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Abstract
Wine reviews, such as those from Wine Spectator and other consumer publications, help drive wine sales. The researchers in this study utilized standardized wholesale "line pricing" from a major wholesale distributor in the Southwest to compare pricing to the ratings published by Wine Spectator and to determine whether there were any correlations among other key attributes of the wine. The study produced interesting results, including that the wholesale price and vintage of a wine are significant in the prediction of the wine's rating.

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Relationship of Wine Ratings and Wholesale Pricing, Vintage, Variety, and Region

By D. Christopher Taylor and Nelson A. Barber

Wine reviews, such as those from Wine Spectator and other consumer publications, help drive wine sales. The researchers in this study utilized standardized wholesale "line pricing" from a major wholesale distributor in the Southwest to compare pricing to the ratings published by Wine Spectator and to determine whether there were any correlations among other key attributes of the wine. The study produced interesting results, including that the wholesale price and vintage of a wine are significant in the prediction of the wine's rating.

INTRODUCTION

The literature has considered wine's quality, reputation, and price in marketing and economic research. For example, Landon and Smith (1998) found empirical evidence indicating that a wine's reputation has a greater impact than its quality on the price of the wine. Roberts and Reagans (2007) studied how critical exposure and ratings affect producer pricing strategies. However, few have researched wine in relation to price and ranking by wine critics. Horowitz and Lockshin (2002) used previously developed wine-quality ratings to predict retail pricing. They found no strong correlation between price and wine-quality rating. However, the influence of the other factors--vintage, variety, and region-- influenced the findings significantly.

Hedonic price influences were explored by Combris, Lecocq, and Visser (1997) and Landon and Smith (1998), both of which studies used sensory techniques to attempt to determine the quality of Bordeaux wines. This culminated in their trying to develop a pricing scheme based on these influences. Yet this, too, failed to address the simpler question of whether rating systems currently utilized in popular consumer culture correlate with price.

In economics, an *experience good* is a product or service whose characteristics, such as quality, are difficult to observe prior to consumption (Nelson, 1970). For certain experience goods, research is ineffective. In assessing a product or service, consumers must instead rely on quality determinants, which include evaluations by product experts.

Unlike other products, for which *Consumer Reports* provides quality assessments, wine is rated for quality by the *Wine Spectator*, the *Wine Advocate*, the *Wine Enthusiast* and the *Connoisseur's Guide*. According to research by Roberts and Reagans (2007) on critical exposure and price-quality relationships, when consumers value quality and rely on expert opinion, the price for a product is positively related to its reported quality rating.

In their study of the price-quality relationship in a sample of Bordeaux wines, Landon and Smith (1998) found a positive relationship between the quality scores reported in the *Wine Spectator* and the wines' prices. A similar result was obtained using *Connoisseur's Guide*, by Benjamin and Podolny (1999) in their study of California wines, and by Schamel and Anderson (2003) in their study of wines from Australia and New Zealand using quality ratings from James Halliday and *Winestate*. In 2007, however, Miller, Genc, and Driscoll examined the wide variance in pricing as related to *Wine Spectator* ratings of 2001 California Cabernet Sauvignon but did not systematically compare wholesale pricing with *Wine Spectator* ratings.

Presumably, wines have been evaluated since they were first consumed. Over the past 100 years, these evaluations have developed into formal ranking systems that have impacted how wines have been priced and how consumers have accepted these wines. Despite the multitude of informal wine ratings performed by internet bloggers, cooking magazines, mail-order retailers, and other sources, none has been as influential or controversial as the rating systems developed by wine critic Robert Parker and the *Wine Spectator*.

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According to Arrow (1974), the strength of the relationship between a wine's price and its quality rating depends upon the extent to which individuals pay attention to the product and its rating. Recent research found that consumers, particularly at lower retail-price points, do not fully understand how price and ratings can equate to a "quality/value" wine product. This is particularly so given the disparity in ratings from critique to critique and from brand to brand (Barber, Almanza, & Dodd, 2008).Information about higher quality may increase demand and translate into a higher price. For lower-quality products, greater accessibility reveals negative information, which reduces demand and lowers price (Roberts & Reagans, 2007).

The question then becomes whether there are any significant discrepancies between a wine's price and its rating. A wine's retail price can vary from one retailer to another, and from one geographic area to the next. A good rating from a major publication can affect the retail price almost instantly. Conversely, wholesale prices are stable within a large distributor network and are less likely to be affected by wine ratings until the winery increases prices to the distributor on future deliveries.

Restaurants and other hospitality providers typically purchase wines from a wholesale distributor rather than from a retailer. Therefore, it is more relevant to address the wholesale price in this study. Furthermore, as wholesale purchasing from the producer takes place prior to the release and distribution of the wine, ratings on a particular wine are not typically made; nor do they impact pricing at the wholesale level. It is important to understand that wine producers and wholesalers generally have formed an opinion about product quality when they set their list prices, and there is a connection between their own and the critics' assessments of quality (Roberts & Reagans, 2007).

According to Lockshin (1993), when a new vintage is released, its wholesale price is generally determined not by its critical rating, but by its taste and/or a negotiation process between the producer and the wholesaler. However, Roberts and Reagans (2007) found that prior reputation--particularly if critic ratings have been issued--can influence the pricing decisions of a current release.

This viewpoint was confirmed through discussions with several large wholesale distribution houses, where expert tasting and evaluations are part of the numerous services provided to producers. These wholesalers noted that they have a very good idea of a wine's quality before they assist a producer in setting its list price. Following Roberts and Reagans (2007), this concept--that experienced wine tasters tend to reach similar conclusions about quality--was confirmed by examining the quality ratings of a random sample of 50 wines evaluated by both the *Wine Spectator* and the *Wine Advocate* in 2005, each using a 100-point rating system. The results showed that 87% of the wines were within two points of one another.

This leads to the purpose of this research study, which is to use regression to determine the impact that price has on predicting a wine's rating. Other variables used in prior research studies, such as vintage, varietal, and country of origin, were also included in the regression model. This study employed available wholesale prices of wines sold in the state of Texas and the scores that those wines received from the *Wine Spectator*.

METHODOLOGY

The relationship between wholesale price and wine-critique ratings was examined. Wholesale pricing data was obtained using the spring and summer 2007 Texas wholesale catalog from the Domaines and Estates division of Glazer's Wholesale, based in Dallas, Texas. This wholesale catalogue contains hundreds of different wine brands, varieties, and vintages. The names of each of the 853 wines from the catalog were individually entered into the *Wine Spectator* online wine- rating database (www.winespectator.com) in order to search for its published ratings. (This is not a free service; a monthly fee is charged for access to these ratings.) When an

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exact match of the wine brand, varietal, and vintage was found, the corresponding rating and price were recorded, thereby creating an expanded database of the wine's price, rating, vintage, varietal, and country of origin. For this study, a total of 197 exact matches were found and analyzed.

The data were analyzed using statistical procedures, including descriptive statistics, correlation analysis, and multiple regression (SPSS, release 14.0 and SAS 9.0 TS level 02M0). The descriptive analysis focused on the wine's price, rating, vintage, varietal, and country of origin. Correlations were calculated to measure association between the price, vintage, and rating variables. Finally, multiple regression was used to gain insight into the rating as the dependent variable in relation to price, vintage, varietal, and country of origin in predicting a wine's rating.

The general purpose of multiple regression (Cohen & Cohen, 1983) is to learn more about the relationship between several independent or predictor variables, and a dependent or criterion variable. For the multiple regression, a set of variables, either continuous or categorical, were used as the independent variables. The general regression model for the dependent variable wine rating is written as follows, where Y is the linear combination:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \quad \cdots \quad + \beta_n X_n$$

In this symbolic representation

Y = wine rating

β_0 = a constant that can be interpreted as the value of Ywhen $X_1 = X_2 = \quad \cdots \quad = X_k = 0$

β_1 -β_n = estimates of the parameters

X_1 - X_n = the independent variables of interest.

Multiple regression requires a large number of observations. The number of cases (participants) must substantially exceed the number of predictor variables used in regression. The absolute minimum suggested is five times more cases than predictor variables. A more acceptable ratio is 10:1(Hair, Anderson, Tatham, & Black (1998). Four main assumptions about the relationships between the dependent and independent variables involved in the multiple regression analysis are as follows: *Linearity* (using a bivariate scatterplot), *Equality of variance* or *homoscedasticity* (scatterplot between each independent variable and the dependent variables), and *Independence and Normality* (construction of a normal probability plot).

These assumptions were tested prior to running the regression analysis (Hair et al., 1998). Standard multiple regression can accurately estimate the relationship between dependent and independent variables only if the relationships are linear. Regression assumes that variables have normal distributions. Non-normally-distributed variables (highly skewed or kurtosis variables, or variables with substantial outliers) can distort relationships and significance tests.

Overall, the products in our sample were from producers who never before had received a single review, and from producers who had had several prior critical reviews. This variance allowed a test of whether the producers' different histories of ratings influenced the extent to which their product-quality ratings and their reputations were reflected in the prices charged. This time-rating variable is the number of prior reviews received by the producer up to the year of release, divided by 10, and dates from the first year in which a producer received a review.

Other variables used in this study included the country of origin, the vintage, the varietal, the price per bottle, the producer's age (the current year minus the focal producer's founding year), the exchange rate (percentage change, relative to 1987, of the value of the focal country's currency relative to the U.S. dollar), and the log quantity (the natural log of the total number of cases produced).

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The regression model also included a set of indicator variables for each country, for each varietal, and for each year within the sample period. Because the wines sampled were produced in different countries, exchange rate fluctuations may have affected the prices charged in the U.S. In particular, local currency appreciations relative to the U.S. dollar should be associated with higher local production costs (measured in U.S. dollars) and therefore higher U.S. prices. This was controlled for with a variable that accounted for the percentage change (relative to 2000) of the value of each country's currency relative to the U.S. dollar.

This study considered that producers and distributors have a good idea about product quality, which produces a strong relationship between producers and critics' assessments of product quality and suggests whether producers tend to become better over time in predicting the reactions of critics to their wines. We dealt with this issue by controlling for total producer experience. Here, we consulted numerous sources to compile information on the founding dates of wine producers. To determine the extent to which the producer's learning had an impact on the sensitivity of price-to-quality, we included the producer's age variable and its interaction with the quality variables in the model tested in this study.

The age of each wine at release was also controlled for, as wines aged longer tend to command higher prices. For wines produced in different quantities, the price-quantity trade-offs may affect the results (Roberts & Reagans, 2007). The *Wine Spectator* reported quantity data for 47% of the observations in our sample. We used the log of the number of cases produced (divided by 1,000) for the quantity available for sale in the U.S.

RESULTS

Data Analysis

After reviewing and matching the data,we found 197 wines with *Wine Spectator* ratings that matched the spring and summer 2007 Texas wholesale catalog. Of these matched wines, none was removed from the sample because of missing or incomplete data. The descriptive statistics are presented in Table 1. Forty-six percent of the sample was from the United States, followed by Australia and France. Forty-seven percent of the wines had a *Wine Spectator* rating of between 86 and 90. Only 16.3% of the wines were over $50 per bottle, while 26.6% were under $15 per bottle. The majority of the wines (40%) were from the vintages 2003 and 2004, and 33.2% of the wines were "other red styles," mostly from Bordeaux. Forty-six percent of the wines came from the United States.

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Table 1

Descriptive Statistics of Sample Data (n=197)

Characteristic	Percentage	Characteristic	Percentage
Country of Origin		Variety	
USA	46.9%	Red Other	33.2%
Australia	17.9%	Syrah	12.4%
France	15.8%	Cabernet Sauvignon	12.4%
Italy	11.7%	Chardonnay	11.2%
South Africa	3.1%	White Other	9.7%
New Zealand	2.6%	Pinot Noir	8.7%
Other	2.0%	Sauvignon Blanc	5.1%
Total	100.0%	Merlot	4.1%
		Zinfandel	3.6%
		Total	100.0%
Price per Bottle		Vintage	
Less than $10	9.2%	2000	5.1%
$10 to $15	17.4%	2001	8.2%
$16 to $20	13.3%	2002	9.7%
$21 to $25	14.8%	2003	25.5%
$26 to $35	12.8%	2004	23.5%
$36 to $49	16.3%	2005	25.5%
$50 to $100	12.2%	2006	2.6%
Over $100	4.1%	Total	100.0%
Total	100.0%		
Rating			
Less than 80	7.1%		
80 to 85	18.9%		
86 to 90	47.5%		
91 to 95	22.9%		
Greater than 95	3.6%		
Total	100.0%		

Correlation Data

As indicated, correlation coefficients were calculated using Pearson's correlation measure of association. The strongest and most significant correlation among the variables was between rating and price (α=.428, p = <0.0001). This was expected, as price is generally associated with wine ratings. The relationship between vintage and price was significant, α = -.412, p = <0.0001, which was also expected: As a wine ages, its price tends to increase.

Several factors affect both a wine's ability to age and the length of time required for proper aging. The grapes used, the region of origin, the age of the vines, and the yields are all to be taken into consideration when assessing how long a wine can cellar. When considering the characteristics of grape varietal, there were interesting correlations among the variables of price, vintage, and rating. For example, as shown in Table 2, there was a strong and significant correlation between price and vintage (r = .783).

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Table 2

Correlation Matrix Between Variables

Variable	Price	Vintage	Rating
Cabernet Sauvignon (n=25)			
Price	-	.783***	.301
Vintage	.783***	-	-.220
Rating	.301	-.220	-
Pinot Noir (n=20)			
Price	--	.352	-.130
Vintage	.352	-	.654
Rating	-.130	.654**	-
Sauvignon Blanc (n=21)			
Price	-	-.836**	.097
Vintage	-.836**	-	.210
Rating	.097	.210	-
Chardonnay (n=23)			
Price	-	-.238	.443***
Vintage	-.238	-	-.063
Rating	.443***	-.063	-

*=significant at p<0.0001. ** = significant at p<.01. *** = significant at p<.05.

Vintage is the year in which a wine is made. A vintage's quality is essentially tied to the weather during the grape-growing season. When a vintage is considered "great," its price can be high; when it is considered "poor," its price can be low. The Cabernet Sauvignon varietal is considered by many to be the "prominent and classic of red grape varietals" (Bowers & Meredith, 1997).

Table 3

Correlation Matrix Between Variables (n=181)

Variable	Price	Vintage	Rating
USA (n=92)			
Price	-	-.656**	.135
Vintage	-.656**	-	.105
Rating	.135	.105	-
France (n=31)			
Price	-	.031	.567**
Vintage	.031	-	.250
Rating	.567**	.250	-
Australia (n=35)			
Price	-	-.538**	.398*
Vintage	-.538**	-	-.109
Rating	.398*	-.109	-
Italy (n=23)			
Price	-	-.688**	.667**
Vintage	-.688**		-.737**
Rating	.667**	-.737**	-

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Region of origin and, particularly, appellation can also be important to price. Only a few results are presented on Table 3. For wines from the United States, Australia, and Italy, there was a negative correlation between vintage and price. This was not the case for French wines, which showed a correlation only between price and rating. The same was true of Australian and Italian

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wines, but not U.S. wines. Lastly, Italian wines were unique in that they reflected a negative relationship between vintage and rating.

Regression

Multiple regression is another tool that helps explain ratings and the relationship between price, country of origin, vintage, and varietal. As previously indicated, the analyses focused on the wine's rating as the dependent variable, and the price, vintage, origin, and varietal as the independent variables. Before proceeding to the multiple regression analysis, we screened the date for missing values, outliers, normality, linearity, and multicollinearity. To determine which observations were outliers, we utilized the Mahalanobis distance (D^2) procedure (Hair et al., 1998; Tabachnick & Fidell, 2001). Accordingly, except for two outliers, which were determined to have a detrimental impact on the results, the data was clean, and the final *n* was set at 195 cases. No outliers were detected in this study.

The other assessment deals with skewness and kurtosis. There are ranges of acceptability to skewness and kurtosis. According to Hildebrand (1986) and West, Finch, and Curran (1995), the observed skewness should be between -2 to +2; and according to Hildebrand (1986) the observed kurtosis should be -1 to +, and West et al. (1996) -7 to +7, to be considered acceptable. For this study the results did not deviate from these ranges. Most of the variables were within the range of (-1 to +1) for both skewness and kurtosis.

Using the enter method, a significant model emerged ($F4.190=8.257$, $p < 0.0001$). Adjusted R square = .130, with significant variables, is shown below in Table 4.

Table 4

Regression Coefficients with Rating as Dependent Variable (n=195)

	Standardized Beta Coefficient Estimates
Origin	.138*
Vintage	.097
Varietal	.084
Price	.408***
Log Quintiles	-.120***
Producer Age	-.004**
Exchange Rate	.058**
Time-Rating	.064*

*p<.05. **p<.01. ***p<.001.

Results of the regression indicate significant relationships between the dependent variable (rating) and price and origin. Given the amount of time and effort put into creating "premium" quality wine--from the selection of grapes based upon *terroir* to the production methods used to make the wine--it makes sense that a wine's rating would have a stronger relationship to price and country of origin than any other variable. The same can be said for the relationship to vintage.

When the right weather conditions combine with vineyard management controls for appropriate yields and sugar quality, there is a greater likelihood that the wine produced will be exceptional. Although highly significant despite a very low coefficient, the producer's age (length of time a winery has been in existence) has a predicable effect on the rating. It makes sense that a wine's rating would be impacted by the length of time a winery has been producing wine, particularly if that winery has a strong reputation in the industry for producing consistently good quality wines.

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CONCLUSIONS

When determining which wines to purchase, and when to purchase them, hospitality and restaurant managers would be greatly assisted by knowing which wines have received high ratings, particulary as their prices rise at the wholesale level. Further, this research adds credence to those who espouse publicized ratings as a means for predicting a wine's monetary cost.

While prices fluctuate depending on the market, individual retailers, and consumer demand, wholesale pricing tends to be more constant; it is not as readily affected by ratings. This makes wholesale pricing a more stable basis for judgement.

These results measure how the characteristics of grapes can affect wine wholesale prices. Additionally, demand for wine determines demand for grapes. Therefore, it can be expected that a price premium for a certain wine variety or appellation could be translated into a price premium for the corresponding grape variety and location (Bombrun & Sumner, 2003).

These results confirm the dual role of a wine critic. First, the quality information a critic generates can be an important determinant of price. Second, ratings can over time focus the attention of the market on certain producers. In terms of quality ratings and prices, this study highlights a fundamental difference between the information included in a quality indicator and the methods by which it impacts pricing. In this light, it is tempting to view the critic's rating as a quality indicator in and of itself. Risk-averse wholesalers should prefer products made by producers with track records of legitimate quality ratings.

Further studies need to be conducted to determine whether the same results can be obtained when comparing pricing of other wholesalers to rating systems. Further, in order to continue to build on the question of whether a rating is a predictor of wholesale price, is it necessary to compare the *Wine Spectator*'s ratings to those of other popular rating systems, such as that of Robert Parker. A longitudinal study could also look at the effects that the *Wine Spectator*'s or Robert Parker's ratings have on the future wholesale price of a wine.

MARKET IMPLICATIONS

The future of the wine industry in any country or region depends upon global competitiveness performance,--that is, the ability to keep selling wine. There is always an element of risk in buying wine; however, the risk is less for inexpensive, low-quality wines that are generally rated low. Yet, perceived risk increases as the rating and price go up. For wine producers, this research provides important information for longer-term investment and purchase decisions. These results measure how vintage and price affect a wine's rating in the market. Moreover, to a great extent market demand for wine determines demand for grapes. There was a strong correlation between price and vintage when considering wines from the United States and Italy. Therefore, it would be expected that a price premium for a certain wine from a certain vintage would translate into a price premium for the corresponding wine based upon location. If a wine's price replicates the market, then this price reflects on average the overall information on the market and the measure of volatility associated with that wine, and should allow a determination of wines. This suggests that wine investors should follow a portfolio approach to investing, such that holding wines from different countries and from different vintages could allow for overall investment protection.

A comparison of results with a follow-up study that relates the price of a wine after the rating has been reported, along with other attributes, such as suggested in Lee and Sumner (2001), would allow wholesalers to determine the quantity of wine to pre-purchase and the extent of price negotiations at release.

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