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Price Determinants of California Wine in the U.S. Market: Does the Type Matter?

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Abstract

The price of wine reflects the various features that differentiate each bottle. This study is aimed at analyzing the determinants of California wine prices. A hedonic price model is estimated using data collected between 2004 and 2015 from the *Wine Spectator*, with a total of 4,693 individual wines, focusing on type, age, critical points, and variables related to the origin. The impact of geographic production of origin from Bay Area/Central Coast, Carneros, Napa, Mendocino/Lake, and South Coast is analyzed. An important aspect of this analysis is to investigate whether the type of wine is important, and if any price premium regarding to the type (still and sparkling) is changing, holding quality and quantity constant. The main findings suggest California wine prices are determined by time related variables such as age. The expert points given by the *Wine Spectator* also have a significant impact on prices.

Keywords: Hedonic price model, Sparkling, California Wine prices, U.S. wine market

Introduction

The United States is the largest supplier of retail wine in the world, and in addition, it is expanding as one of the fastest growing wine markets internationally, both in production and consumption. In 2014, around 340 million cases of wine were consumed by U.S. consumers. This number is expected to increase by 11% to 378 million cases by 2018. This expansion is due to increased consumption resulted from government subsidies, an increasing younger population of wine enthusiasts, and the convenience of purchasing all types of wine, from all regions, and from online retailers. Currently, there is an estimation of over 100 million wine consumers in the United States (Vino California, 2015).

<<Figure 1 and 2 here>>

Among all viticultural regions in the U.S., undoubtedly, California is the star of the show. California is the America's top wine producer by making 90% of all U.S. wine and after Italy, Spain and France is the 4th leading wine producer in the world (Wine Institute Statistics, 2015). "California has had three excellent harvests in both quantity and quality in 2012, 2013 and 2014 and these vintages are receiving global recognition," said Robert P. Koch, Wine Institute President and CEO. Moreover, California wine sales experienced a growth of 6.7% and 4.4% in both value and volume respectively. While 2014 shows the 22nd successive year of growth for all wine sales, the U.S. has been remained the world's biggest wine market since 2010 (Wine Institute Press Room, 2015).

<<Figure 3 here>>

Furthermore, California is the leader in production of not only still wines, but also sparkling wines in the U.S. based on the Alcohol and Tobacco Tax and Trade Bureau reports (TTB Statistics and Data, 2015). Christian Davis asserts that based on indications of the sparkling wine segment in the 2015 U.S. market, approximately 18 million Americans, one third of sparkling wine consumers, are drinking sparkling wine at least once a week. In the U.S. there is a 3% increase in volume to 16 million cases of sparkling wine in 2014. Sparkling wine consumption leads overall in wine growth in the U.S. and is still the leader in sparkling wine consumption worldwide. However, the U.S. is second to France in red wine consumption, and second to Italy white wine consumption. It is predicted by International Wines and Spirits Record, by 2018 the U.S. will be the leader as the worldwide consumer in red and white wines (Vino California, 2015).

<<Table 1 here>>

Based on the Wines & Vines report of 2015, sparkling wine sales exceeded Pinot Grigio and became the third main varietal or type in the U.S. market after Chardonnay and Cabernet Sauvignon. According to Nielson, these two latter white and red varietals are the most prominent wine types, by having 19% and 13% of the market share, respectively (Wine Institute Press Room, 2015). Nevertheless, domestic sparkling wine growth was twice faster than table wine and grew by 9% and 6% in both value and volume respectively. In addition, the imported and

domestic overall growth of sparkling wine was 12% in value and 9% in volume, comparing to 6% and 2% for table wine (Wine & Vines, 2015).

Among all alcoholic beverages, wine is an extremely differentiated item for consumers that can be sold over a very wide range. Price is one of the most influential factors that consumers consider while they are making buying decisions. That being said, there is a stable revolution towards premium wines with higher prices, and producers are staying away from producing wines under \$8. MacMillan, in the Silicon Valley Banks's annual State of the Wine Industry Report states that, at this time, millennials' consumption habits are impacting the average wine prices sold in the U.S. market. The report shows that there is a rise up to 8% in price of wines that cost over \$10 for wine drinkers (SVB Wine Report, 2016).

Literature Review

Even though the price of wine primarily controls the consumers' purchasing decisions, there are other features that increasingly affect the wine consumption. These features are mainly the characteristics revealed on the label of the bottle, such as varietal, vintage, origin, and also the quality and ratings given by experts to each specific wine.

Understanding of correlation between wine prices and wine characteristics is of interest, given the fact that there is a vast variability in both the types of wines and their prices. Moreover, the exact impacts of the features revealed on the label of the bottle, the growing season's weather conditions, technology, and the appellation's natural aptitudes on the wine prices are not precise (Lecocq and Visser, 2006).

Hedonic price models are found in wine price literature assessing the price impact on observable features found on a bottles' label (vintage year, vineyard region and grape variety), sensory features of the wine (level of acidity, tanning, and alcohol) (Combris, Lecocq and Visser (1997), as well as regressing wine prices on a set of attributes (Jones and Storchmann, 2001; Haeger and Storchmann, 2006) to examine which attributes significantly affect the hedonic functions. Oczkowski (2001) asserted that quality and reputation are hidden paradigms, Benfratello, Piacenza and Sacchetto (2009) offered new proof on the elements influencing wine prices, not only on methodological but also factual grounds. For the first time, they worked on two wines with high quality, Barolo and Barbaresco. Their results indicate that sensorial

characters, the wines and producers' legitimacy, and objective features are altogether main elements that impact the consumers' willingness to pay. While these studies have explored different set of variables, no work is done to test the effect of wine types (still and sparkling), despite of the varietal, on the price of wine.

The objective of this paper is to determine which variables significantly affect the price of still and sparkling wines from California in the U.S. market using a hedonic approach. As mentioned above, there are many factors that affect quality and also prices of wine in past studies. This paper explores the impact of type, age, region, and rating.

The paper proceeds as follows: After presenting the model and data in the next section, section 4 provides the main empirical results. The paper ends in section 5 with a conclusion and implication of results.

Empirical Model and Data Description

The hedonic technique is a valuable methodology to study the correlation between quality and price of a certain product. The implied price of a feature is interpreted as the derived price regarding to the product characteristic (Combris, Lecocq and Visser, 1997). Furthermore, this method of analysis has backgrounds in agricultural economics. Waugh (1928), the pioneer of hedonic analysis, investigated the connection between factors of quality that impact vegetable prices in pursuance of determining relative assessments of these features by customers.

In this paper, a hedonic price function is used to identify the determinants that influence price for bottled wine and to see if there is any correlation regarding these variables in regards to the attributes. We use a pooled dataset of 4,693 wines reported and reviewed by the Wine Spectator magazine, one of the most comprehensive sources of wine information on the web. It includes more than 250,000 wine ratings, tasting reports, news and features, editors' blogs and more (Wine Spectator, 2015). Vintages are between 2004 and 2014 and are grown in 5 different regions in the state of California. Information provided in the Wine Spectator include the type of wine (still and sparkling), varietal (Cabernet Sauvignon, Merlot, Pinot Noir, Chardonnay, Riesling, and Sauvignon Blanc), vintage, age, region, price data (suggesting retail prices), and the ratings given to each wine by the Wine Spectator.

In the model, P stands for wine price, all prices are nominal and belong to standard 750ml bottle, assumed to increase over time, and vary from \$10 to \$95. The inflationary effect is captured by using alcoholic beverage CPI (consumer price index) to adjust prices for inflation to current dollars (Bureau of Labor Statistics, 2015).

The time-related variable, age, is included in the model because the value of most wines suitable for aging increases as they become older, but it does not happen to most table wines. Hence the overall effect regarding these variables is uncertain and needs to be investigated (Haeger and Storchmann, 2006). In the model, AGE represents age of wine which is the difference between vintage year and the year that the wine was reviewed. The reviewed year is one year after the vintage in most cases and means that the wine was available in the market.

The impact of experts' ratings is controversial. While some studies found significant impact (Jones and Storchmann, 2001), others proposed that the effects of fundamentals such as weather or knowledge of the winemaker on the wine prices, are more important (Ashenfelter and Corsi, 2001). Scoring systems for ranking or rating wines normally use a 0 to 20 or a 100-point scale. Scores are considered as ordinal instead of cardinal. Many factors affect the scoring of wine quality: aesthetics, pleasure, complexity, color, appearance, odor, aroma, bouquet, tartness, and the interactions with the senses of these features (Olkin et al., 2015). To examine the possible effects of critical scores, the rating system of a well-known wine journal, Wine Spectator, is used. The journal employs a parker point system with a 100-point scale. Ratings given to the wines by the Wine Spectator in this sample vary between 70 and 95.

Additionally, with favor to the production origin, buyers might value wines from certain regions. We considered Bay Area/Central Coast, Carneros, Mendocino/Lake, Napa, and South Coast using the data provided by Wine Spectator. Moreover, if wine drinkers set a value on the particular wine's feature, the difference between the two wines' prices should, holding other variables constant, convey their willingness to pay for an improvement in the feature (Benfratello, Piacenza and Sacchetto , 2009). One objective of this paper is to examine the possible effect of wine type on prices. On the other hand, we will examine if consumers are willing to pay a premium for each particular type of wine. Therefore, we added dummy variables for each of the two different types (still and sparkling), as well as the five major regions of

California. Dummy variables for California regions represent the skill and experience of the winemaker in the model.

<<Table 2 here>>

An Ordinary Least Squares (OLS) regression is used to estimate the following models:

$$\log(P_i) = \alpha_0 + \alpha_1 AGE_i \tag{1}$$

$$\log(P_i) = \alpha_0 + \alpha_1 AGE_i + \alpha_2 PTS_i \tag{2}$$

$$\log(P_i) = \alpha_0 + \alpha_1 AGE_i + \alpha_2 PTS_i + \sum_{k=1}^5 \gamma_k REG_i + \varepsilon_i \tag{3}$$

$$\log(P_i) = \alpha_0 + \alpha_1 AGE_i + \alpha_2 PTS_i + \alpha_3 Sp * AGE + \sum_{k=1}^5 \gamma_k REG_i + \sum_{j=1}^2 \delta_j TYPE_i + \varepsilon_i \tag{4}$$

In which, P represents adjusted price of wine; AGE indicates age of wine; PTS represents critical scores; REG denotes regional dummies. In this equation $i=1,2, \dots, 4693$ represents an individual wine, $k=1, 2, \dots, 5$ represents each region, $j=1, 2$ represents each type of wine. In order to adjust the scale of price unit, logarithmic form is used for P variable.

Estimation Results

Table 3 presents the results of ordinary least squares (OLS) estimates of the models. It can be inferred from the results, that wines get more expensive over time as age increases, indicated by the significant positive coefficient for the age variable. The marginal effect and elasticity are 3.20 and 0.25, respectively. It means for each year increase in age, ceteris paribus, the price rate of wine will increase by \$3.2/bottle and also for each 10% increase of age; the price rate will increase by 2.5%. As predicted, with an R^2 of only 11% Equation 1 does not give an enough explanation of wine price dissimilarity.

<<Table 3 here>>

Column 2 of table 3 shows the results of estimating Equation 2 which refers to the *Wine Spectator* points and their ability to describe the price variations. The variable PTS has a significantly positive influence on California wine prices. By adding the expert knowledge,

which is considered in the form of rating given to the wines by the Wine Spectator, the results of Equation 2 display a significant increase in the goodness to fit measured by $R^2 = 0.21$.

By considering Equation 3 and leaving out “Bay Area/Central Coast” dummy variable, the estimated coefficients for regional dummies were compared to that variable. All of the regional dummy variables are significant. Wines from other regions in California are more expensive than Bay Area/Central Coast region except Mendocino/Lake region. Regions such as Napa, Carneros, and South Coast show a premium comparing to the left out region. On the one hand, positive parameters can be interpreted as an indication of better and more expensive wines from these regions. This can be due to geological factors or skill, knowledge and experience of winemakers. The other factor could be the reputation of winemaker. The regions with lower prices are required to leave their wines in more reasonable prices because they have not gained enough reputation that satisfies their customers. Thus, wines originating from Bay Area/Central Coast seem to show a discount and lower price in the U.S. market.

It is not surprising to see the high premium for sparkling comparing to other types. However, the sparkling prices have declined over time to compete within U.S. highly competitive wine market. The significantly positive estimated coefficient for the variable $Sp*AGE$ is to be interpreted as the premium price for sparkling wine that erodes with later (“larger”) vintages (Figure 4).

<<Figures 4 here>>

By including all variables in the model, R^2 of Equation 4 increases to 0.23 which may imply an improvement in the model by considering the type of wine in the model. Furthermore, the White test results show some evidence of heteroskedasticity in the model; therefore robust standard errors are considered and the proper t-statistics are reported in parentheses. Furthermore, the Ramsey RESET test shows the possible presence of a specification error in Equation 4. It could be due to the functional form or missing variable bias. Different functional forms, linear, quadratic and logarithmic, have been tested and the problem still remains. Next step would be to test whether including climate variables can address the issue. Hence, the results should be interpreted with caution before resolving this issue.

Another potential problem could be multicollinearity. The variance inflation factors (VIF) for all variables in Equation 4 are reported in Table 4. Any number above 10 is representing multicollinearity problem. None of the variables causes the multicollinearity problem in this model.

Conclusion/Implication

The objective of this paper is to determine significant variables affecting the price of California wine in the U.S. market using a hedonic approach. The analysis draws on a pooled data set of 4,693 wines reported and reviewed by the Wine Spectator. Vintages are between 2004 and 2014 and were grown in 5 different viticulture regions in California. Price data, considering suggested retail prices, were associated with age of wines, ratings given to each wine by the Wine Spectator magazine, regional dummy variables of geographic production of origin and also interacting variable between price and age of sparkling wine.

The age variable is significant and has a positive impact on price. The critical scores given by experts to each wine has a significantly positive influence on California wine prices. By adding points and type variables into the model the overall goodness to fit of the model greatly improved. The premium price for sparkling wine erodes with later vintages.

The empirical results point out that the objective features which are accessible on the bottle's description, such as age and origin of production could explain the price of both still and sparkling wine in the market. As the expert points has a significantly positive influence on wine price, providing information about ratings and also awards received by the winemaker for that specific wine on the label is recommended. Tasting and having subscription of wine magazines, in order to reading guides and obtaining information, are only ways of learning about sensory features. This can be costly enough to force consumers to make their decision about wine choices based on the objective characteristics. Additionally, the premium prices for sparkling wine in this sample, indicates that U.S. consumers are willing to pay more for a sparkling wine comparing to still wine. Since results mirror evaluation of wine characteristics by consumers, producers could take this information and apply it to their business in order to make long-term investment decisions and to remain profitable and competitive. Therefore, the U.S. winemakers should work

towards the targeted market to gain more market share and compete with rivals such as French Champagne producers.

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Table 1. Per Capita Wine Consumption by Country

Country	2009	2010	2011	2012
France	46.5	44.06	45.61	44.19
Italy	39.34	40.2	37.66	37.54
Germany	24.87	24.23	24.23	23.98
New Zealand	15.2	15.99	16.5	17.01
Canada	11.12	11.78	11.7	12.5
U.S.	9.08	9.59	10.48	10.42
South Africa	6.93	7.09	7.23	7.37

Source: Wine Institute Statistics, 2015

Table 2. Descriptive Statistics of Variables

Variable	Definition	Unit	Mean	Std. Dev.	Min	Max
P	Adjusted retail price	\$ per bottle	29.17	9.85	10	98.41
AGE	Age of wine	year	2.32	0.96	1	11
PTS	Critics' scores	points	86.36	3.17	70	95
Sp*AGE	Interaction of sparkling and age	-	0.11	0.80	0	11
BC	Regional dummy variable for Bay Area/Central Coast	-	0.12	0.33	0	1
C	Regional dummy variable for Carneros	-	0.13	0.34	0	1
ML	Regional dummy variable for Mendocino/Lake	-	0.10	0.30	0	1
N	Regional dummy variable for Napa	-	0.39	0.48	0	1
SC	Regional dummy variable for South Coast	-	0.23	0.42	0	1
St	Type dummy variable for Still Wine	-	0.97	0.15	0	1
Sp	Type dummy variable for Sparkling Wine	-	0.02	0.15	0	1

Table 3. OLS Estimation Results

Variables	Equation (1)	Equation (2)	Equation (3)	Equation (4)
	n= 4693	n= 4693	n= 4693	n= 4693
Constant	3.02*** (0.01)	-0.11 (0.14)	0.01 (0.14)	0.009 (0.14)
Age	0.12*** (0.005)	0.11*** (0.005)	0.11*** (0.005)	0.11*** (0.006)
Points		0.03*** (0.001)	0.03*** (0.001)	0.03*** (0.001)
ML			-0.05*** (0.02)	-0.05*** (0.02)
C			0.15*** (0.017)	0.15*** (0.017)
N			0.05*** (0.016)	0.05*** (0.016)
SC			0.05*** (0.017)	0.05*** (0.017)
Sp				0.23*** (0.072)
Sp*AGE				-0.03*** (0.015)

R ²	0.111	0.216	0.238	0.239
F-statistic	586.79	645.90	244.43	184.77

Note: heteroskedasticity consistent standard errors in parentheses.

*** 1% significance level, **5% significance level and *10% significance level.

Table 4. Variance Inflation Factors for Equation 4

Variable	VIF
AGE	1.36
PTS	1.03
ML	1.60
C	1.81
N	2.46
SC	2.16
Sp	7.29
Sp*AGE	8.10

Note: Multicollinearity is assumed to be present when $VIF > 5$

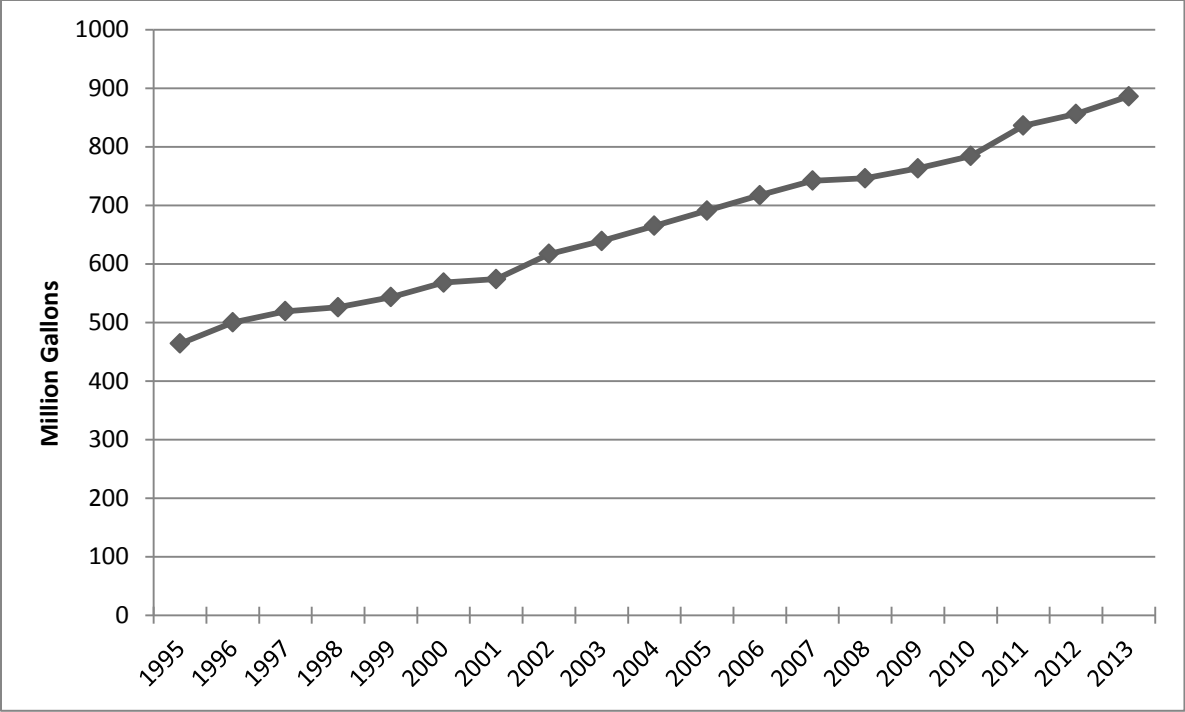


Figure 1. U.S. wine consumption

Source: Wine Institute Statistics, 2015

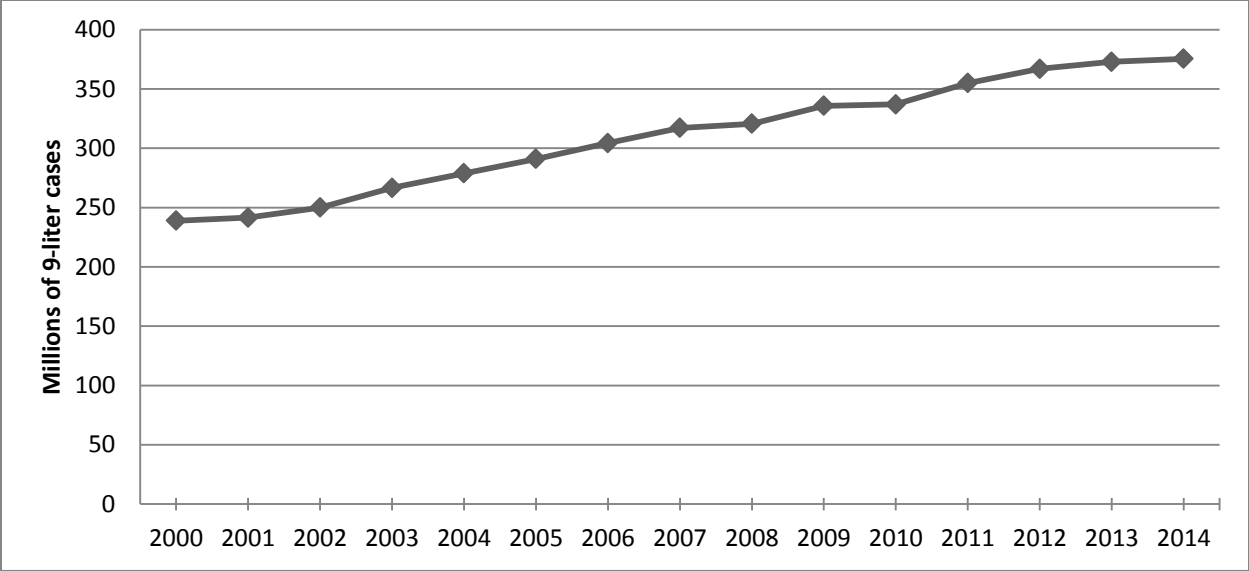


Figure 2. U.S. wine sales

Source: Wine Institute Statistics, 2015

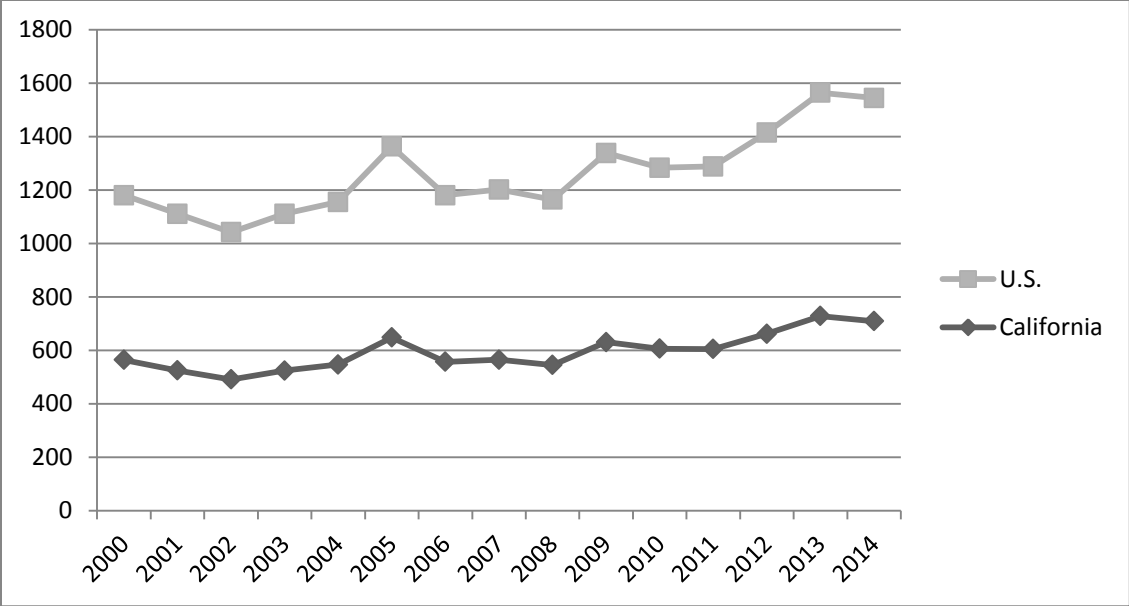


Figure 3. California and U.S. production

Source: Wine Institute, 2015

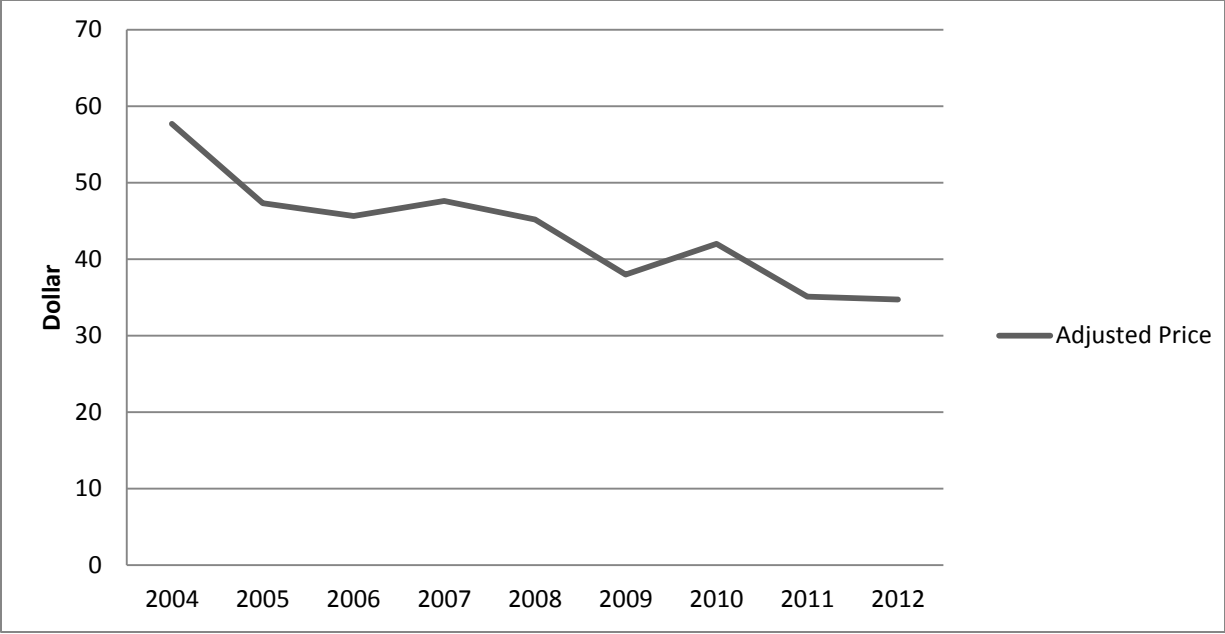


Figure 4. California sparkling price