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Price and Quality in the California Wine Industry: An Empirical Investigation*

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Abstract

This paper examines price and quality in the California wine industry using medals won in nine tasting events in 1995 as indexes of quality. For each tasting event, there were four possible medals: double gold, gold, silver, and bronze. Using stepwise least squares regression analysis, we estimate hedonic price functions for the 1884 wines in our sample treating quality as exogenous to price. We also look at results for some wine types, including chardonnay and cabernet sauvignon. The results are largely as expected. The San Francisco Wine Competition appears to be the best predictor of quality with the Orange County and Sacramento (California State Fair) competitions the second best predictors of quality. (JEL Classification: D4, L6)

I. Introduction

This paper applies hedonic pricing to the California wine industry. We perform empirical tests of the relationship between price and quality. For quality, we use medals won in each of nine different tasting competitions. This data are available from Varietal Fair (Devine and Devine, 1996). This volume is published annually. These tastings differ in standards, judges, and restrictions on the wines entered.[1] However, the tastings have a few things in common. Each tasting awards four possible medals: double gold, gold, silver, and

*I am indebted to many individuals and institutions who provided invaluable help in this study. Varietal Fair (Sebastopol, California) was kind enough to supply me with their database, saving me many hours of tedious data entry. California State University, East Bay, gave me sabbatical leave and other support that encouraged me in this work. Professors Alex Cassuto, Leo Kahane Nan Maxwell, and Steve Shmanske of Cal. State, East Bay, provided valuable discussion that helped me past a number of mental blockages. Participants in the Seminar in Economic Research at California State University, East Bay, provided valuable feedback on an early draft of this paper. Thanks to D. Romana Freimanis and Kim Wagner who discovered the Varietal Fair data in the course of a directed reading seminar at CSUEB. Thanks also to the two anonymous referees who provided valuable feedback. Unfortunately, none of these individuals or institutions was inclined to accept responsibility for errors; those remain mine alone.
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[1]For example, some tastings impose a minimum quantity requirement, rejecting wines that have fewer than a specified number of cases bottled.

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bronze.[2] Each tasting invites entries from all wineries that meet the entrance requirements. And the data are made public.[3] Further, all tasting competitions are broken down by wine type (often, but not always, corresponding to the grape varietal used predominately in making the wine). The overall sample consists of 1884 different wines, each of which won at least one medal in a 1995 tasting event. The data are also broken down by wine type. Even with this large sample, some wine types do not have sufficient data to yield decent statistical results. In particular when there are fewer than 100 observations for a particular wine the number of medals won in a tasting and/or the number of wines in a particular vintage year was often fewer than ten. While the results may be statistically significant they are probably not important since the coefficient is based on such a small cell size.

This approach corresponds to the "quality index" model. Indexes are used to summarize the quality characteristics of a good. In this case, each index is a dummy variable. If a particular wine won a medal at a given tasting the dummy for that tasting is assigned a value of 1. Otherwise the value is 0. Since the same wine can win medals at several tastings, multiple quality indexes are being used. The objective of this paper is to determine which indexes are the best measures of wine quality.[4]

The results are what any economist would expect. For all wines and most wine types, some tastings were better measures of quality than others. For the overall data set, the San Francisco tastings appear to be the best measures of quality. Other tastings that had significant impacts on price results were the Orange County Fair and the California State Fair (Sacramento) tastings.

II. Previous Empirical Work in the Wine Industry

Combris, Lecocq, and Visser (1997) used the results of an independent panel of tasters to show that price and quality are not correlated in Bordeaux wines.[5] They performed a hedonic regression using the logarithm of price as the dependent variable and a number of measures of wine quality as independent variables. Subjective quality measures were obtained from a tasting study held by the *Institut National de la Consommation* (INC). In addition to these sensory characteristics the authors include objective information such as the vintage year, the group (as defined by the French government), and the rank (*grand cru, cru burgeois, or cru non classé*). This information was obtained from the label.

[2]The "double gold" medal category actually refers to special medals awarded at some of the tastings. In 1996, the Dallas Morning News tasting did not award any of these special medals. Others awarded from two (West Coast) to 21 (Riverside). The criteria for winning a special medal obviously varies greatly among the competitions. This lack of consistency will become apparent when the empirical results are examined.

[3]I owe a great debt to Varietal Fair of Sebastopol, California, who publish this data in their annual volume *California Wine Winners* and were kind enough to allow me to use their data in this study, as well as supplying it in a machine-readable format.

[4]The index is a proxy for wine quality.

[5]Lecocq and Visser (2006) recently published an updated version of this work. They synthesize their earlier work and provide some new results.

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In this study, twenty collaborators of the INC purchased two bottles of wine each from 600 Bordeaux wineries.[6] Professional INC tasters evaluated each wine's characteristics. The authors conclude that the "market price of Bordeaux wine can be explained primarily by the objective characteristics appearing on the label of the bottle" (Combris et al., 1997, p. 401). Additionally, sensory characteristics are not the best determinant of wine price. This implies consumers ignore these sensory characteristics when making a purchase decision. A later study of Burgundy wines by the same authors (Combris, Lecocq, and Visser, 2000) reached similar conclusions about wines from that area.

In a related study, Oczkowski (1994) estimates a hedonic price function for Australian wine. His paper uses data from *The Penguin Good Australian Wine Guide* (Shield and Meyer, 1991, 1992). The data in these volumes includes suggested retail price and quality assessments from the same panel of expert tasters. Additional data includes vintage year, location where grapes were grown, and cellaring potential recommendations. Oczkowski's sample of 1,604 wines is impressive, but necessary since he employs 104 dummy variables. He concludes that there are six major determinants of price: "quality, cellaring potential, grape variety/style, grape region, grape vintage, and producer size" (Oczkowski, 1994, p. 108).

Medals won at wine tastings are possible indexes of quality. We expect some tastings to be superior to others as quality indicators. The fundamental question is whether winning a medal in a specific tasting causes the price consumers are willing to pay to change by a measurable amount. That is an empirical question. The objective of this study is to determine whether any tastings appear to be good measures of quality and, if so, which tastings are the best such measures.

Fortunately for this paper, California is not France. In 1995, the appellation scheme was in its infancy in California (of course, over the last ten years there has been a trend toward use of an appellation system). That means there is no need to include dummy variables for the various appellations in our estimating equations.

It is also true that the market for California wine is not the same as the market for French wine. French winemakers have a tradition that spans centuries, while the California wine industry is midway through its second century.[7] With over 1,500 wineries in California,[8] the industry is also quite competitive (both in price and quality). Because of this level of competition, a California winemaker is less able to rely on brand loyalty than his French counterpart. Thus, we would expect that the market for California wine would not respond to quality in the same way as the market for French wine.

[6]However, only 541 wines were included in the study because 59 wineries were closed when the panel visited them.

[7]However some wine historians trace the beginnings of the California wine industry to much earlier dates.

[8]According to Wine Business Monthly Online (February 2005), as of November 2004 there were 1,605 bonded wineries in California and another 840 "virtual wineries" that operate under another winery's bond. http://www.winebusiness.com/html/MonthlyArticle.cfm?dataId=36590 (accessed June 23, 2006)

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Additionally, neither Combris, Lecocq, and Visser nor Oczkowski recognize the possibility of substitution and complementarity among characteristics. For example, to have cellaring potential a red wine will often have high levels of both oak and tannin. However, a high level of either characteristic without the other is undesirable. To correctly measure this quality requires inclusion not just of a dummy variable for each characteristic, but also dummies for interactive terms, including pairs, triples, quadruples, etc. Failure to recognize this possibility is a major shortcoming of these studies. Oczkowski implicitly includes some complementarity variables by including dummies for certain combinations of vintage year and grape region; vintage year and grape variety; and year marketed, grape variety and vintage. Clearly, however, inclusion of all the various combinations of wine characteristics possible would quickly exhaust the available degrees of freedom.

We solve this problem by using indexes of wine quality. A medal won in a particular tasting is such an index. This abstracts from the problems of substitutes and complements among characteristics by simply collapsing the vector of wine characteristics into a single summary measure of quality.

III. The Data

Data from the 1995 tastings was used.[9] Of all wines entered, 1,884 wines won at least one medal in one tasting. Entry information required by the tasting includes estimated retail price; the suggested retail price for each wine is listed in *California Wine Winners* (Devine and Devine, 1996).

In addition to reporting results for the entire sample of 1,884 wines, some results will also be reported for each of the 18 wine types.[10] The number of responses for each type is shown in Table 1. Small sample size will clearly be a problem in a few cases (e.g., pinot blanc, semillon and white meritage). Other summary statistics are shown in Tables 2 and 3.

The timing of the tastings is a possible source of bias. Tastings begin in January and end in July. Many wines entered in the early competitions are sold out by the time the later competitions begin. While this undoubtedly introduces a bias in the data, the only way we can know the direction of this bias is to know which competitions are the best predictors of quality. We will simply forge ahead, having faced this issue squarely, acknowledged its potential importance, and realized there is little that can be done about it.

Entering a competition is costly for the winery. Obvious direct costs include entry fees and the time and effort expended on getting wine to the tasting. Less obvious is the cost of the wine itself. In many competitions, winning entries must donate a quantity of wine

[9]Much of the material in this section is drawn from *California Wine Winners* (Devine and Devine, 1996).

[10]*California Wine Winners* does not include all wine types that won a medal in any tasting (e.g., Garnay, Grenache and Port are all excluded). Only those types that are included in most of the tastings are also included in this volume and this study.

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Table 1
The Sample Broken Down by Wine Type

Wine type	*No. Obs.*
Chenin Blanc	28
Cabernet Franc	35
Chardonnay	381
Cabernet Sauvignon	368
Gewürztraminer	50
Johannisberg Riesling	65
Merlot	165
Petite Sirah	34
Pinot Blanc	12
Pinot Noir	137
Red Meritage	61
Sauvignon Blanc	150
Semillon	17
Sparkling Wine	96
Syrah	25
White Meritage	18
White Zinfandel	53
Zinfandel	189

Table 2
The Sample Broken Down by Vintage Year

Vintage year	*No. Obs.*
<1987	15
1987	14
1988	33
1989	81
1990	243
1991	529
1992	670
1993	245
NV	54

Table 3
The Sample Broken Down by Tasting Event

Tasting event	*No. Medals*
Los Angeles	429
Orange County	709
Farmers' Fair Riverside	487
San Francisco	398
Dallas Morning News	324
Sacramento (CA State Fair)	608
New World International	474
Reno West Coast	478
San Diego	487

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to the fair. For example, the San Francisco Fair required gold medal winners to reserve up to 10 cases to sell to the fair. This means smaller wineries are less likely to enter the San Francisco tasting, biasing the sample for that tasting somewhat. As *California Wine Winners* notes, "Many of these small producers sell out all their wines every year" (Devine and Devine, 1996, p. 5) There is little incentive for a winery in that fortunate situation to bother entering any competitions at all, especially smaller wineries with limited production available for sale. Table 4 gives more details about the requirements for each competition.

Varietal Fair also calculates a point total for each wine. Points are assigned as follows: double gold, 7; gold, 5; silver, 3; and bronze, 1. Interestingly, point totals for each winery are also calculated. Based on these point totals, the "best" winery in California is Kendall-Jackson with 291 points. Second "best" is Geyser Peak (281), while Fetzer is third (273) (Devine and Devine, 1996, p. 118).[11]

IV. Empirical Results

The specific estimation technique used is a simple stepwise regression. Dummy variables are used for vintage year (eight dummies, non-vintage wine is the omitted variable); wine type (17 dummies, white zinfandel is the omitted variable) and whether or not a medal was won at each tasting (nine dummies, no variable omitted as the data are not mutually exclusive).[12] Stepwise selection is halted when the next dummy variable would have a *t*-statistic that would not be significant at the five percent level.

We examine the data in two different ways. First, the stepwise procedure is used on all the wines in the sample ($n = 1884$). Second, each wine type is analyzed separately to see whether particular tasting events are better at evaluating specific wine types.

Vintage year dummies were included for each wine that had such a year. However, there were only 15 observations with vintages before 1987. To avoid potential problems with degrees of freedom these were lumped into a single dummy. The potential singular matrix was avoided by not including a dummy for the NV wines. There were nine vintage dummies, corresponding to one variable each for the years 1987 through 1994, plus the dummy for vintages earlier than 1987.

Each tasting is assigned one dummy variable, equal to 1 if the wine won any medal in that tasting, zero otherwise. Thus, the variable SFMEDAL is equal to 1 if the wine won any medal at the San Francisco tasting, 0 otherwise. Since wines can win medals in multiple tastings there is no problem with matrix singularity caused by these dummies.

[11]Note that this ranking is not very meaningful. The wineries with the most total points are likely to be those that enter a large number of wines in many competitions. A more meaningful measure is points per entry. Unfortunately, *California Wine Winners* only reports wines that won medals, not all wines entered.

[12]In our early work we attempted to use separate dummy variables for each medal type-tasting event combination. That produced contradictory and confusing results, *viz.* winning a bronze medal in San Francisco appeared to be valued more highly than winning a silver medal at the same tasting.

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Table 4
Summary of the Tasting Events

COMPETITIONS	*ENTRIES* *# Wines* *Wineries in Calif.*	*MEDALS* *Total #* *From CA included in book*	*AWARDS* *Double gold* *Gold* *Silver* *Bronze*	*1996* *Entry deadline* *Judging dates*	*ENTRY* *Fee* *Bottles to send* *Minimum produced* *Minimum inventory at judging*	*WINNERS* *Requirements after judging*	*JUDGING SCOPE* *Geographic area covered* *Judging categories* *Entry restrictions*
Los Angeles County Fair P.O. Box 2250 Pomona, CA 91769 (909) 623-3111	1845 364 284	651 513 386	6 89 143 148	May 15 June 20–23	$25.00 Six 120 gal. “Some”	Golds only to sell 2–3 cases to fair	Any wine from any of the American continents. Some judged in vintage groups. Limit of one entry per class.
Orange County Fair P.O. Box 11059 Costa Mesa, CA 92627 (714) 546-8664	2305 ? ?	1025 1025 880	10 114 312 444	May 15 June 1–2	No charge Six None “Some”	All wineries invited to pour at the fair	California wines available in Orange Co. Judged in price categories. Not all entries voluntary. Current releases only.
Farmers Fair, Riverside 18700 Lake Perris Dr. Perris, CA 92571 (909) 657-4221	1504 296 ?	717 593 485	21 39 147 278	Mar. 25 May 5–6	$24.00 Four 500 gal. 50 cases	All entries invited to pour at the fair	Any U.S. wine. Same judged in vintage groups.
San Francisco Fair 455 Golden Gate Ave., #2095 San Francisco, CA 94102 (415) 703-2729	2150 497 313	733 502 408	15 26 131 236	May 31 June 15–16	$50.00 Five None 50 cases	Golds to reserve up to 10 cases to sell to the fair	Any wine in the world. No limit on number of entries. Wines judged in vintage groups.
Dallas Morning News P.O. Box 38643 Dallas, TX 75328 (214) 319-7000	1484 350 ?	493 371 298	0 32 95 171	Mid. Dec. Jan. 27–28	$55.00 Four 120 gal. 5 cases	Golds to give 5 cases for tastings	Any U.S. wine. Limit of 3 entries per category.

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California State Fair P.O. Box 15649 Sacramento, CA 95852 (916) 263-3159	1724 386 386	676 676 534	18 62 211 243	June 7 July 12–14	$25.00 Six 180 gal.	Reserve to sell up to 10 cases for the fair	Any California wine. Wines judged in 10 geographical groups. Limit of 2 entries per class per region.
New World International P.O. Box 5306 Diamond Bar, CA 91765 (800) 845-9463	1700 401 309	850 680 584	14 140 215 215	Jan. 25 Feb. 11–12	$35.00 Six None "Some"	All entries invoted to pour at awards	Any wine from the New World. All wines judged in price groups. Must be available to buy in at least one state.
Reno-West Coast Competition P.O. Box 837 Reno, NV 89504 (702) 827-7618	1314 261 225	687 610 541	2 58 162 319	Early April May 8–10	$17.00 Six 500 gal. 150 cases	Golds are required to pour at events	Wines from CA, ID, OR, WA, NV and AZ. Some grouped in vintage/price. No limit on entries.
San Diego Competition P.O. Box 880881 San Diego, CA 92168 (619) 421-9463	1693 381 281	709 590 504	3 63 138 300	April 12 April 27–28	$30.00 Four 300 gal. No min.	All winners to donate 1 case for charity sale	Any U.S. vinifera wine. Some judged in vintage groups. No limit on number of entries except same wine in 2 classes.

Source: *California Wine Winners* [1996], pp. 6–7. Copyright, 1996, Varietal Fair. Reproduced with permission.

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An additional set of 18 dummy variables were used for each of the wine types. For example, the variable ISCH was equal to 1 if the wine was chardonnay, 0 otherwise. Since each wine falls into exactly one of these categories, one category must be omitted to avoid a singular matrix. White zinfandel was arbitrarily chosen as the omitted wine type dummy.

A. *Overall Results (n = 1884)*

The first results are for all wines combined. For all wines the mean price was $11.75 per bottle ($58.97 per gallon).

Before proceeding to the stepwise regression, a model was estimated including all dummy variables. The results are shown in the appendix. These results combined with the results of the stepwise procedure indicate that the stepwise procedure is robust and is selecting the correct combination of variables.

We used a standard stepwise regression procedure, allowing the software to select which variables to include and which to exclude. Table 5 shows the detailed results. The constraints imposed on the stepwise process guarantee that all variables selected will be significant at the five percent level.

Table 5
Stepwise Regression, Entire Sample

Variable	*Coefficient*	*t*
(Constant)	6.576	16.607
Medal, San Francisco	3.652	9.639
Medal, Orange County	2.334	7.321
Medal, Sacramento	1.889	5.731
Medal, Riverside	2.019	5.613
Medal, New World International	–1.144	–3.206
Medal, San Diego	–1.016	–2.834
Vintage before 1987	8.836	5.051
Vintage 1987	4.199	2.301
Vintage 1988	6.056	4.891
Vintage 1989	4.834	5.868
Vintage 1990	3.571	6.605
Vintage 1991	1.942	4.861
Vintage 1993	–2.475	–4.811
Cabernet sauvignon dummy	1.842	3.748
Chardonnay dummy	2.737	6.262
Pinot noir dummy	2.952	4.657
Merlot dummy	1.633	2.737
Sparkling wine dummy	3.146	3.934
Red meritage dummy	11.619	12.533
White meritage dummy	3.292	2.090
Adjusted R^2	0.281	
Standard error of the estimate	6.552	

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Note first that the coefficients on the vintage year dummies tend to increase in both size and significance for older wines. In fact, the coefficient for the 1993 vintage dummy is actually negative. This suggests a strategy for wineries similar to the old Paul Masson commercial: "We will sell no wine before its time."[13] Holding a wine in inventory until it is ready to drink tends to increase the price. In fact, holding a 1987 wine until 1991 yields a compound annual growth rate of 21.2%.

The San Francisco, Orange County, Sacramento and Riverside tastings seem to have the largest positive impact on price. Conversely, winning a medal at the New World International or in San Diego appear to have a significantly negative impact on price. Cabernet sauvignon, chardonnay, pinot noir, merlot, red meritage, and white meritage appear to have above average prices. Consumers are willing to pay more for wines that are currently trendy – and, by implication, pay relatively less for wines currently out of favor.

Winning a medal in San Francisco adds about $3.65 to the price of a bottle of wine. Winning a medal at the Orange County tasting adds $2.33, Sacramento adds $1.89 and Riverside adds $2.02. Winemakers are best advised to avoid the New World International and San Diego events because winning a medal there subtracts about $1.14 and $1.02 respectively from the price of a bottle. Consumers appear to value medals won at San Francisco, Orange County, the California State Fair (Sacramento) and the Farmers' Fair (Riverside). The New World International and San Diego events are apparently viewed as an indicator that a wine possesses below average characteristics.

B. *Results for Wine Types*

Our sample is large enough to allow investigation of several wine types.[14] We will only look at the results for the six wines with over 100 observations: chardonnay, cabernet sauvignon, merlot, pinot noir, sauvignon blanc, and zinfandel.[15] Other than filtering the data by wine type and omitting the wine type dummy variables, the statistical process and sample remain unchanged. Table 6 summarizes the results, followed by some analysis.

Chardonnay (n = 381)

The stepwise procedure selected six variables for inclusion. The four competitions that appear to have the most influence over chardonnay prices are the Sacramento, San Francisco, Orange County and Riverside. Winning a medal in the first two increases a wine's price by about three dollars while a medal in the last two has a value of about two dollars. Probably the most interesting result is the large and positive coefficient on older chardonnays.

[13]Famously uttered by Orson Welles, this statement is often quoted.

[14]Results for many wine types were either not statistically significant because of small sample size or were otherwise meaningless. Only results that were statistically significant and interesting are reported.

[15]There is no discussion of results for wines with fewer than 100 observations. As noted earlier these wines often had very few medals won at some tastings and/or observations from a specific vintage year. With fewer than ten observations in many cells the results, while statistically significant, are probably not meaningful.

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Table 6
Estimation Results for Five Wine Types

	Chardonnay		*Cabernet Sauvignon*		*Merlot*		*Pinot Noir*		*Zinfandel*	
	Coeff.	*t*	*Coeff.*	*t*	*Coeff.*	*t*	*Coeff.*	*t*	*Coeff.*	*t*
(Constant)	7.995	15.656	13.355	17.226	8.604	11.608	9.948	12.525	7.853	15.043
Medal, Los Angeles			−2.659	−2.580						
Medal, Sacramento	3.166	5.117			3.493	3.170	4.012	3.200	2.024	2.680
Medal, San Francisco	3.065	4.214	6.066	5.740	3.613	3.144	5.323	3.802	2.485	2.725
Medal, Orange County	2.122	3.369	3.025	3.159	2.858	2.656			3.004	4.239
Medal, Riverside	1.728	2.509			4.416	4.331				
Medal, Dallas							3.463	2.226		
Vintage before 1987	28.839	5.043								
Vintage 1987									17.147	3.573
Vintage 1988			5.180	2.050						
Vintage 1989					13.396	2.300				
Vintage 1991	3.360	4.741	−3.273	−3.379						
Vintage 1992			−5.724	−3.696	−2.688	−2.825				
$\bar{R}^2$	0.213		0.139		0.331		0.178		0.193	

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However this is highly suspect since there was only one chardonnay that old. By contrast there were 90 chardonnays with a 1991 vintage, making that coefficient somewhat more believable. It appears that waiting a few years before entering chardonnays in tasting competitions is a good strategy. Specifically four year old chardonnays have prices about $3.36 higher than what would otherwise be expected.

Cabernet Sauvignon (n = 368)

The stepwise procedure selected six variables. Three were vintage year dummies for 1988, 1991 and 1992. The coefficients of these dummies are quite large and very instructive. Only the 1988 vintage dummy has a positive coefficient. The 1991 and 1992 dummies are negative, again indicating that proper aging will produce superior financial results in the marketplace. Winning a medal at the San Francisco tasting increased the price of a bottle by about $6.07. An Orange County tasting medal is worth about half that. Winemakers are advised to avoid the Los Angeles for their cabernet sauvignon because winning a medal there lowered price by about $2.66.

Merlot (n = 165)

Merlot grapes are usually vinified as red wines. In Bordeaux, merlot is blended with cabernet sauvignon to add depth and character to the wine. Over the last 20 years, merlot has developed a following of its own; it is now quite popular, competing successfully with cabernet sauvignon in the premium red wine market.

The stepwise procedure selected six variables. Two were vintage year dummies for 1989 and 1992. The coefficients of these dummies are again quite large and very instructive. Holding everything else constant a seven year old merlot will have a price that exceeds the average by $13.40. However looking at the frequencies we notice again that there is one merlot from this vintage year. Therefore that result should be discounted. The 1992 dummy is negative, again indicating that proper aging will produce superior financial results in the marketplace.[16] Winning a medal at the Riverside tasting increased the price of a bottle by about $4.42. A San Francisco or Sacramento tasting medal is worth about $3.50. A medal at the Orange County tasting added $2.86 to the price of a bottle.

Pinot Noir (n = 137)

The results show that consumers place a high value on medals won at the San Francisco competition (about $5.32) and somewhat lower values on medals won in Sacramento ($4.01) and Dallas ($3.46).

Zinfandel (n = 189)

Medals at the Orange County, San Francisco and Sacramento tastings each added between $2.00 and $3.00 to the price of a bottle of zinfandel. The large coefficient on the 1987 vintage dummy is once again due to a single zinfandel from that year.

[16]There were 63 merlots with 1992 vintages.

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V. Summary and Conclusion

One way of summarizing these results is by examining the significant coefficients. Table 7 shows the results for wines with more than 100 observations.

We can safely say that the San Francisco competition is the best predictor of quality (given the way we have defined quality). The San Francisco competition has positive, significant coefficients for the entire sample and each of the five varietals with over 100 observations. Orange County and Sacramento have positive coefficients for the entire sample and four of the five varietals with over 100 observations. Winning medals at the New World International and San Diego competitions has a tendency to lower the price.

It has been suggested that timing may play a role in these results. In fact, the San Francisco competition is scheduled seventh of the nine tastings. As noted earlier, some wines (particularly those from smaller wineries) may have sold out by the time of this tasting and therefore not be included in the sample. This imposes a supply constraint on the model that is not reflected in the statistical results presented. In fact, what we may be seeing in these results is simply the fact that wines that are available for the San Francisco competition are available simply because their price is high, reducing demand and allowing enough wine to remain in stock to enter the competition.[17]

Yet another interpretation involves market signaling. Perhaps a wine that wins a medal in a particular tasting is valued more highly by consumers because of the medal. Visit any wine shop and you'll see shelf tags with some wines advertising the medal(s) won in various tasting(s). It is entirely possible that the large number of positive coefficients for the San Francisco, Orange County and Sacramento competitions are caused by consumers placing a high value on those results, rather than using the results as a signal of wine

Table 7
Summary of Empirical Results: Coefficients

	Overall (n =1884)	*Chardonnay (n = 381)*	*Cabernet Sauvignon (n = 368)*	*Merlot (n = 165)*	*Pinot Noir (n = 137)*	*Zinfandel (n = 189)*
Medal, Los Angeles			−2.659			
Medal, Orange County	+2.334	+2.122	+3.025	+2.858		+3.004
Medal, Riverside	+2.019	+1.728		+4.416		
Medal, San Francisco	+3.652	+3.065	+6.066	+3.613	+5.323	+2.485
Medal, Dallas					+3.463	
Medal, Sacramento	+1.889	+3.166		+3.493	+4.012	+2.024
Medal, New World Int'l	−1.144					
Medal, Reno West Coast						
Medal, San Diego		−1.016				

[17]I am indebted to the Seminar in Economic Research, California State University East Bay for suggesting this line of reasoning.

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quality. To say that it would be difficult to separate cause and effect in this case would be a gross understatement of the difficulties presented by this possibility. And, in some sense, it does not matter whether consumers value the wine or the medal. We can safely say that winning a medal in San Francisco, Orange County, and/or Sacramento is associated with a higher price and quality for that wine. We leave separating cause and effect to future research.[18]

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[18] One possible direction for future research is adding another source of wine quality such as the *Wine Spectator's* point rating of each wine.

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Appendix: Additional Statistical Results

To test the robustness of the stepwise procedure we ran a regression including all the variables shown in Table 5. The omitted dummy variables were NV (no vintage date on label) and WZ (white zinfandel wine type). The results (shown in Table 8) indicate that the stepwise procedure is robust. Coefficients marked with an asterisk are significant at the five percent level.

Table 8
Regression Including All Independent Variables

Variable	*Coeff.*	*t*
(Constant)	3.166*	2.075
Medal, Los Angeles	–0.401	–1.067
Medal, Orange County	2.291*	7.137
Medal, Riverside	1.966*	5.363
Medal, San Francisco	3.539*	9.191
Medal, Dallas	–0.251	–0.601
Medal, Sacramento	1.889*	5.615
Medal, New World International	–1.081*	–2.982
Medal, Reno	0.577	1.553
Medal, San Diego	–1.060*	–2.912
Vintage before 1987	9.359*	4.829
Vintage 1987	4.795*	2.428
Vintage 1988	6.559*	4.450
Vintage 1999	5.418*	4.375
Vintage 1990	4.108*	3.507
Vintage 1991	2.514*	2.207
Vintage 1992	0.783	0.679
Vintage 1993	–0.940	–0.747
Chenin blanc dummy	0.773	0.499
Cabernet franc dummy	2.508	1.615
Chardonnay dummy	5.389*	5.003
Cabernet sauvignon dummy	4.709*	4.121
Gewürztraminer dummy	2.122	1.623
Johannisberg riesling dummy	2.922*	2.361
Merlot dummy	4.489*	3.805
Petite sirah dummy	4.607*	2.987
Pinot blanc dummy	2.409	1.132
Pinot noir dummy	5.696*	4.767
Red meritage dummy	14.587*	10.494
Sauvignon blanc dummy	2.157	1.959
Semillon dummy	2.469	1.326
Sparkling wine dummy	6.250*	4.453
Syrah dummy	4.808*	2.855
White meritage dummy	6.031*	3.243
Zinfandel dummy	2.983*	2.577
$\bar{R}^2$	0.283	

*significant at the .05 level

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