

# What Determines the Price of Wine?

## The Value of Grape Characteristics and Wine Quality Assessments

Helene Bombrun and Daniel A. Sumner<sup>1</sup>

### Introduction

Wine is a highly differentiated product derived from grapes of various varieties grown in different regions under diverse agronomic and climatic conditions, which vary by location and year. The wide range of wine products and prices reflect this heterogeneity. Naturally, the price of wine, as with other goods, will be strongly and positively associated with its quality as perceived by consumers. However, in most cases, the comparison across bottles of wine is made without really knowing the quality in the bottle relative to other wines. Consumers must rely on information other than their own tasting experience. Label information at the point of purchase is the most accessible, and quality assessments in the press supplement that information.

Each bottle of wine sold in the United States must provide such information as brand name, class or type of the wine, alcohol content, net volume content, and the name and address of the bottling firm. Most wineries also provide tightly regulated information regarding grape variety, vintage (harvest year) and appellation of origin. (Details of federal laws on wine labeling are in 27 CFR Part 4, published on the Wine Institute website, [www.wineinstitute.org/](http://www.wineinstitute.org/).)

The purpose of this *Issues Brief* is to consider how information about grape characteristics and wine assessments affects wine prices. We present statistical analysis using data from the prices of 8,460 individual California wines.

### Technical approach – hedonic price analysis

The wine consumer faces complex choices. A bottle of wine embodies a bundle of characteristics that different consumers may identify and value differently. Hedonic (from the Greek word for pleasure) analysis relates the price of a good wine to its various quality or cost attributes. Statistical analysis helps to measure consumer valuations of the different wine attributes. Markets for attributes are implicit, but the implicit prices of the attributes determine the actual price of the wine.

Any variable that influences consumer benefit or producer cost is a candidate for inclusion in the hedonic price function. To obtain an estimation of these implicit prices, we use a statistical technique that relates the price of the wine to characteristics of the grapes, winery and wine.

### Data

The data used here consist of 8,460 observations on prices of five premium varietal wines (Cabernet Sauvignon, Chardonnay, Merlot, Pinot Noir, and Zinfandel) and 12 vintages (1989 to 2000) from all regions of California. The data were collected from the “New Releases for California” wines published in bimonthly issues of the *Wine Spectator* from January 15, 1995 to December 31, 2001. The data are spread evenly across the seven years of publication. For each observation, the magazine provides information

---

<sup>1</sup>Helene Bombrun was a post graduate researcher at the University of California Agricultural Issues Center; Daniel A. Sumner is the Frank H. Buck, Jr. Professor, Department of Agricultural and Resource Economics, University of California, Davis, and director, University of California Agricultural Issues Center.

**Table I: Data description and statistics**

---

Variable to be explained	Weighted sample mean <sup>1</sup>
Price (in year 2001 dollars) <sup>2</sup>	16.85
Explanatory variables = Wine attributes	
Tasting score of the wine	84.7
Age of the wine at release (years)	2.0
Grape variety	
Cabernet Sauvignon	28.8%
Chardonnay	42.3%
Merlot	17.4%
Pinot	4.7%
Zinfandel	6.8%
Grape location (from appellations) <sup>3</sup>	
North Coast region	47.2%
(Napa County) <sup>4</sup>	17.9%
(Sonoma County) <sup>4</sup>	22.0%
Central Coast region	15.5%
Sierra Foothills region	0.5%
South and Central Valley	1.7%
California, state appellation	35.6%
Label designation	
Vineyard	4.2%
Estate	1.3%
Reserve	12.8%
Grape vintage	
Vintages before 1993	3.8%
Vintage 1993	8.1%
Vintage 1994	13.3%
Vintage 1995	13.7%
Vintage 1996	15.1%
Vintage 1997	17.7%
Vintage 1998	16.5%
Vintage 1999	11.4%
Vintage 2000	0.4%

---

<sup>1</sup> The means are weighted by the number of cases of each wine.

<sup>2</sup> The prices are reported in 2001 dollars using the CPI deflator.

<sup>3</sup> The sum of share for location variables is larger than 100% since some appellations contain two or more counties.

<sup>4</sup> These shares do not include Carneros appellation (6.5% of the observations), since it overlaps Napa and Sonoma counties.

contained on the wine label, the winery-recommended retail price per 750 ml bottle, the tasting score established by the *Wine Spectator* staff, and the number of cases produced. Moreover, the month and year of publication give an indication about the period of market availability of the wine, as well as its age at release. We note that the *Wine Spectator* mainly reviews relatively high-priced wines made from grapes grown in the coastal regions of California. Therefore, our data reflects only a small percentage of the California wines deriving from lower priced grapes grown in the Central Valley. Table 1 lists and summarizes means and standard deviations for some key variables.

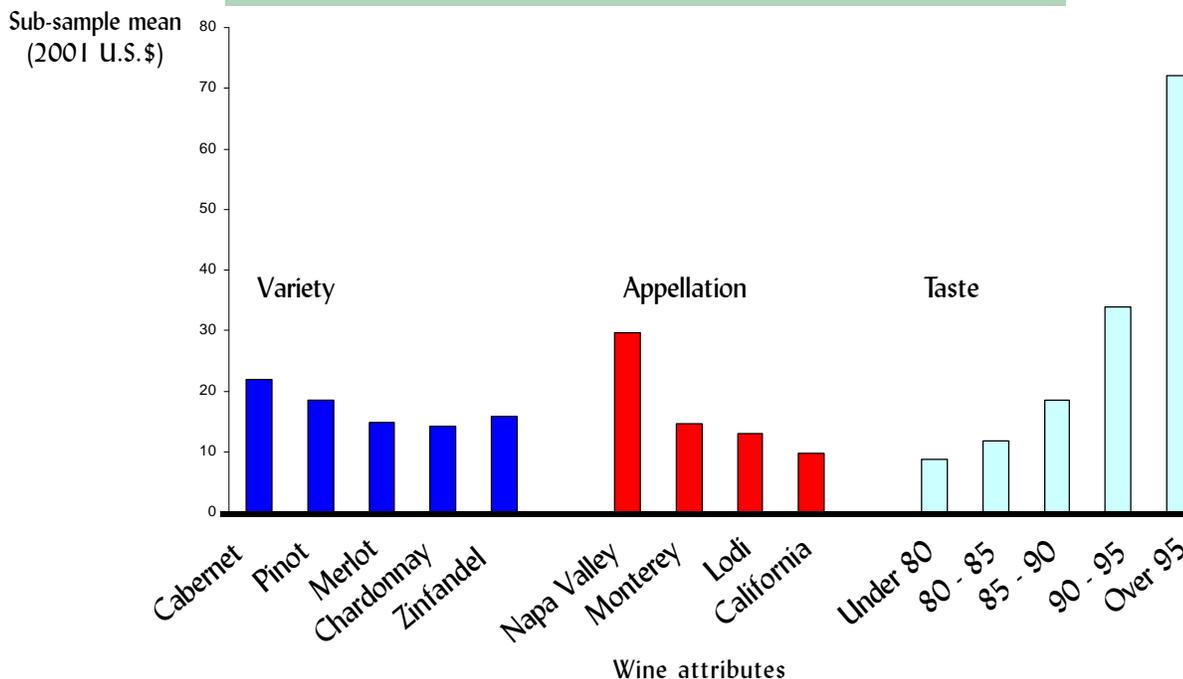
The published price is a suggested retail price the wineries provide to the *Wine Spectator* at the time the wine is tasted and listed—which is also the time the wine is released on the market. Price, however, is susceptible to change over time. We may expect that higher published scores lead to higher actual retail market prices. In our sample, prices range from a minimum of \$5 to a maximum of \$325 per bottle, with a mean of \$29.20 per bottle. The weighted mean price is \$16.80 per bottle, reflecting higher prices for wines made in smaller quantities. Wine ratings reported in the *Wine Spectator* reflect how highly the editors regard each wine relative to other wines in its category.

Wines are tasted with labels covered. Tasters are told the general type of wine, variety, region, and vintage. (For details about how tastings are conducted, see *Wine Spectator*, Nov. 15, 2000, p.224.) In our sample, the wine quality index ranges from 68 to 99 with a mean of 86.9 and a weighted mean of 84.7.

Wines are released an average of two years after harvest. Almost 20 percent of the individual wines and 4.2 percent of the total wine quantity have a vineyard designation, which requires that at least 85 percent of the grapes used come from the designated vineyard. Only 2.4 percent of the wines and 1.3 percent of wine quantity contain the label designation “Estate.” This designation requires that 100 percent of the fruit comes from the designated location and that winemaking takes place where the fruit was grown. About 14 percent of the wines and 12.8 percent of the wine quantity are “reserve wines,” a term defined by the wineries with no regulations regarding its use.

The sample contains 126 grape appellations of origin. An appellation names the geographic origin of between 75 percent and 100 percent of the grapes used in the wine. About 79 percent of the wines and 46 percent of the wine quantity are also official American Viticultural Areas (AVAs) which are specific regions

**Figure 1: Weighted average prices for different sub-samples**



defined by wine regulators. Almost half of the total wines in the sample come from grapes grown in the North Coast, which represents almost three-quarters of the distinct wines and wine labels, including 18 percent from Napa County and 22 percent from Sonoma County. Most of the other wines designate essentially Central Coast grape appellations; very few refer to the South, the Central Valley or the Sierra regions. The general state appellation, “California,” describes 5.8 percent of the labels, but more than one-third of the total wine.

Figure 1 shows that without controlling statistically for any other attributes, Cabernet wines are the highest priced wines in the state (\$21.90 per bottle in weighted average), and Chardonnay wines are the lowest (\$14.20). The figure also displays the average price of wines from four illustrative appellations among the 126 different designations for grape growing regions. Wines with the generic state appellation, “California,” are the lowest priced (\$9.80 in weighted average), while wines from Napa Valley reach a weighted average price of \$29.60 per bottle. Oakville, at \$45 per bottle, and Howell Mountain, at \$43.60 per bottle, are the appellations with the highest average prices. Both are in the Napa Valley. Finally, Figure 1 also shows that the higher the tasting score, the higher the weighted average price. Moreover, the higher the score, the higher the price difference for one unit of score.

## Effect of Attributes on Price

The estimated hedonic price function is presented in Table 2. For continuous variables such as “score” and “age,” the estimates represent implicit attribute prices. The results are presented as percentage impact of each variable on price. Conversely, for variables such as “Cabernet” or “Napa Valley,” that take the value zero or one, the estimates measure the relative percentage impact (from the average price of the reference variable) of the attribute represented by the variable. The reference variables are “California” for the category “appellation”; “Merlot” for the category “variety”; and “1995” for the category “vintage.” We also present the dollar values of the marginal effects associated with each of the explanatory variables. These values can be used to compare the magnitude of each characteristic of the reference variable for the corresponding category for all the other variables.

The variables (score, age at release, grape vintage, variety, appellation of origin) and the label designations (vineyard, estate, and reserve) explain 72 percent of the wine price variation when weighted by the number of cases made of each wine.

Let us consider the meaning of each of the estimates in Table 2. A one-point score increase in the *Wine Spectator* is worth almost 5 percent of the price or, on average, \$0.83 per bottle. We expect that one unit difference in score in the top tasting rates will be worth more than \$1 per bottle. The age of wine also matters. An additional year of storage before release is valued at \$3.27 per bottle, on average. This benefit has to be compared to the cost of storing to determine if the additional year of storage is profitable. The specific “vineyard” designation has a higher impact on price than “reserve” designation. However, the strict “estate” designation does not have any significant impact on price.

Some characteristics of the grapes themselves have important direct impacts on wine prices, others do not. Grape varieties Chardonnay, Zinfandel and Cabernet (given other attributes constant) do not have significant impacts on wine prices (relative to Merlot wines). Pinot Noir however, has a price premium of 9.9 percent above Merlot prices. Similar regressions on variety subsamples do show some differences across varieties. Tasting score matters the most for Cabernet wines (which have a 7.6 percent premium per unit of score) and the least for Merlot wines (3.1 percent). This has to be compared to the marginal cost of improving quality for each variety in order to determine if growers and winemakers should attempt to increase the score of their Cabernet wines. Age at release matters most for Cabernet and Merlot, while age has a negative impact for Zinfandel wines. Vineyard designation is the most valuable for Pinot Noir wines and the least for Merlot and Zinfandel wines, while Zinfandel wines have by far the highest price premium for reserve wines (60.3 percent).

Region of origin and, particularly, appellation are also important to price. Only a few results are presented on Table 2. Out of 125 appellations included in the regression (California being the reference), more than half have a significant impact on prices. For example, Napa Valley, one of the most famous appellations in California, produces wines that are, on average, 61 percent more expensive than wines with a California

**Table 2: Selected partial effects of some key wine attributes on the price<sup>1</sup>**

Explanatory variables (or wine attributes)	Percentage Impact <sup>2</sup>	Dollar Impact <sup>3</sup>
Tasting score (1 point)	4.9	0.83
Age at release (years)	19.4	3.27
Label designation		
Vineyard	12.7	2.09
Reserve	5.9	0.99
Grape variety (relative to Merlot)		
Pinot Noir	9.9	1.47
Grape vintage (relative to 1995)		
Vintage 1994	-5.1	-0.85
Vintage 1996	8.9	1.49
Vintage 1997	13.0	2.18
Vintage 1998	12.2	2.04
Vintage 1999	8.7	1.46
Grape appellation (relative to “California”) <sup>4</sup>		
Selected appellations		
Oakville	90.6	8.91
Sonoma Mountain	84.9	8.36
Napa Valley	60.9	5.99
Napa County	31.2	3.07
Paso Robles	30.4	2.99
Mendocino	29.6	2.91
Amador County	28.3	2.78
San Luis Obispo County	27.4	2.70
Sonoma County	27.1	2.67
Monterey	22.3	2.19
Central Coast	19.0	1.87
Lodi	12.8	1.26

Number of observations:  
8,460

<sup>1</sup> 2001 dollars using the Consumer Price Index.

<sup>2</sup> All variables are statistically significant at 95% confidence interval, Nonsignificant effects were for Estate, Cabernet Sauvignon, Chardonnay, Merlot, and Zinfandel.

<sup>3</sup> Calculated at sample mean for “score” and “age”; at sample mean of wines without the vineyard designation for “vineyard”; at the sample mean of wines without the reserve designation for the variable, “reserve”; and at the sample mean of wines with the attribute on price.

<sup>4</sup> A total of 125 appellations are included in the model and 64 appellations have a statistically significant effect relative to the “California” appellation.

appellation. This means that a bottle of Napa Valley wine, other characteristics constant, costs \$6 more, on average, than a wine with a California appellation. Appellations with the highest premiums are mainly located within the Napa Valley appellation. For example, Oakville and Howell Mountain appellations earn a premium of 91 percent over wines with the California appellation.

Vintage is another key wine attribute directly related to grapes that has a significant impact on wine prices. Table 2 shows that the vintage 1997 has the highest price premium relative to vintage 1995. However, several effects have to be carefully considered. Year of release and age effect are closely (and linearly) related to vintage (harvest year). In Table 2, we controlled for the age at release and inflation effects. But this means vintage and age together imply a marketing period which is affected by aggregate grape and wine supply and demand factors. Further study should consider variables related to vintage or release date, such as the size of the total crush by location and variety, as well as the price of wine grapes. As price of grapes and price of wine are endogenous, a system of equations would have to be considered.

## Market implications

The estimated hedonic price function provides farmers, winemakers, marketers, and consumers with important marketing information.

The use of the average market price of a wine obtained from the estimated hedonic price function may help wine marketers review prices and position their wines in the market while allowing wine consumers to compare the actual and expected wine retail prices. To do so, consumers and marketers would need to identify all the attributes of their prospective sale or purchase, and sum the associated implicit prices in order to calculate the expected average price of the differentiated product.

For wine producers, the estimates provide important information for longer-term investment decisions. The comparison of benefits (estimated by the hedonic price function) and costs associated with the acquirement of each attribute must be evaluated in order to direct resources. For example, moving the production from California Merlot wines to Monterey Pinot Noir wines (everything else constant) leads to an increase in price of \$3.70 per bottle. This benefit should be compared to the cost of producing and blending Monterey Pinot

Noir wines in order to determine whether an effort to achieve these new attributes is worthwhile.

These results measure how grape characteristics affect wine prices. Moreover, demand for wine determines, to a great extent, demand for grapes. Therefore, we would expect that a price premium for a certain wine variety or appellation would translate to a price premium for the corresponding wine grape variety and grape location. A comparison of results with a complementary study that relates grape prices with grape attributes, such as in Lee and Sumner (2001), would allow one to check the relationships between valuable attributes of grapes and the value of related attributes in wines.

## Conclusions

Most of the results presented here align with *a priori* expectations. Nevertheless, as far as we know, this is the first time such a thorough empirical study on California wine prices has been reported. We focused on how grape characteristics affect wine prices. Other studies using related data will focus on winery characteristics and related factors such as production size, advertising, and reputation.

## References

- Lee H. and D. A. Sumner 2001. "Econometrics of grape prices in California: the roles of grape supply, location, variety, market power and contracted quality limits." Paper presented at the conference Enometrics VII, May 21-22, 2002, St. Helena, California.
- Shanken, M., ed. 1995-2001. Wine Spectator: The Buying Guide – New Wines Around the World – California, bimonthly issues from Jan. 15, 1995 to Dec. 31, 2001., M. Shanken Communications, Inc., New York.
- Sumner, D. A., H. Bombrun, J. Alston, and D. Heien. (In press.) "An economic survey of the wine and winegrape industry in the United States and Canada." In Globalization of the World's Wine Markets, Editor: K. Anderson. London: Edward Elgar, 2002.
- Wine Institute. 2002 Federal Regulations, CFR 27, Part 4. [www.wineinstitute.org](http://www.wineinstitute.org), San Francisco: Wine Institute.

AIC Issues Brief is published by the University of California Agricultural Issues Center.  
Website: [www.aic.ucdavis.edu](http://www.aic.ucdavis.edu)