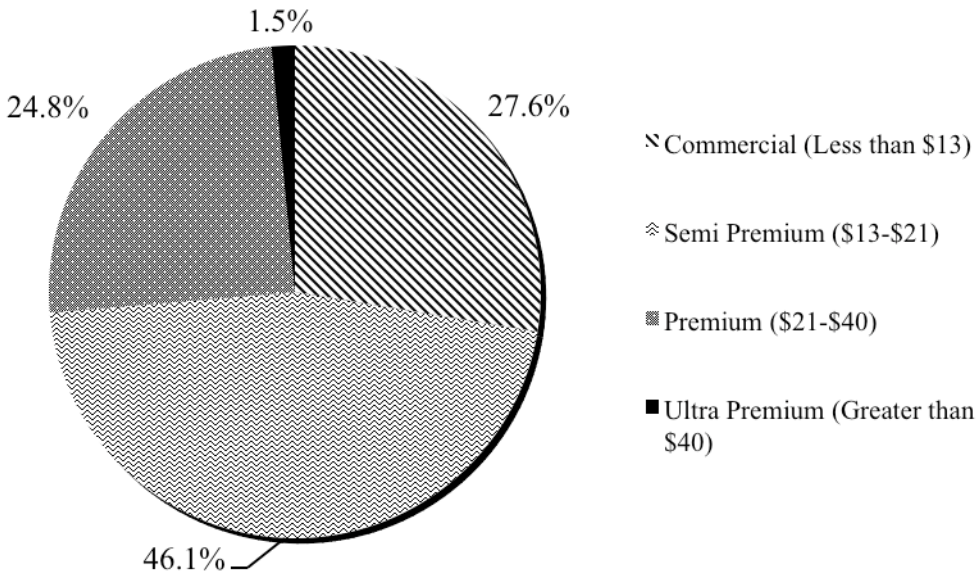

Figure 17: Price Distribution (n=395)

Due to the small amount of Riesling observations and to ensure a better distribution of wines by varietal, the varieties Riesling and Sauvignon Blanc were combined. Figure 18 shows that of the 395 wines collected, 53.4 percent were Chardonnay, 21.3 percent Pinot Noir, and 25.3 percent Riesling or Sauvignon Blanc.

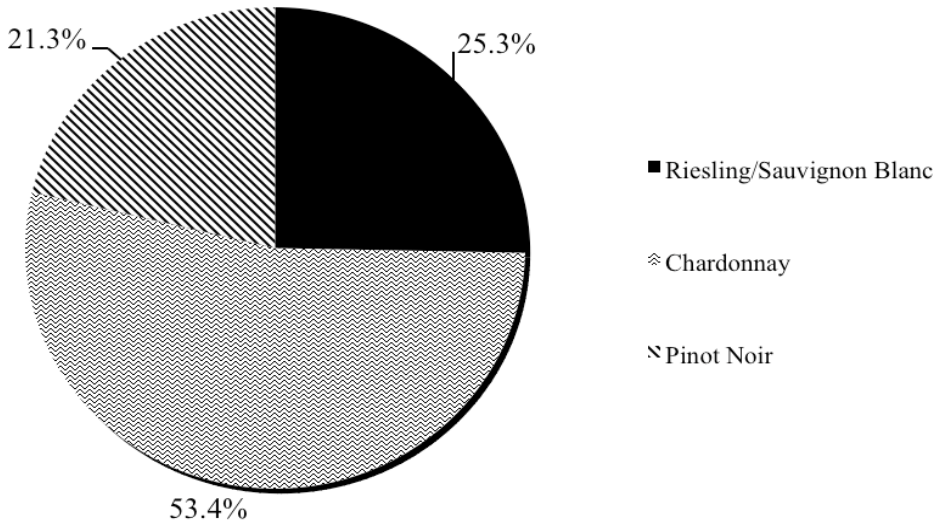

Figure 18: Frequency of *Beverages & More* Wines by Variety (n=395)

All wines were produced in California, but were segmented by sub-region. Figure 19 shows that 34.2 percent from Sonoma, 33.7 percent from the Bay Area/Central Coast, 26.6 percent from Napa, and 5.6 percent from Mendocino.

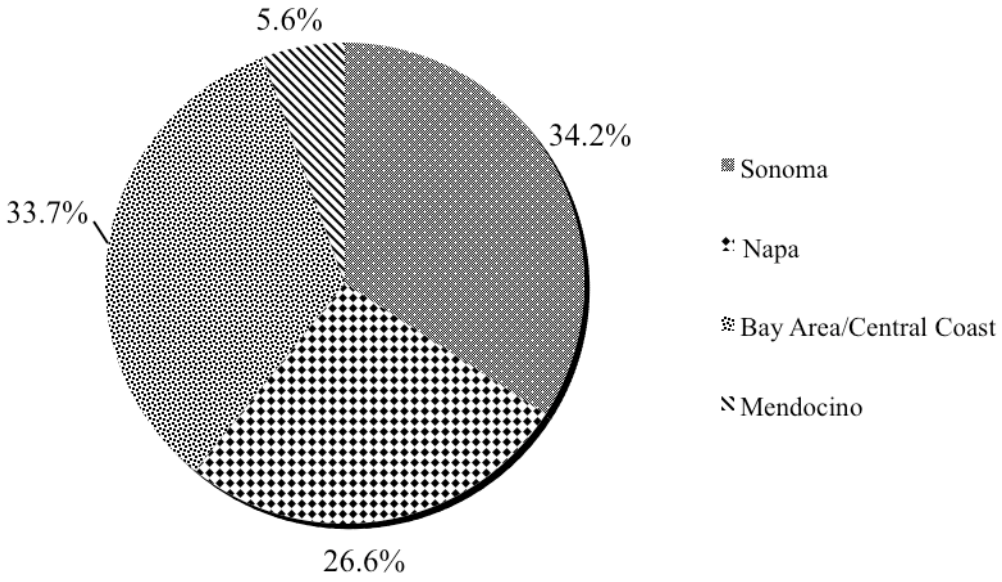

Figure 19: Frequency of *Beverages & More* Wines by California Sub-Region (n=395)

Every wine bottle reports a figure for alcohol content on the label; however, laws and regulations allow some flexibility. U.S. law allows a range of plus or minus 1.5 percent alcohol for wine with 14 percent alcohol volume or less, and plus or minus 1.0 percent for wine with more than 14 percent. Furthermore, wineries may have incentives to distort the percentage they display on the label because the tax rate is higher for higher alcohol content of wine. For example, the Federal Excise Wine Tax is $1.07 per gallon for wine 14 percent or less, and $1.57 per gallon for wine 14.1 to 21 percent (Alston et. al 2011). Therefore, this study developed to categories to represent these tax rate regulations and requirements.

The first category contained wine bottles that indicated alcohol content of 14 percent or less, and the second category consisted of wine bottles with more than 14 percent alcohol content. Alcohol content was also analyzed by varietal, as specific wine varietals are known to have a higher percentage of alcohol content. Average retail prices were

determined by each alcohol content category to predict the average retail price of the specific varietals, as shown in Table 8. Results suggested that the highest average retail price for both categories is for Chardonnay, followed by Riesling or Sauvignon Blanc, and then Pinot Noir.

Table 8: Average Retail Prices for Each Variety by Alcohol Content Percentage

	14% or Less	**More than 14%**	**Total**
Riesling/Sauvignon Blanc	$22.36	$15.01	$18.15
Chardonnay	$26.44	$20.28	$23.36
Pinot Noir	$16.70	$14.41	$14.73

Cork types were also examined, indicating whether a natural or synthetic cork was used versus a screw cap. Results indicated that 84.3 percent of the wines collected had a natural or synthetic cork, as shown in Figure 20. In regards to price categories, semi-premium wines were the most likely to have natural/synthetic corks in comparison to screw caps. When analyzing cork type by varietal, using a natural or synthetic cork was most common in Chardonnay, followed by Riesling/Sauvignon Blanc, and Pinot Noir. These results are shown in Table 9.

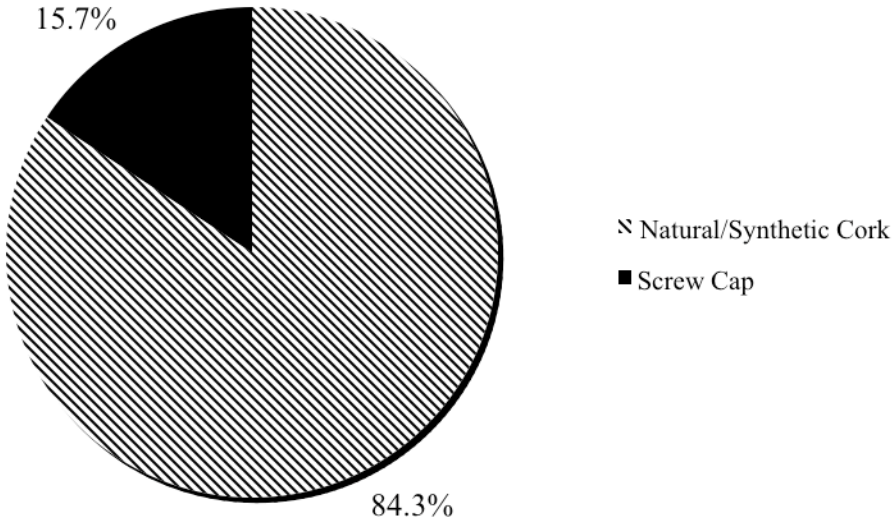

Figure 20: Frequency of Cork Type: Natural/Synthetic vs. Screw Cap (n=395)

Table 9: Cork Type by Price Category, Wine Type, and Varietal (n=395)

	Price Categories				**Varietal**		
Cork Type	Commercial (<$13)	Premium ($13-$21)	Semi-Premium ($21-$40)	Ultra-Premium (>$40)	White		Red
					Chardonnay	Riesling/ Sauvignon Blanc	Pinot Noir
Natural	85	92	150	6	186	68	79
ScrewCap	24	6	32	0	25	32	5

In addition, many label attributes were observed. The first was the production method, whether the bottle indicated it was produced organically or sustainably. If no indication on the bottle was made, it was assumed the wine was produced conventionally. Results suggested that 98 percent of the wines were produced conventionally, as shown in Figure 21.

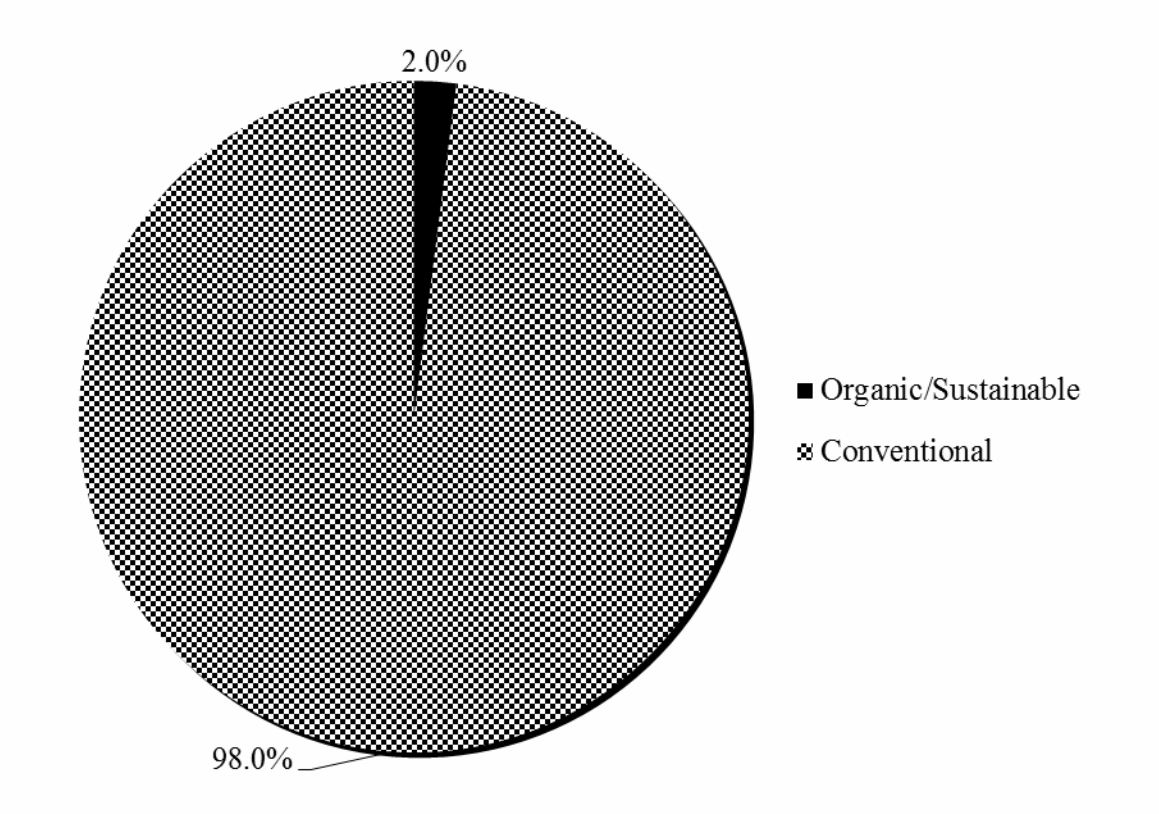

Figure 21: Frequency of Production Method: Organic/Sustainable vs. Conventional (n=395)

Next, the ownership structure was taken into consideration. Whether or not the label indicated it was produced at a family winery was examined. If the bottle had no indication, it was assumed that the winery was corporate-owned and operated. Figure 22 shows that 65.6 percent of the wines were corporately owned.

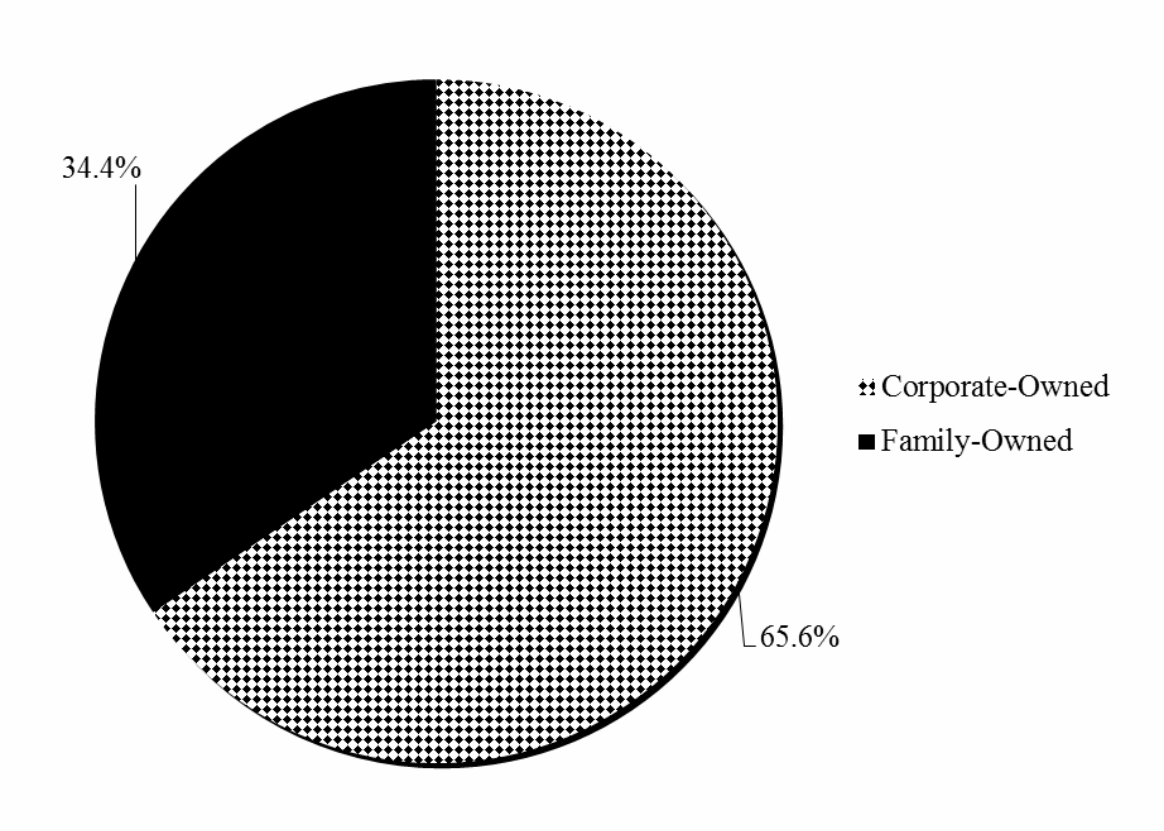

Figure 22: Frequency of Ownership Structure: Corporate vs. Family Owned (n=395)

Whether a quality descriptor was indicated on the bottle was also recorded. Quality descriptors included Selection, High, Reserve, or Grand Reserve. Results showed that 91.4 percent of the wines collected indicated none of these quality descriptors on the label, as shown in Figure 23.

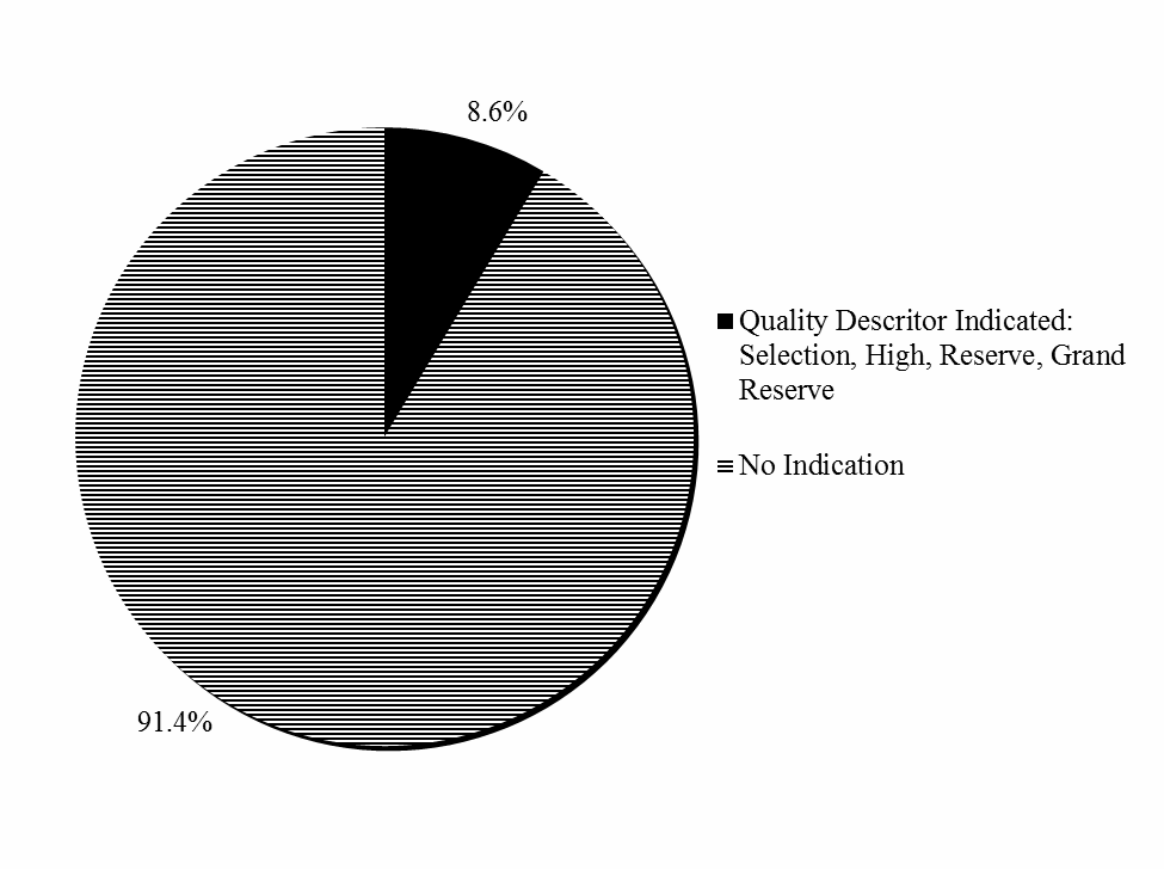

Figure 23: Frequency of Quality Descriptors Indicated on the Wine Label (n=395)

The last label attribute evaluated was whether or not the label included an image (of any type) or whether it was only text. Figure 24 shows that 78.5 percent of the wines had some type of image on the label.

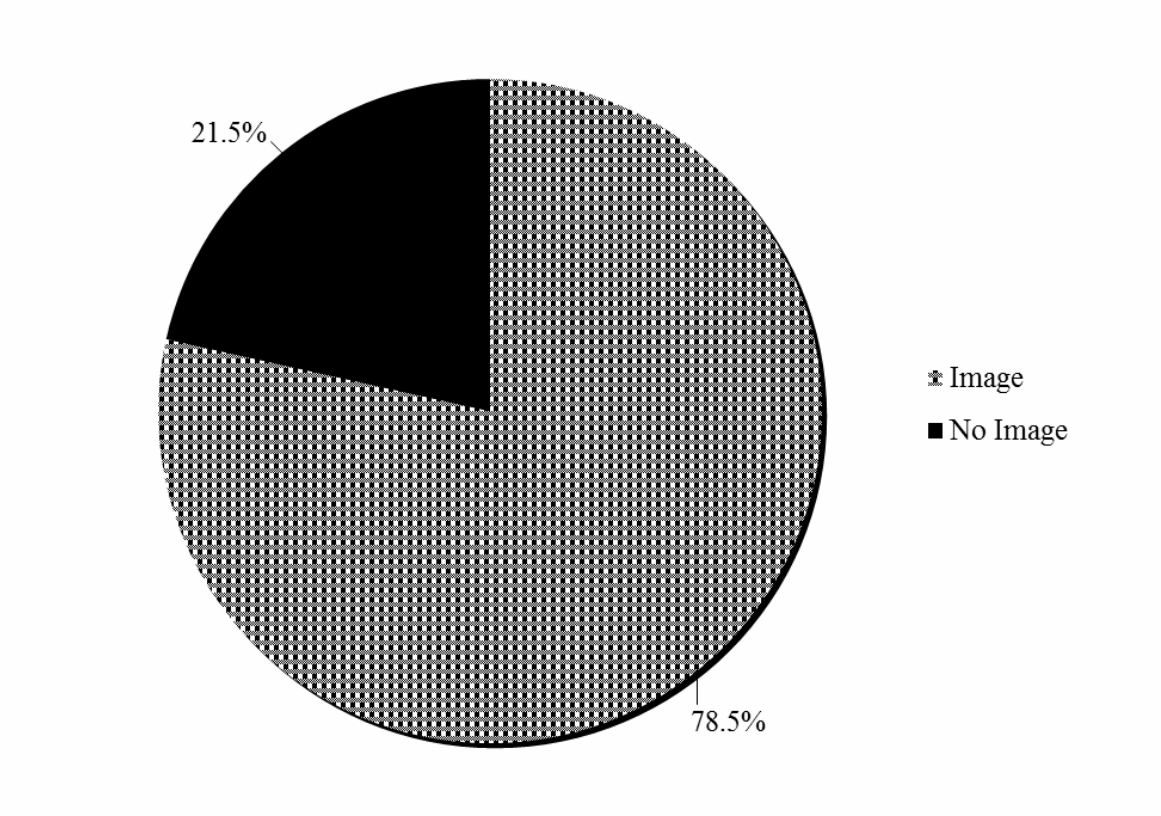

Figure 24: Frequency of Image Being Used on Wine Labels (n=395)

Table 10 provides the descriptive statistics of the *Beverages and More* data, including the definition, mean and standard deviation of each variable.

Table 10: Descriptive Statistics of the *Beverages & More* Data

Variable	Definition	Number of Obs. (N = 395)	Frequency and Average Price for each category
Price			
Retail Price	Shelf Price	395	($18.39)
ln (Retail Price)	Natural log of Shelf Price	395	($2.83)
Variety			
Chardonnay	Varietal Chardonnay	211	0.534 ($18.15)
Riesling/Sauvignon Blanc	Varietal Riesling or Sauvignon Blanc	100	0.253 ($14.73)
Pinot Noir	Varietal Pinot Noir	84	0.213 ($23.36)
California Wine Regions			
Napa	Production region is Napa	105	0.266 ($20.30)
Sonoma	Production region is Sonoma	135	0.342 ($18.81)
Bay Area/Central Coast	Production region is Bay Area/Central Coast	133	0.337 ($16.65)
Mendocino	Production region is Mendocino	22	0.056 ($17.17)
Varietal by California Wine Region			
Chardonnay Napa	Varietal Chardonnay from Napa	54	0.137 ($20.23)
Chardonnay Sonoma	Varietal Chardonnay from Sonoma	73	0.185 ($20.27)
Chardonnay Bay Area/CC	Varietal Chardonnay from Bay Area/CC	71	0.180 ($15.33)
Chardonnay Mendocino	Varietal Chardonnay from Mendocino	13	0.033 ($14.07)
Riesling/Sauvignon Blanc Napa	Varietal Riesling/SB from Napa	29	0.073 ($17.06)
Riesling/Sauvignon Blanc Sonoma	Varietal Riesling/SB from Sonoma	39	0.099 ($13.45)
Riesling/Sauvignon Blanc Bay Area/CC	Varietal Riesling/SB from Bay Area/CC	26	0.066 ($12.49)
Riesling/Sauvignon Blanc Mendocino	Varietal Riesling/SB from Mendocino	6	0.015 ($21.49)
Pinot Noir Napa	Varietal Pinot Noir from Napa	22	0.056 ($24.76)
Pinot Noir Sonoma	Varietal Pinot Noir from Sonoma	23	0.058 ($23.90)
Pinot Noir Bay Area/CC	Varietal Pinot Noir from Bay Area/CC	36	0.091 ($22.27)
Pinot Noir Mendocino	Varietal Pinot Noir from Mendocino	3	0.008 ($21.99)

Table 10: Descriptive Statistics of *Beverages & More* Data Cont.

Variable	Definition	Number of Obs. (N = 395)	Frequency and Average Price for each category
Commercial Wines	Wines priced below $13	109	0.276 ($11.12)
Semi Premium Wines	Wines priced between $13-$21	98	0.248 ($16.73)
Premium Wines	Wines priced between $21-$40	182	0.461 ($27.82)
Ultra Premium Wines	Wines priced above $40	6	0.015 ($47.82)
Percent Alcohol			
Alcohol Content	Percentage of Alcohol Content	395	13.829 ($18.39)
Alcohol Content: 14% or Less	Wines containing alcohol content of 14% or less	249	0.630 ($15.69)
Alcohol Content: More than 14%	Wines containing alcohol content of more than 14%	146	0.370 ($22.99)
Premium Wines with More than 14% Alcohol Content	Premium wines containing alcohol content of more than 14%	74	0.187 ($28.27)
Cork Type			
Cork	Whether the cork was natural/synthetic or screw cap	333	0.843 ($18.94)
Label Attributes			
Production Method	Whether the wine was produced organically/ sustainably or conventionally	8	0.020 ($17.37)
Ownership Structure	Whether the wine came from a corporate or family owned farm	259	0.656 ($18.38)
Quality Descriptors	Whether the bottle indicated High, Selection, Reserve or Grand Reserve	34	0.086 ($19.52)
Label Image	Whether the bottle had a image on the label or just text	310	0.785 ($17.95)

Analysis of Data

For the *Wine Spectator* dataset, three models were chosen for discussion. One model was selected for the *Beverages and More* dataset. These models were expected to find which wine characteristics best-explained any variations in price. The marginal effect depends on the values of the independent variables, and its relationship to the mean of the dependent variable. Therefore, price premiums associated with each variable were estimated by multiplying the coefficient by the mean of the dependent variable, in this case price (Schamel and Anderson 2003). Price premiums were calculated using both the overall mean price and for the mean price for its individual category.

Wine Spectator Results

The three regressions used in data analysis represented the differences in explanatory power characteristics depending on its origin, and if vintage and label indicators estate, vineyard and reserve, or quality ratings and production size indicators were included. Table 11 shows the regression results, whereas Table 12 displays the marginal effects estimated for each attribute.

Table 11: *Wine Spectator* Regression Results (n=2,809)

		Model 1		Model 2		Model 3	
Variable	**Description**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
	Constant	2.709***	38.858	4.283***	35.876	4.179***	34.275
Region	California	0.046	0.504	0.108**	2.169	0.108**	2.167
	Oregon	-0.083	-1.009	-0.088*	-1.950	-0.071	-1.580
	Washington	-0.300***	-5.132	0.044	1.251	0.066*	1.873
	New York	0.003	0.064	-0.065**	-2.272	-0.045	-1.520
	Canada	0.760***	8.985	0.356***	7.586	0.355***	7.595
	Austria	0.626***	12.050	-0.031	-1.044	-0.024	-0.812
	France	0.518***	9.668	0.087***	2.921	0.112***	3.757
	Germany	1.198***	22.169	0.082***	2.590	0.121***	3.689
	New Zealand	Omitted					
Quality Descriptors by Price Category	Commercial: Classic-Outstanding			-0.395**	-2.230	-0.366**	-2.083
	Commercial: Very Good			-0.397***	-10.616	-0.402***	-10.635
	Commercial: Good-Mediocre-Not Recommended			-0.462***	-12.538	-0.462***	-12.113
	Semi Premium: Classic-Outstanding			0.042	0.809	0.062	1.224
	Semi Premium: Very Good	Omitted					
	Semi Premium: Good-Mediocre-Not Recommended			-0.044	-1.534	-0.050*	-1.747
	Premium: Classic-Outstanding			0.433***	15.066	0.454***	15.779
	Premium: Very Good			0.413***	15.942	0.420***	16.250
	Premium: Good-Mediocre-Not Recommended			0.286***	6.909	0.296***	7.178
	Ultra Premium: Classic-Outstanding			1.299***	47.298	1.306***	47.657
	Ultra Premium: Very Good			1.101***	32.693	1.100***	32.835
	Ultra Premium: Good-Mediocre-Not Recommended			1.159***	14.018	1.153***	14.022
Producer Size	Ln (Number of Cases Produced)			-0.129***	-22.713	-0.129***	-22.641
	150,000 gallons or less			-0.571***	-5.690	-0.566***	-5.688

Table 11: *Wine Spectator* Regression Results Cont. (n=2,809)

		Model 1		Model 2		Model 3	
Variable	**Description**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**	**Coeff**	**t-Stat**
	150,000-250,000 gallons			-0.172	-1.429	-0.189	-1.586
	250,000 gallons or more	Omitted					
Vintage	2009	0.105	1.349			0.016	0.380
	2008	0.273***	3.882			0.071*	1.846
	2007	0.284***	4.327			0.120***	3.346
	2006	0.308***	4.598			0.097***	2.654
	2005	0.336***	5.061			0.132***	3.684
	2004	0.204***	2.950			0.126***	3.359
	2003	0.435***	5.838			0.207***	5.162
	2002	0.337***	4.630			0.153***	3.915
	2001	0.112	1.568			0.072*	1.892
	2000	0.167**	2.069			0.125***	2.906
	1999	0.133*	1.790			0.071*	1.787
	1998	0.075	.996			0.063	1.579
	1997	Omitted					
Label Attributes	Estate	Omitted					
	Vineyard	0.203***	6.255			-0.070***	-3.885
	Reserve	-0.021	-.481			-0.066***	-2.837
R-squared		0.442		0.837		0.842	

***Significant at the 1% level **Significant at the 5% level *Significant at the 10% level

Table 12: *Wine Spectator* Marginal Effects Using Overall Mean Price and Mean Price by Category (n=2,809)

		Model 1			Model 2			Model 3		
Variable	**Description**	**Percent Change (%)**	**ME ($) Overall**	**ME ($) by Category**	**Percent Change (%)**	**ME ($) Overall**	**ME ($) by Category**	**Percent Change (%)**	**ME ($) Overall**	**ME ($) by Category**
Dependent Variable	ln (Price)									
Region	Constant									
	California	4.6%	$2.38	$1.25	10.8%	5.58	$2.93	10.8%	$5.58	$2.93
	Oregon	-8.3%	-$4.28	-$1.60	-8.8%	-4.51	-$1.68	-7.1%	-$3.65	-$1.36
	Washington	-30.0%	-$15.40	-$7.60	4.4%	2.25	$1.11	6.6%	$3.41	$1.68
	New York	0.3%	$0.18	$0.08	-6.5%	-3.34	-$1.58	-4.5%	-$2.32	-$1.10
	Canada	76.0%	$39.08	$52.09	35.6%	18.32	$24.42	35.5%	$18.26	$24.33
	Austria	62.6%	$32.20	$26.03	-3.1%	-1.59	-$1.29	-2.4%	-$1.24	-$1.00
	France	51.8%	$26.65	$22.34	8.7%	4.48	$3.75	11.2%	$5.78	$4.84
	Germany	119.8%	$61.58	$132.09	8.2%	4.23	$9.08	12.1%	$6.23	$13.37
	New Zealand	Omitted								
Quality Descriptors by Price Category	Commercial: Classic-Outstanding				-39.5%	-20.31	-$4.13	-36.6%	-$18.81	-$3.83
	Commercial: Very Good				-39.7%	-20.39	-$3.93	-40.2%	-$20.68	-$3.99
	Commercial: Good-Med-Not Recom				-46.2%	-23.74	-$4.55	-46.2%	-$23.73	-$4.55
	Semi Premium: Classic-Outstanding				4.2%	2.14	$0.76	6.2%	$3.21	$1.14
	Semi Premium: Very Good	Omitted								
	Semi Premium: Good-Med-Not Recom				-4.4%	-2.27	-$0.71	-5.0%	-$2.57	-$0.81
	Premium: Classic-Outstanding				43.3%	22.26	$13.18	45.4%	$23.33	$13.81
	Premium: Very Good				41.3%	21.24	$11.86	42.0%	$21.59	$12.05
	Premium: Good-Med-Not Recom				28.6%	14.70	$7.46	29.6%	$15.24	$7.73
	Ultra Premium: Classic-Outstanding				129.9%	66.77	$150.79	130.6%	$67.16	$151.67
	Ultra Premium: Very Good				110.1%	56.60	$72.79	110.0%	$56.56	$72.75

Table 12: *Wine Spectator* Marginal Effects Using Overall Mean Price and By Category Cont. (n=2,809)

		Model 1			Model 2			Model 3		
Variable	**Description**	**Percent Change (%)**	**ME ($) Overall**	**ME ($) by Category**	**Percent Change (%)**	**ME ($) Overall**	**ME ($) by Category**	**Percent Change (%)**	**ME ($) Overall**	**ME ($) by Category**
	Ultra Premium: Good-Med-Not Recom				115.9%	59.57	$76.50	115.3%	$59.27	$76.11
Producer Size	ln (Number of Cases Produced)				-12.9%	-6.62	-$6.62	-12.9%	-$6.62	-$6.62
	150,000 gallons or less				-57.1%	-29.37	-$29.66	-56.6%	-$29.10	-$29.39
	150,000-250,000 gallons				-17.2%	-8.84	-$1.88	-18.9%	-$9.72	-$2.06
	250,000 gallons or more	Omitted								
Vintage	2009	10.5%	$5.40	$3.31				1.6%	$0.83	$0.51
	2008	27.3%	$14.04	$10.39				7.1%	$3.66	$2.71
	2007	28.4%	$14.60	$15.29				12.0%	$6.17	$6.45
	2006	30.8%	$15.84	$14.45				9.7%	$4.99	$4.55
	2005	33.6%	$17.26	$24.86				13.2%	$6.79	$9.79
	2004	20.4%	$10.50	$9.44				12.6%	$6.47	$5.82
	2003	43.5%	$22.38	$35.19				20.7%	$10.66	$16.76
	2002	33.7%	$17.31	$23.66				15.3%	$7.87	$10.76
	2001	11.2%	$5.74	$5.08				7.2%	$3.72	$3.30
	2000	16.7%	$8.57	$6.41				12.5%	$6.44	$4.82
	1999	13.3%	$6.85	$6.56				7.1%	$3.66	$3.50
	1998	7.5%	$3.84	$2.80				6.3%	$3.26	$2.38
	1997	Omitted								
Label Attributes	Estate	Omitted								
	Vineyard	20.3%	$10.46	$16.02				-7.0%	-$3.57	-$5.47
	Reserve	-2.1%	-$1.08	-$0.88				-6.6%	-$3.41	-$2.80
R squared		0.442			0.837			0.842		

***Significant at the 1% level **Significant at the 5% level *Significant at the 10% level

The initial regression performed on the data set was a basic region-based model that included Old World attributes vintage, as well as the label indicators estate, vineyard and reserve. Results indicated that 44.2 percent of the variation in the price of Riesling could be explained by the regions California, Oregon, Washington, New York, Canada, Austria, France, Germany and New Zealand, as well as vintage and label indicators estate, vineyard and reserve.

The coefficients associated with the region variables capture the price relative to a Riesling from the region Oceania (New Zealand). Therefore, the coefficients describe the price premiums or price discounts that other regions would earn compared to a Riesling from New Zealand. In comparison to Riesling wines from New Zealand, Riesling wines from California, Oregon and New York had no significant impact on price. However, Riesling from Washington would earn price discounts of 30 percent ($15.40), Riesling from Canada would earn price premiums of 76.0 percent ($39.08), Riesling from Austria would earn price premiums of 62.6 percent ($32.20), Riesling from France would earn price premiums of 51.8 percent ($26.65), and Riesling from Germany would earn price premiums of 119.8 percent ($61.58).

The coefficients for vintages refer to price differences relative to the excluded year 1997. Although not all vintages were significant, those that were had significant positive price impacts. In comparison to the 1997 New Zealand Riesling, the vintage 2003 was the largest in magnitude, earning a price discount of 43.5 percent ($22.38). Lastly, the coefficients associated with the label indication variables capture the difference in price relative to the producer indicating “estate” on the bottle. In comparison to estate, indicating “vineyard” on the label increases price by 20.3 percent ($10.46), whereas indicating “reserve” had no significant impact on price.

The second regression performed was also a model that utilized a region-based approach, but included New World attributes quality ratings by price category, and producer size by incorporating indicator variables for the number of gallons produced. According to this model, 83.7 percent of variation is explained by these variables. The coefficients associated with the country variables capture the difference in price relative to

the country New Zealand. Therefore, the coefficients describe the price premiums or price discounts that Rieslings from other regions would earn compared to a Riesling from New Zealand. In comparison to a Riesling from New Zealand, a Riesling from Washington and Austria had no significant impact on price. However, a Riesling from California would earn price premiums of 10.8 percent ($5.58), a Riesling from Oregon would earn price discounts of 8.8 percent ($4.51), a Riesling from New York would earn price discounts of 6.5 percent ($3.34), a Riesling from Canada would earn price premiums of 35.6 percent ($18.32), a Riesling from France would earn price premiums of 8.7 percent ($4.48), and a Riesling from Germany would earn price premiums of 8.2 percent ($4.23).

In addition, indicator variables capturing the relationship between quality ratings and price categories were included in the model. The coefficients associated with these variables capture the difference in price relative to the category Semi Premium: Very Good, which includes wines priced between $13 and $21 that earned *Wine Spectator* scores between 85 and 89. In comparison to "Semi-Premium, Very Good Wines," all of the Commercial wine categories received price discounts, whereas Premium and Ultra-Premium wine categories earned price premiums.

Lastly, production size was incorporated into this model. First, the natural log of the number of cases produced was used to scale down the quantities. Therefore, this variable's coefficients are interpreted differently as it is a double log function. In this case, it suggests the elasticity of price with respect to the number of cases produced. In this model, if the number of cases produced increased by one percent while all other variables are held constant, the price of New Zealand Riesling would earn price discounts of 12.9 percent ($6.62). In addition, the number of gallons produced was also incorporated with a

production scale of 150,000 gallons or less, 150,000-250,000 gallons, or 250,000 gallons or more. In comparison to wine production of 250,000 gallons or more, the production of 150,000 gallons or less had a significant impact on price, earning price discounts of 57.1 percent ($29.37).

The third regression utilized the region-based approach and included both Old World and New World attributes. The model included regions California, Oregon, Washington, New York, Canada, Austria, France, and Germany, as well as quality ratings by price category, producer size by incorporating indicator variables for the number of gallons produced, vintage and the label attributes estate, vineyard and reserve. This model explained 84.2 percent of variation in the price of Riesling.

The coefficients associated with the region variables capture the difference in price relative to the region New Zealand. Therefore, the coefficients describe the price premiums or price discounts that Rieslings from other regions would earn compared to a Riesling from New Zealand. In comparison to New Zealand Rieslings, California Riesling receive price premiums of 10.8 percent ($5.58), Washington Riesling receive price premiums of 6.6 percent ($3.41), Canadian Riesling receive price premiums of 35.5 percent ($18.26), French Riesling receive price premiums of 11.2 percent ($5.78), and German Riesling receive price premiums of 12.1 percent ($6.23). Results indicated that the regions Oregon, New York and Austria had no significant impact on price.

In regards to quality ratings by price category, the coefficients associated with these variables capture the difference in price relative to the category Semi-Premium: Very Good, which includes wines priced between $13 and $21 that earned *Wine Spectator* scores between 85 and 89. In comparison to “Semi-Premium, Very Good Wines,” all of

the Commercial wine categories received price discounts, whereas Premium and Ultra-Premium wine categories earned price premiums.

Production size was also incorporated into this model. First, the natural log of the number of cases produced was used to scale down the quantities. In this model, if the number of cases produced increased by one percent while all other variables are held constant, the price of New Zealand Riesling would earn price discounts of 12.9 percent ($6.62). The number of gallons produced was also incorporated with a production scale of 150,000 gallons or less, 150,000-250,000 gallons, or 250,000 gallons or more. In comparison to wine production of 250,000 gallons or more, the production of 150,000 gallons or less had a significant impact on price, earning price discounts of 56.6 percent ($29.10).

The coefficients for vintages refer to price differences relative to the excluded year 1997. Although not all vintages were significant, those that were had significant positive price impacts. In comparison to the 1997 New Zealand Riesling, the vintage 2003 was the largest in magnitude, earning a price discount of 20.7 percent ($10.66). Lastly, the coefficients associated with the label indication variables capture the difference in price relative to the producer indicating “estate” on the bottle. In comparison to estate, indicating “vineyard” on the label decreases price by 7 percent ($3.57), whereas indicating “reserve” decreases price by 6.6 percent ($3.41).

Beverages and More Results

The second dataset, based on wine data collected at *Beverages and More*, a local retail store examined not only Riesling, but also varietals Sauvignon Blanc, Chardonnay and Pinot Noir. All wines were from California, but were segmented by the following sub-regions Sonoma, Napa, Bay Area/Central Coast, and Mendocino. Other variables included interactions between Varietal and Region, Price Categories, Alcohol Content, Cork Type, Production Method, Ownership Structure, Quality Descriptors and Label Image. This model explains 86.7 percent of the variation in the price of California wine varietals Riesling or Sauvignon Blanc, Chardonnay and Pinot Noir.

Table 13: *Beverages & More* Regression Results (n=395)

Variable	Description	Coeff	t-Stat
Dependent Variable	ln (Price)		
	Constant	3.272***	10.844
Variety	Chardonnay	Omitted	
	Riesling/Sauvignon Blanc	0.001	0.043
	Pinot Noir	0.013	0.344
Region	Napa	Omitted	
	Sonoma	-0.009	-0.406
	Bay Area/Central Coast	-0.040*	-1.711
	Mendocino	-0.123***	-2.845
Variety by Region	Chardonnay from Napa	Omitted	
	Chardonnay from Sonoma		
	Chardonnay from Bay/CC		
	Chardonnay from Mendocino		
	Riesling/SB from Napa	Omitted	
	Riesling/SB from Sonoma	0.060	0.566
	Riesling/SB from Bay/CC	0.049	0.901
	Riesling/SB from Mendocino	0.405***	3.312
	Pinot Noir from Napa	Omitted	
	Pinot Noir from Sonoma	0.094*	1.917
	Pinot Noir from Bay/CC	0.092**	1.983
	Pinot Noir from Mendocino	0.290***	2.879
Price Categories	Commercial	-1.401***	-21.151
	Semi Premium	-1.009***	-15.477

Table 13: *Beverages & More* Regression Results Cont. (n=395)

Variable	Description	Coeff	t-Stat
Price Categories Cont.	Premium	-0.552***	-7.796
	Ultra Premium	Omitted	
Alcohol Content	Alcohol Content	0.042*	1.915
	Alcohol Content: More than 14%	0.026	0.966
	Alcohol Content: 14% or Less	Omitted	
	Premium Wines with more than 14%	0.001	0.028
Cork Type	Cork Type	-0.026	-1.207
Label Attributes	Production Method	-0.056	-0.961
	Ownership	0.000	0.008
	Quality Descriptors	-0.052**	-1.971
	Label Image	-0.020	-1.058

***Significant at the 1% level **Significant at the 5% level *Significant at the 10% level

Table 14: *Beverages & More* Marginal Effects Using Overall Mean Price and By Category (n=395)

Variable	Description	Percent Change (%)	ME Overall ($)	ME by Category ($)
Dependent	ln (Price)			
	Constant			
Variety	Chardonnay	Omitted		
	Riesling/Sauvignon Blanc	0.1%	$0.02	$0.01
	Pinot Noir	1.3%	$0.23	$0.29
Region	Napa	Omitted		
	Sonoma	-0.9%	-$0.16	-$0.16
	Bay Area/Central Coast	-4.0%	-$0.74	-$0.67
	Mendocino	-12.3%	-$2.26	-$2.11
Variety by Region	Chardonnay from Napa	Omitted		
	Chardonnay from Sonoma			
	Chardonnay from Bay/CC			
	Chardonnay from Mendocino			
	Riesling/SB from Napa	Omitted		
	Riesling/SB from Sonoma	6.0%	$1.11	$0.81
	Riesling/SB from Bay/CC	4.9%	$0.90	$0.61
	Riesling/SB from Mendocino	40.5%	$7.45	$8.70
	Pinot Noir from Napa	Omitted		
	Pinot Noir from Sonoma	9.4%	$1.73	$2.25
	Pinot Noir from Bay/CC	9.2%	$1.68	$2.04
	Pinot Noir from Mendocino	29.0%	$5.34	$6.38
Price Categories	Commercial	-140.1%	-$25.76	-$15.58
	Semi Premium	-100.9%	-$18.55	-$16.84
	Premium	-55.2%	-$10.16	-$15.36

Table 14: *Beverages & More* Marginal Effects Using Overall Mean Price and By Category Cont. (n=395)

Variable	Description	Percent Change (%)	ME Overall ($)	ME by Category ($)
Price Categories Cont.	Ultra Premium	Omitted		
Alcohol Content	Alcohol Content	4.2%	$0.78	$0.78
	Alcohol Content: More than 14%	2.6%	$0.48	$0.60
	Alcohol Content: 14% or Less	Omitted		
	Premium Wines with more than 14%	0.1%	$0.02	$0.03
Cork Type	Cork Type	-2.6%	-$0.48	-$0.50
Label Attributes	Production Method	-5.6%	-$1.03	-$0.97
	Ownership	0.0%	$0.00	$0.00
	Quality Descriptors	-5.2%	-$0.97	-$1.02
	Label Image	-2.0%	-$0.36	-$0.35

The coefficients associated with the variety and region variables capture the difference in price relative to Chardonnay grapes and the Napa region. Results indicated that in comparison to Chardonnay, Riesling and Sauvignon Blanc, as well as Pinot Noir varietals had no significant impact on price. In regards to region of origin, relative to Napa, wines from the Sonoma region has no significant impact on price, whereas wines from the Bay Area/Central Coast and the Mendocino regions earned price discounts of four percent ($0.74) and 12.3 percent ($2.26), respectively.

Of the interaction variables between varietal and region included in the model, Riesling/Sauvignon Blanc wines from Mendocino earned price premiums of 40.5 percent ($7.45) in comparison to Chardonnays from the Napa region. In addition, Pinot Noir wines from Sonoma, Bay Area/Central Coast, and Mendocino regions earned price premiums of 9.4 percent ($1.73), 9.2 percent ($1.68), and 29 percent ($5.34), respectively. The coefficients associated with the price category variables capture the difference in price

relative to ultra premium wines. Results indicated that in comparison to ultra premium wines, commercial, semi premium, and premium wines earn significant price discounts of 140.1 percent ($25.76), 100.9 percent ($18.55) and 55.2 percent ($10.16), respectively.

Alcohol content was also examined, and results suggested that indicating the percent of alcohol on the label earned price premiums of 4.2 percent ($0.78). In addition, indicating one of the following descriptors Selection, High, Reserve, Grand Reserve or Consignment on the wine label earned price discounts of 5.2 percent ($0.97). Lastly, label attributes indicating production method, ownership structure, and label image had no significant impact on price.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The highly competitive global wine market is full of wines with unique characteristics. The intent of this study was to estimate price premiums for cool climate wines regarding growing region and label characteristics. It was conducted to analyze whether certain attributes such as region, *Wine Spectator* score, number of cases produced, vintage and other bottle characteristics, would have a relationship with the price of cool climate wines. The objectives were to 1) analyze the cool climate wine varietal, Riesling, by regions California, Oregon, Washington, New York, Canada, Austria, France, Germany, and New Zealand, 2) to determine what factors impact the cool climate wine varietal Riesling by region based on various attributes, and 3) to determine what factors impact the cool climate wine varietals Riesling, Chardonnay, Sauvignon Blanc and Pinot Noir based on various attributes for the California region. To perform this study, two different datasets were collected to help evaluate the drivers of prices in cool climate wine markets. Both datasets were used in a regression analysis. The regression results enabled the researcher to analyze whether there was a relationship between the price of cool climate wines and the various attributes chosen.

The *Wine Spectator* dataset was collected to help evaluate the first two objectives. It consisted of 2,809 Riesling wine observations that gathered information by region.

Three regression results were chosen for analysis in this study. The variables included regions California, Oregon, Washington, New York, Canada, Austria, France, Germany and New Zealand; as well as quality ratings based on price category, number of cases produced, vintage and the label indicators estate, vineyard and reserve. The first regression examined the characteristics associated with price by region and Old World attributes vintage and the label indicators. The second regression examined the attributes associated with price by region and New World attributes quality ratings by price category, and number of cases produced. The third regression incorporated both Old and New World attributes. Results indicated that third model that incorporated both Old and New World attributes had the greatest explanatory power explaining 84.2 percent of the variation in the price of Riesling.

The *Beverages and More* dataset was gathered to evaluate the third and final objective, to estimate the impact of various factors on price of cool climate wines Riesling, Chardonnay, Sauvignon Blanc and Pinot Noir based for the California region. The collection consisted of 395 wine observations. Variables included variety (Riesling, Chardonnay, Sauvignon Blanc and Pinot Noir), California wine regions (Sonoma, Napa, Bay Area/Central Coast, Mendocino and South Coast), Varietal by region, Alcohol Content, Cork Type, Production Method, Ownership Structure, Quality Descriptor, and Label Image. Unlike the *Wine Spectator* dataset, it included multiple wine varietals, but focused only on California wine producing regions. The varieties, Sauvignon Blanc and Chardonnay, both had a significant impact on price, earning price discounts of 35.1 percent ($0.06) and 24.8 percent ($0.04), respectively. In comparison to the Sierra Foothills region, all other California wine regions had a significant impact on price, with

Napa and Sonoma earning the highest price premiums of 42.7 percent ($0.07) and 38.9 percent ($0.07), respectively. The following label attributes also had a significant impact on price: indicating alcohol content resulted in a price premium of 18.7 percent ($0.03), produced organically earn price premiums of 20.6 percent ($0.03) and having an image on the label earned price discounts of 11.3 percent ($0.02). Of the label attributes, produced organically was the largest in magnitude. Although, some of the price premiums and discounts by percent are rather large, the associated monetary marginal effects are extremely small due to the low mean prices. The remaining variables cork type (Natural/Synthetic or Screw Cap), ownership structure (conventional or family), and quality descriptor, were not significant.

After analyzing the data for both datasets, it has been found that there is an overall relationship between price and all of the considered wine attributes. The results of the study supported the hypothesis that the attributes indicated, excluding cork type, ownership structure, and quality descriptor, had a statistically significant effect on the price of cool climate wines.

Conclusions

The results show that region, quality ratings by price category, number of cases produced, vintage and several other label characteristics significantly influenced the price of wine. These findings shed some new light on the relative importance of key variables of wine prices.

According to the *Wine Spectator* dataset, the regions California, Washington, Canada, France and Germany had a significant impact on the price of Riesling. In addition, each of these regions earned price premiums in comparison to a New Zealand Riesling. These results are similar to the many past studies that have examined the regions' impact on the price of wine, determining that origin significantly affects the price of wine (Steiner 2002 and 2004; Troncoso and Aguirre 2006; Schamel 2009). In particular, Troncoso and Aguirre (2006) results showed that cool climate regions are preferred to other regions. For example, Schamel and Anderson (2003) examined cool climate regions of Australia and New Zealand. Results showed strong upward trends for newly developing ultra-premium cool climate regions, earning price premiums upwards of 31 percent in comparison to other regions. This study confirms this trend with the cool climate regions of Canada and Austria receiving extremely high price premiums of 76.0 and 62.6 percent, respectively.

Past research (Oczkowski 1994; Landon and Smith 1997; Schamel and Anderson 2003) indicates that ratings are significant, earning wines significant price premiums. Costanigro, McCluskey and Mittelhammer (2007) found that earning an additional point for the *Wine Spectator* score would earn price premiums of 62.0 percent. As expert ratings act as a signal of quality to the consumer, it is evident that the price of the wine will increase as the quality score increases. Therefore, quality ratings should be included in hedonic price models.

Unlike past models, this study incorporates wine ratings as an interaction term to help capture the unique price-quality relationship of wine. Quality ratings by category also had a significant impact on price, with commercial wines priced below $13 earning price

discounts, and premium to ultra premium wines earning price premiums in comparison to semi premium wines that earned very good scores (85-89). These results can be explained by the idea that more expensive wines are likely to have received higher quality ratings. This confirms the results by Schamel (2002) who had found that reputation had significant, positive impacts on price. Results show that there is a linear trend between *Wine Spectator* score and price; thus, a wine's price is related to its quality. The perceived quality often depends on the consumers' prior knowledge of the wine or the assumptions they form from quality rating scores. As producer and varietal reputation accumulates, consumers could pay more attention to the individual producer-specific and varietal quality signals and become less reliant on regional quality indicators (Costanigro, McCluskey and Goemans 2010).

However, the price-quality relationship among cool climate wines appears to be stronger in cool climate regions than other regions. Results show that Germany has earned the highest *Wine Spectator* scores for Riesling, as 90 percent of observations from Germany received Classic-Outstanding scores. Furthermore, of all regions, Germany had the highest mean price of $110.28. Given that Canada also received a high price premium, it is evident that numerous studies have studied Old World wine regions but few have analyzed the New World cool climate regions. This clearly portrays the relationship between price and quality; it is likely that the higher prices mean higher quality ratings.

In addition, the variable, number of cases produced was proven to be significant in all models. Di Vittorio and Ginsburgh (1995), Nerlove (1995), Costanigro, McCluskey, and Mittelhammer (2007), and Guillermo, Brummer, and Troncoso (2008) found that the quantity of cases produced had a statistically significant negative impact on price. The

quantity should help capture a demand effect, which should be negative, and indeed is, valued at -0.129. This study confirms Costanigro, McCluskey, and Mittelhammer's (2007) findings that the number of cases is negative and approaches zero as the number of cases increases. Therefore, it would require a large amount of cases to enter the market to reduce price, which makes sense in the huge American market.

This study is unique as it not only examined the number of cases produced, but also considered the small domestic producer credits based on production levels by including variables based on production size. The first category of producing 150,000 gallons or less earned producers a $0.90 tax credit on their first 100,000 gallons; the second category of production between 150-250,000 gallons earned producers $0.89-$0.01 per gallon on their first 100,000 gallons; and the last category of production of more than 250,000 gallons earned producers no tax credit (TTB 2011). In comparison to production of 250,000 gallons or more, producers of 150,000 gallons or less received price discounts of 56.6 percent ($29.10).

In regards to vintage, all significant vintages had positive price impacts in comparison to a 1997 Riesling from New Zealand, confirming results of numerous previously published studies (Di Vittorio and Ginsburgh 1995; Combris, Lecocq, and Visser 2000; Steiner 2002; Schamel 2002, 2009; Schamel and Anderson 2003; Troncoso and Aguirre 2006; Costanigro, McCluskey, and Mittelhammer 2007; Guillermo, Brummer, and Troncoso 2008; Carew and Florkowski 2010). Costanigro, McCluskey and Mittelhammer (2007) found that the oldest vintage had the highest price premiums. Results suggest that cool climate varietals are not necessarily better when they are older, since the vintage earning the highest price premium of 43.5 percent was in the year 2003.

Lastly, confirming previous results, the label indicators estate, vineyard and reserve seem to be somewhat valuable in determining the price of wine (Costanigro, McCluskey, and Mittelhammer 2007). However, indicating "vineyard" on the label seems to be the most commonly specified term, with 29.7 percent of the wines collected specifying "vineyard" on the wine label. The majority of Riesling wines that indicated "vineyard" were from Europe, including regions Germany (56.8 percent), France (17.2 percent), and Austria (12.7 percent). Results suggest that European wine producers are more likely to specify "vineyard" on the wine label, indicating that Old World wine producers value the importance of indicating vineyard. In addition, they emphasize the quality of its wine to consumers by stressing the relationship between wine quality and the particular vineyard site where the grapes are produced. However, in comparison to indicating vineyard, indicating both estate and reserve significantly influence the price of Riesling.

According to the *Beverages and More* dataset, results indicated that the varieties Riesling or Sauvignon Blanc as well as Pinot Noir had no significant impact on price in comparison to the variety Chardonnay. These results are unlike many studies that have found grape variety to be an important factor when determining the price of wine (Troncoso and Aguirre 2006; Guillermo, Brummer, and Troncoso 2008; Schamel 2009).. The studies performed by Schamel (2002) and Guillermo, Brummer, and Troncoso (2008) also had results that suggested that the price is quite sensitive to the variety. Specifically, Schamel (2002) found that varietals Pinot Noir, Riesling, and Sauvignon Blanc had significant impacts on price. Pinot Noir earned price premiums of 12.0 percent, while

Riesling and Sauvignon Blanc both earned price discounts of 32.2 and 36.1 percent, respectively.

In this study, these varieties may not have had a significant impact on price since they are not as popular of a variety to be grown in California as it is in other cooler regions. These studies showed that the more popular, well-known varieties are associated with higher price premiums than less known varieties. Although Riesling, Sauvignon Blanc and Pinot Noir are not foreign varietals to California consumers, California Chardonnay remains as one of the top wines in terms of production and sales (Wine Institute 2009a), explaining why other varietals may not have been statistically significant in comparison to Chardonnay.

In comparison to the Napa region, significant effects were found for the California wine producing regions Bay Area/Central Coast and Mendocino on price. The regions earned price discounts of 4.0 percent ($0.74) and 12.3 percent ($0.67), respectively. As seen in previous research, it appears that consumers attach a much higher value to wines from Napa Valley than the other regions (Schamel 2002; Steiner 2002; Costanigro, McCluskey, and Mittelhammer 2007). This could be explained by the fact that Napa is one of the most popular, and historically well-known wine producing regions in California. This region might portray a "higher quality" wine to consumers, suggesting higher quality wines result in higher prices. Regional producers benefit from each other's quality performance because of spillover effects. So the overall relationship among producers is a combination of complementary and competitive forces (Schamel and Anderson 2003).

Furthermore, several interaction terms were developed to reflect the relationship between varietal and region. Steiner (2002) also used interaction terms to capture the differences of region and variety. Each wine from a different region can be considered distinctly as a different bundle of attributes. Results showed that the majority of these interaction terms had a significant impact on the price of wine in comparison to the varietal Chardonnay from the Napa region. Riesling/Sauvignon Blanc wines from the Mendocino region, as well as Pinot Noir from Sonoma, Bay Area/Central Coast, and Mendocino regions all earned price premiums of 40.5 percent ($7.45), 9.4 percent ($1.73), 9.2 percent ($$1.68), and 29.0 percent ($5.34), respectively.

The price categories including commercial wines (priced below $13), semi-premium wines (priced between $13-$21), premium wines (priced between $21-$40), and ultra premium wines (priced greater than $40) were developed to establish price breakpoints. In comparison to the highest price category, ultra premium wines, all price categories had a statistically significant negative impact on price. The categories commercial, semi-premium, and premium all received price discounts of 140.1 percent ($25.76), 100.9 percent, ($18.55) and 55.2 percent ($10.16), respectively. Results suggest that in comparison to ultra premium wines, lower prices are expected for the remaining categories.

Past literature indicates that the information presented on the label has a great influence on the price of wine (Guillermo, Brummer and Troncoso 2008; Carew and Florkowski 2010). The label attributes including Alcohol Content and Quality Descriptors had a significant impact on price. Majority of studies have found that indicating the wine's alcohol content had no significant impact on price. Combris, Lecocq and Visser (1997)

found that a variable "excess alcohol" had a minute, but statistically significant impact on price. Wineries may have incentives to distort the alcohol content information presented on the label because the tax rate is higher for higher alcohol wine or because they perceive a market preference for a particular range of alcohol content for a given style of wine. For example, the Federal Wine Excise Tax is $1.07 per gallon for 14 percent alcohol or less and $1.57 per gallon for wines with more than 14% alcohol (Alston et. al 2011). Therefore, this study incorporated variables that represented these two tax categories in addition to the alcohol content variable.

Results showed that indicating alcohol content had a significant impact on price, earning price premiums of 4.2 percent ($0.78), confirming Thrane (2004) that indicating alcohol content had a significant impact on price. On the other hand, alcohol content categories by percentage had no significant impact on price. Additionally, including quality descriptors such as Selection, High, Reserve Grand Reserve, or Consignment on the label was proven to have a small, yet significant negative impact on price. These results were congruent to those from Guillermo, Brummer, Troncoso (2008), suggesting that the insignificant descriptors have no meaning for U.S. consumers, or if there is a meaning associated with these descriptors, consumers might not be willing to pay a higher price for them.

Cork type had no significant impact on price. These results could be explained by the decreased use and popularity of screw caps. Screw cap has made great strides between 2004 and 2007, but slowed and declined in 2008 before rebounding in 2009. Manufacturers claim that this is because the newness of the screw cap has faded. Also,

manufacturers realized that U.S. consumers still associate the cork with quality (GMID 2010d).

Overall, this study is unique in comparison to former research that has examined cool climate regions. Previous studies mainly incorporated New World regions, whereas this study expands to include more regions and additional attributes that may be important in purchasing wine. Research also shows that most studies tend to use quality ratings, such as *Wine Spectator* scores, in the linear form. Using the ratings in the form may be limiting, as it may not bring forth the same monetary effects within each of the quality categories. Therefore, this study used interaction terms to help define the wine-quality relationship. It also adds price-quality interactions to capture the unique nature of the price-quality relationship. Results show that there is a linear relationship between *Wine Spectator* score and price; Although, it suggests that increasing the *Wine Spectator* score for a Classic-Outstanding wine might increase the price more than increasing it for a Mediocre wine. Furthermore, encouraging segmentation by price class.

Lastly, results confirm previously published results indicating that region, reputation, price categories, and vintage have a significant impact on price (Combris, Lecocq, and Visser 2000; Schamel and Anderson 2003; Costanigro, McCluskey, and Mittelhammer 2007; Costanigro, McCluskey, and Goemans 2010; Schnabel and Storchmann 2010). All of these variables are directly linked to quality. Results imply the importance of quality and suggest a difference between the valuation of Old World and New World wine consumers.' For instance, it appears that consumers of Old World wines are more educated on the importance of region and vintage, whereas New World wine consumers are not as aware of the importance of certain attributes. Therefore, when

consumers are new or inexperienced, they often look for guidance before purchasing wines, such as the *Wine Spectator* score. This solicits the question as to how expert ratings, in addition to the other variables related to quality, affect the price of wine. Since the quality of a particular bottle of wine cannot be known until it is consumed, consumers' willingness to pay depends on reputations associated with wine. In addition to quality ratings, consumers' perception of a wine's quality depends on producer reputation, region reputation and of the grape variety (Schamel and Anderson 2003). Therefore, it will be important for producers to educate new wine consumers and to figure out what these consumers truly value when making wine purchasing decisions, to determine what will increase the consumers' willingness to pay.

Recommendations

The experience of purchasing, consuming or processing a quality wine should be viewed from a hedonic perspective. A decrease in wine consumption in parts of the Old World has resulted from consumers being less predictable and having more choices than they had in the past. Today, consumers are much more adventurous and are more likely to try different wines. Consumers used to be primarily driven by their loyalty to certain vintages, wine mixtures and grape varieties of brands. Research suggests wine consumption is as much a social transmission as an economic transaction (Mora and Moscarola 2010), which indicates that consumers' wine purchases are not always directly related to its price.

Hedonic price analysis was employed to reveal the values which consumers place on various wine attributes. Estimation results deliver information on wine consumer preferences for attributes contained on the bottle, as well as the value they place on region, varietal, price categories, vintage, alcohol content, amount of cases produced and various label attributes.

This study could be useful for current cool climate wine producers as well as others who are considering planting cool climate wine varietals. In addition, the information could be useful for the many different sectors of the wine industry including companies specializing in growing, harvesting, fermenting, bottling, marketing, branding, buying, selling grapes, or a combination of all these processes. The information could enable them to understand what qualities affect the price of cool climate wines.

However, several issues remain. The analysis may not be fully representative of the wines and regions due to the availability of data. The first dataset containing Riesling data of California, Oregon, Washington, New York, Canada, Austria, France, Germany and New Zealand was collected from the *Wine Spectator* database. Although, the sample size is large with 2,809 observations, it may not be a fully representative sample of Riesling production. The second dataset gathered from a local retail store, *Beverages and More*, examined California wines Riesling, Sauvignon Blanc, Chardonnay and Pinot Noir. However, the store had a much wider selection of Chardonnay than the other varieties, which could have influenced the results. Due to the nature of the data (dummy variables), limited functional flexibility may also limit the validity of the estimates. However, early studies have already shown that such constraints may not be limiting. In addition, previous

research indicated that the variables chosen had the most significant impacts on price in comparison to other wine characteristics.

The question remains as to whether the attributes included as variables in the regression are proxies for other attributes, which themselves are the true attributes in the consumers' eyes. In future analyses, the issue of brand loyalty should be addressed and the current hedonic framework should be accompanied by further testing. Hedonic pricing allows the identification of consumer preferences in the proximity of observed choices, but tends to ignore consumer tradeoff behavior. In addition, the market for cool climate wines could be analyzed using price categories to allow the researcher to segment the wine market by price. Costanigro, McCluskey, and Mittelhammer (2007) specified hedonic functions for different price categories would help determine if consumers valued the same wine attributes across all wines in any price segment. In addition, other functional forms could be explored to compare results to the log-linear model used in this study.

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