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INDIVIDUAL AND COLLECTIVE REPUTATION INDICATORS OF WINE QUALITY

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CIES DISCUSSION PAPER 0009

INDIVIDUAL AND COLLECTIVE REPUTATION INDICATORS OF WINE QUALITY

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ABSTRACT

A hedonic pricing model is estimated using U.S. data for premium wines from North America (Napa and Sonoma Valley, Sonoma County, Oregon, Washington State), Australia, South Africa and Chile. Implicit prices for quality attributes including variety, sensory quality ratings, as well as for individual and collective reputation indicators are identified. We focus on the value of wine quality to consumers and how quality indicators influence their willingness to pay for premium wine. A information model, where consumers are assumed to fully rely on sensory quality ratings is compared to a reputation model where collective indicators for wine growing areas and individual indicators for specific wine attributes provide additional information about wine quality to the consumer. Highly significant estimators for sensory wine quality as well as individual and collective reputation indicators explain price differences of premium wines.

Key Words: Wine Quality, Reputation, Information, Hedonic Pricing.

JEL Classification codes:

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NON TECHNICAL SUMMARY

INDIVIDUAL AND COLLECTIVE REPUTATION INDICATORS OF WINE QUALITY

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We estimate how particular quality characteristics affect consumer willingness to pay for wine in the premium price bracket over 7 US$ a bottle. We identify implicit prices for quality attributes including variety, sensory quality ratings, as well as individual and collective reputation indicators. Data source is the *Wine Spectator*, which publishes average retail prices along with sensory quality ratings, as well as information on regional origin, varieties, and other quality attributes.

Regional origin is used as a collective reputation indicator. The wines analyzed are from growing regions in North America (Napa and Sonoma Valley, Sonoma County, Washington State, Oregon), and from Australia, South Africa and Chile. As individual reputation indicators, we include "cellar selection" when a wine has potential to improve with age, "highly recommended" when a wine is especially noteworthy, and "best buy" for outstanding values. Moreover, as consumer may be willing to pay more for a relatively scarce wine, the number of "cases" produced is included to measure any scarcity effect due to the limited availability of a particular label. In addition, we evaluate the differences between two widely recognized premium wine varieties (Cabernet Sauvignon and Chardonnay).

We focus on the value of wine quality to consumers and how quality indicators influence their willingness to pay for premium wine. When consumers fully rely on sensory quality ratings, their willingness to pay should not be affected by other quality indicators for which implicit prices are then zero. However, when collective and individual indicators provide additional information about wine quality to the consumer, their implicit prices should be different from zero. The estimation results indicate highly significant implicit prices for sensory wine quality as well as almost all of the individual and collective reputation indicators. Therefore, the consumers' willingness to pay is affected by other quality indicators.

The results indicate that on average, a 1% increase in sensory quality would yield a 2.9% increase in price. This implicit price elasticity for the sensory quality rating is larger for Chardonnay, indicating a higher quality premium compared to Cabernet Sauvignon.

Implicit prices for collective reputation indicators denote percentage differences in the willingness to pay for wines from a particular growing area relative to wines from Napa Valley. They indicate that consumers are only willing to pay less for non-Napa Valley wines (up to 68% for Chile). For all regions, the coefficients for collective reputation indicators are larger for red wines, indicating a higher premium for red wines. It is surprising that the willingness to pay more for premium wine from Australia, Oregon and Washington State is about equal. For red wine, we estimate a remarkable 13.8% price premium.

The estimation indicates a 48% premium for "cellar selection", a 24% premium for "highly recommended", and a 31% discount for "best buys." For all individual reputation indicators, the coefficients are larger (in absolute terms) for Chardonnay. Moreover, a small snob effect is present and somewhat larger for Cabernet Sauvignon.

INDIVIDUAL AND COLLECTIVE REPUTATION INDICATORS OF WINE QUALITY

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Wine is a product with highly differentiated quality characteristics. It is very difficult to define an objective overall measure for wine quality. Many *sensory* quality indicators are highly subjective including color and intensity, aroma and sweetness, as well as acidity, mouthfeel and body. Additional indicators, such as labeling, bottle design, or the reputation of wine producers and growing regions may advance or hinder the sale of a particular wine. Frequently, it is observed that prices for a bottle of wine may vary heavily despite similar sensory quality characteristics. For instance, a wine from Napa Valley, California typically sells at a higher price than a wine of comparable quality from elsewhere. We attempt explain such an observation by positing that consumers do not have sufficient information about sensory wine quality attributes. Therefore, we postulate that consumer decisions to buy a particular wine are often based on *reputation*. Consumers may be prepared to pay a higher price for a reputable wine from a well-known origin. In particular, we examine collective reputation effects for growing regions as a reliable supplier of quality wine as well as individual reputation effects for specific wines. Although a few empirical studies analyze quality characteristics and attributes for wine (Golan and Shalit 1993; Oczkowski 1994; Nerlove 1995; Combris, Lecocq and Visser 1997), only Landon and Smith (1997; 1998) analyze reputation indicators as a characteristic determining the price of premium wine.

In this paper, we present an empirical analysis of key wine quality attributes. We develop a hedonic pricing model of the premium wine market in the United States and estimate implicit prices for key quality attributes.[1] Our main objective is to analyze the impact of sensory wine quality, individual and collective reputation indicators, and other attributes such as variety and relative scarcity on the willingness to pay for premium wines. We assume that wine consumers have only incomplete information about sensory quality attributes and judge the quality of a particular wine using readily available information on individual and collective reputation indicators as well as other attributes. The results are compared to the nested (full-information)

[1] Premium wine is typically refers to the price bracket over $7 a bottle (The Economist, 1999).

model, where consumers are assumed to have complete knowledge about sensory wine quality and need not refer to other indicators.

Data source is the *Wine Spectator*, a U.S. trade magazine which publishes average retail prices for premium wines along with relatively consistent sensory quality ratings (so-called scores), as well as information on regional origin, varieties, and other distinctive quality characteristics.[2] We analyze two distinct varieties, white wines (Chardonnay) and red wines (Cabernet Sauvignon), from a selection of wine growing regions around the world. The regions are Napa Valley, Sonoma Valley, Sonoma County, Oregon and Washington State, Australia, Chile, and South Africa.

In the following section, a brief literature review will survey the current research on hedonic pricing models, particularly with respect to wine and other agricultural commodities. In Section 3, we discuss the theoretical foundation of our analysis. The data and empirical model and its results will be presented in Section 4. The main conclusions of our analysis and their implications for wine producers and consumers will be discussed in Section 5.

2. Literature Review

Hedonic price analysis is based on the hypothesis that every good can be treated as a bundle of attributes that define product quality and that differentiate closely related products. Producers and consumers evaluate any bundle of product attributes (e.g. features of a car, indicators of air or water quality). The observed market price is the sum of implicit prices paid for each quality attribute. In his seminal paper, Rosen (1974) presents a model of product differentiation based on the hypothesis that goods are valued for their utility-generating attributes, which in turn defines implicit prices for these attributes. Assuming a competitive market, he develops a theoretical model that allows him to construct implicit markets for characteristics embodied in differentiated products. Rosen recognizes an identification problem for supply and demand functions derived from hedonic price functions, as implicit prices are equilibrium prices jointly determined by supply and demand conditions. Hence, implicit prices do not only reflect consumer preferences, but also factors that determine production. Solving the identification problem requires that supply and demand conditions can be separated. Arguea and Hsiao (1993) examine econometric issues when

[2] For a statistical analysis and critique of Wine Spectator scores see Shewbridge (1998).

estimating hedonic price functions and argue that Rosen's identification problem is essentially a data issue which can be avoided by pooling cross-section and time series data specific to a particular side of the market.

A theoretical framework to examine the impact of reputation on price is presented by Shapiro (1983). He develops an equilibrium price-quality schedule for high quality products with perfectly competitive markets, but imperfect consumer information. He demonstrates that reputation allows producers to sell their high quality items above costs. This premium can be interpreted as the revenue for the producer's investment in reputation. On the demand side of the market, consumers' face costs to improve their information about product quality. Although an improved market transparency leads to an increase in consumer welfare, perfect information is shown not to be optimal as long as information is not costlessly available. Thus, the concept of reputation as a quality indicator is only evident in an imperfect information environment.

Several empirical studies apply hedonic pricing models to wine. Oczkowski (1994) estimates a log-linear hedonic price function for Australian premium table wine, relating retail prices to six attribute groups and various interaction terms. Although he stresses the applicability of Rosen's pure competition equilibrium framework, he fails to address the problem of identification in the paper. Nerlove (1995) estimates a hedonic price function for the Swedish wine market. There is no domestic production, imports are small relative to the overall world market, and the government controls prices. This allows him to presume that prices are exogenous (as opposed to assuming supply is exogenous), thereby avoiding the identification problem. He estimates a reduced form hedonic price function by regressing quantities sold on various quality attributes and prices. Thus, Nerlove assumes that Swedish wine consumers express their valuation of a particular quality attribute by varying the derived hedonic demand for it. Golan and Shalit (1993) identify and evaluate quality characteristics for Israeli wine grapes relative to Californian wines. In contrast to Nerlove's analysis, they analyze hedonic grape pricing, i.e. the supply side of the wine market. Their premise is that high quality wines are produced only when growers are given a strong enough price incentive to supply better grapes. In a two-stage model, they first develop a quality index by evaluating the (relative) contributions of various physical grape attributes to wine quality. Second, they construct a quality-price function relating the price of Californian wine to the quality index

developed in the first stage. It is interesting to note that similar to Nerlove, they circumvent Rosen's identification problem assuming that prices are exogenously given. Combris, Lecocq and Visser (1997) estimate a hedonic price equation and what is referred to as jury a grade equation for Bordeaux wine to explain the variation in price and quality respectively. The jury grade equation alone has no economic meaning and simply states how well jury grades are explained by the attributes of a particular wine. However, they present neither theoretical nor empirical reasons why a jury grade equation is estimated in addition to a hedonic price equation.

Landon and Smith (1997; 1998) presented a first empirical analysis focusing on reputation in addition to sensory quality attributes. In both papers, they estimate hedonic price functions for Bordeaux wine, studying the impact of current quality as well as reputation indicators on consumer behavior. First and the second lags of sensory quality ratings indicate individual reputation while collective reputation indicators are government and industry classifications of Bordeaux wine. They conclude that reputation indicators have a large impact on consumer willingness to pay, that an established reputation is considerably more important than short-term quality improvements, and that ignoring reputation indicators will overstate the impact of current quality on consumer behavior. The identification problem is avoided by pooling cross-section and time series data specific to the supply side as argued by Arguea and Hsiao (1993).

In contrast, our paper analyzes individual and collective reputation indicators for wines from eight wine growing regions in four different countries. We do not model the supply side of the wine market, because our main interest is the value of quality characteristics to buyers of premium wine. We assume that the market is in equilibrium. That is, all individuals have made their utility-maximizing choices, given their knowledge of prices and characteristics of alternative wines and other goods. Moreover, all firms have made their profit-maximizing decisions, given their production costs and the costs of alternative wine qualities producible, and that the resulting prices and quantities clear the market. According to Freeman (1992), the equilibrium assumption implies that implicit prices may be specified without modeling the supply side of the market.

In addition, we may argue that there is no identification problem when estimating a hedonic price function for premium wine because supply is fixed, at least in the short and medium run. Supply is determined by exogenous factors for at least three reasons. First, only selected locations

satisfying unique growing conditions (i.e. climate, soil) are suitable to grow premium wines such that vineyard acreage is fixed at least in the short and medium run. In general, yields from premium vineyards cannot be increased by much without loss of quality; despite they may vary over time due to weather. Second, compared with average and low quality grapes, processing and storage of premium wines is crucial. Premium wine is often stored in oak barrels and the ripening process has to be carefully controlled. Although technical progress also affects premium wine, it may have limited effects on production costs and capacities (e.g. mechanical harvest of grapes may not be possible). Third, premium wine production depends to a large extend on industry specific human capital, i.e. on the experience and know-how of winegrowers and vintners. Consequently, it seems unlikely, that the supply of premium wine can be increased significantly by new players at least not in the short run. Given these facts, we argue that the supply of premium wines is determined by primarily exogenous factors.

3. The Model

Assume that the willingness to pay for premium wine is determined by sensory quality attributes. However, wine consumers do not have complete knowledge about such attributes and judge the quality of a particular wine using readily available information about it. In particular, we propose that consumers use information on how wine experts judge the quality of a particular wine (individual quality indicators) as well as a judgement on the overall quality of wines from a particular growing region (collective reputation indicators). Imagine yourself as a consumer looking for a bottle of premium wine as a gift or to accompany an evening meal. You want a particular grape (e.g. Cabernet Sauvignon, Chardonnay) and you are using information about sensory quality attributes published in wine magazines (expert quality ratings) that may be on display in the store. You adjust the expert quality rating and therefore your willingness to pay to reflect the reputation of a particular growing region as a reliable supplier of premium wine. For example, given an equal expert quality rating for a Napa Valley and a Chilean Cabernet you may be willing to pay less for the Chilean Cabernet because you are more uncertain about whether it will be as good as the expert rating promises. Moreover, other individual quality indicators such as special recommendations or the availability of a relatively scarce wine may also affect your buying decision.

In general, suppose that premium wine is composed of *n* product characteristics or attributes, $\boldsymbol{Z} = z_1, ..., z_n$ (e.g. variety, sensory quality rating, regional origin). Associated with the bundle of attributes, which define the type is a unit price $P(\boldsymbol{Z})$. A hedonic price function describes the price of any particular wine i (Pw_i) as a function of its characteristics:

(1) $$P_{w_i} = P_w(z_{i1}, ..., z_{ij}, ..., z_{in})$$

According to different information levels, the hedonic approach is developed in two steps: If consumers do not fully rely on the information about sensory quality available that is available to them, other individual and collective reputation indicators will affect their buying decision (reputation model). On the contrary, if consumers rely fully on the information about the current sensory quality of a wine, the observed market price can be explained exclusively by the expert quality ratings and other quality indicators would not be significant (full information model). Following Rosen (1974), the utility maximization problem for a representative individual is

(2) $$Max \;\; U = U(X , \boldsymbol{Z}) \quad s.t. \;\; M - P_{w_i} - X = 0$$

where *X* is a composite (numeraire) commodity. An implicit assumption of equation (2) is that each individual purchases only one bottle of wine i during the relevant time period. Thus, the model assumes that the quantity consumed is given and that consumers express their valuation of a particular quality attribute by varying their willingness to pay for it. The first order condition for the choice of characteristic z_j is given by

(3) $$\frac{\partial U / \partial z_j}{\partial U / \partial X} = \frac{\partial P_w}{\partial z_j} \; .$$

Condition (3) simply states that the consumer's marginal willingness to pay for attribute z_j is equal to the marginal cost of purchasing more of z_j. $\partial P_w / \partial z_j$ is the marginal implicit price for characteristic z_j and corresponds to the regression coefficients to be estimated with equation (1). The utility function *U* can be rewritten as

(4) $$U = U(M - P_{w_i}, \; z_{i1}, ..., z_{ij}, ..., z_{in})$$

Inverting (4), solving for Pw_i, and holding all but characteristic j constant yields a bid curve:

(5) $$B_j = B_j(z_j, \boldsymbol{Z}^*, U^*)$$

Equation (5) describes the maximum amount a representative individual would be willing to pay for one unit of a particular wine as a function of z_j, holding other things constant. Note that U^* is the optimal utility level associated with maximization problem (2) and $\boldsymbol{Z}^*$ is the vector of optimally chosen quantities for all other characteristics. A well-behaved bid curve exhibits a diminishing willingness to pay for z_j or a diminishing marginal rate of substitution between z_j and X. Because of differences in their preferences and/or incomes, consumers can have different bid curves.

Analogously, a hedonic pricing model can be developed for the supply side of the market. The inversion of the firm's cost function yields an offer curve for characteristic *j*, which describes the minimum price a firm would be willing to accept for one unit of a particular wine as a function of z_j, holding other things constant. In an equilibrium, all bid and offer curves for all quality attributes and for each market participant are tangent to the hedonic price function which is an equilibrium locus of all bid and offer curves (Figure 1). However, we do not model the supply side of the wine market, because we assume a market clearing equilibrium (i.e. all consumers have made their utility-maximizing choice, given their knowledge of prices and quality characteristics and all producers have made their profit-maximizing decisions, given their production costs and qualities producible). In addition, we have argued that the supply of premium wine is fixed, at least in the short and medium run.

4. Empirical Estimation and Results

Hedonic price analysis is a tool that relates product prices to various attributes or characteristics and yields implicit prices for these attributes or characteristics. Premium wine is a highly differentiated product and well suited for a hedonic analysis. Any quantitative or qualitative variable that affects consumer utility may be included in a hedonic price function. Our choice of appropriate product attributes or characteristics is guided by the main objective of this study: to analyze the impact and significance of sensory wine quality, individual and collective reputation indicators, and other attributes on the willingness to pay for premium wine. We formulate a reputation model assuming that consumers have incomplete information about sensory quality and judge of a particular wine using readily available information at the time of purchase. Then, we compare our results to a (nested) information model, where implicit prices are determined only by

expert quality ratings and variety, and where consumers would not refer to other indicators at the time of purchase.

Most importantly, we are interested in the value of sensory wine quality ratings to consumers. We do not consider technical quality attributes such as sugar level or acidity as done by Nerlove (1995) and Golan and Shalit (1993). Rather, we use a random sample of sensory wine quality ratings published in the *Wine Spectator*. A certified panel in a blind tasting procedure assigns the ratings. The tasters are only told the general type of wine (e.g. variety) and the vintage. The tasting panel uses a 100-point scale and their ratings reflect how highly a particular wine is regarded relative to other wines. The wines are sampled one at a time. Sometimes close scoring wines of a similar type are sampled again before a final score is assigned (Shanken, 1994).

The *Wine Spectator* assigns a number of indicators that characterize the individual quality of a particular wine in more detail and may guide consumers in their buying decisions. "Cellar selection" is an indicator assigned when a wine promises great potential to improve with age. It applies only to red wines, as they are more likely to improve their sensory quality characteristics when stored for several years. "Highly recommended" indicates that a wine is especially noteworthy at the time of tasting. The "best buy" indicator characterizes an outstanding value for a premium wine. All these individual quality indicators are represented by dummy variables. Moreover, as consumer may be willing to pay more for a relatively scarce wine, the number of "cases" produced of each wine is included as another individual indicator to correct for possible scarcity or "snob" effects on prices due to a limited availability of a particular label.[3]

In addition, we focus on the collective reputation of particular wine growing areas and how it affects the price of premium wine. For this purpose, we employ regional origin as a conceptual dummy variable categorizing premium wine from the United States (Napa Valley, Sonoma Valley and Sonoma County, Washington State, and Oregon), Australia, Chile and South Africa.[4] One other variable that may affect the willingness to pay for premium wine at the time of purchase is included. Undoubtedly, the type of grape used has a major impact on consumer tastes and

[3] The *Wine Spectator* only publishes cases produced when data is available. Thus, we have restricted our data set to wines where this information is available.
[4] We distinguish Sonoma Valley and Sonoma County to guarantee that a wine is actually grown in Sonoma Valley. Napa Valley is selected as a reference category to avoid the dummy variable trap.

preferences. Thus, we distinguish a typical red wine (Cabernet Sauvignon) and a typical white wine (Chardonnay) in order to evaluate differences between two widely recognized premium wine varieties.

The price data record a current retail price of a particular wine as a weighted average of prices obtained primarily from catalogs, retail advertisements, and wine auctions. A brief description of data in our empirical model is provided in Table 1.

Table 1: Description of the Data [†]

Variable	Description
Price	weighted average retail price (dependent variable)
Score	sensory wine quality score (maximum score = 100 points)
RedWhite	red wine = 1 (Cabernet Sauvignon), white wine = 0 (Chardonnay)
Cases	number of cases made with a particular label
Napa	Napa Valley wine (dummy)
Sonoma Valley	Sonoma Valley wine (dummy)
Sonoma County	Sonoma County wine (dummy)
Washington	wine from Washington State (dummy)
Oregon	wine from Oregon State (dummy)
Australia	Australian wine (dummy)
Chile	Chilean wine (dummy)
South Africa	South African wine (dummy)
Cellar Selection	great potential to improve with age (dummy)
Highly Recommended	noteworthy wine (dummy)
Best Buy	outstanding value at a modest price (dummy)

[†] Source: The Wine Spectator.

Given the nature of the data set, heteroskedasticity is a potential problem. We applied standard testing procedures (Park, Goldfeld-Quant) to the linear and log-linear functional forms. The log-linear form was chosen for the estimation since the linear model revealed a significant degree of heteroske-dasticity. The logarithm was applied to all non-dummy variables. The estimation results are presented in Table 2. The “full sample” column reports implicit prices for all variables listed in Table 1, including a shifter for red wines. The other columns show the results for the sub-samples of red and white wines, respectively. Since we took the logarithm of the dependent variable “price” and of the independent variables “score “ and “cases” their coefficients

measure the price elasticity of premium wine with respect to sensory wine quality and cases made (scarcity effect) respectively. A regional dummy variable coefficient is to be interpreted as a percentage price impact relative to Napa valley wines.

Table 2: Estimation Results for the Reputation Model [†]

Quality Indicator		**full sample**	**red wine**	**white wine**
i = individual c = collective		n = 578 $R^2 = 0.660$	n = 271 $R^2 = 0.719$	n = 307 $R^2 = 0.605$
Constant		–9.32 (–7.94)*	–5.613 (–3.55)*	–13.34 (–7.49)*
Score	i	2.902 (11.2)*	2.154 (6.17)*	3.763 (9.52)*
RedWhite		0.138 (5.23)*	---	---
Cases	i	–0.098 (–11.3)*	–0.109 (–8.41)*	–0.082 (–7.21)*
Sonoma Valley	c	–0.121 (–2.67)*	–0.289 (–3.95)*	–0.056 (–0.97)
Sonoma County	c	–0.162 (–3.20)*	–0.355 (–4.36)*	–0.079 (–1.24)
Washington	c	–0.302 (–6.35)*	–0.408 (–5.42)*	–0.308 (–4.99)*
Oregon	c	–0.352 (–6.53)*	–0.638 (–5.67)*	–0.236 (–3.90)*
Australia	c	–0.299 (–6.58)*	–0.471 (–6.12)*	–0.223 (–4.04)*
Chile	c	–0.477 (–8.41)*	–0.679 (–8.13)*	–0.312 (–3.63)*
South Africa	c	–0.274 (–4.66)*	–0.467 (–5.44)*	–0.140 (–1.66)
Cellar Selection	i	0.480 (6.46)*	0.420 (5.07)*	---
Highly Recommended	i	0.240 (4.09)*	0.134 (1.46)	0.275 (3.69)*
Best Buy	i	–0.307 (–5.84)*	–0.296 (–3.11)*	–0.325 (–5.27)*

[†] t-statistics are in parenthesis; * indicates significance at the 5% level.

In Table 2, between 60.5% and 71.9% of the variation in price can explained by variations of explanatory variables. First, consider the coefficients for individual quality indicators. The coefficients for sensory wine quality (score) are highly significant in all samples, suggesting that it is an important criteria to consumers across wine varieties. The elasticity is larger for white wines, indicating a higher quality premium compared to red wines. The individual reputation indicators are significant except for "highly recommended" red wines. As expected, the coefficients for "cellar selection" and "highly recommended" are positive, whereas the coefficients for "best buy" are negative. In particular, note a 48% premium for "cellar selection" wines, a 24% premium for "highly recommended" wines, and a 31% discount for "best buys." However, for all individual reputation indicators, the coefficients are larger (in absolute terms) for white wines than for red wines. The coefficients for cases made are negative and highly significant in all three samples. It

suggests that a small scarcity effect may be present which is somewhat larger for red wines, where a 1-% increase in cases made yields a 0.11% decrease in consumer willingness to pay.

Now, consider the coefficients for the collective reputation indicators. Coefficients for collective reputation indicators denote percentage premiums/discounts in the willingness to pay for wines from a particular growing area relative to wines from Napa Valley. The dummies categorizing regional origin (collective reputation) are all negative, indicating that for non-Napa Valley wines consumers are only willing to pay less (up to 68% for Chile). South African wines enjoy the lowest discounts relative to Napa Valley wines, which may be due to the relative novelty of such wines in the US market. The collective reputation indicators are significant for all wine growing areas except for Sonoma Valley, Sonoma County, and South Africa in the white wine sub-sample. Moreover, for all regions, the coefficients for collective reputation indicators are larger for red wines, indicating a higher premium for red wines. The shifter for red wines (RedWhite) is also significant, indicating on average a remarkable 13.8% price difference for premium red wines compared to white wines.

Next, we estimate a (nested) information model to determine the bias when individual and collective reputation indicators of wine quality are ignored. For this purpose, we drop all quality indicators except the RedWhite shifter in the full sample. This model assumes that consumers fully rely on the expert quality rating and do not refer to any other indicator except variety at the time of purchase. The estimation results for the information model are listed in Table 3.

Table 3: Estimation Results for the Information Model[†]

Variable	full sample	red wines	white wines
	n=578	n=271	n=307
R^2	0.378	0.367	0.354
Constant	−20.15 (−16.0)*	−19.36 (−10.9)*	−21.06 (−11.5)*
Score	5.113 (18.0)*	4.979 (12.49)*	5.317 (12.9)*
RedWhite	0.191 (5.78)*	---	---

[†] t-statistics are in parenthesis; * indicates significance at the 5% level.

If consumers rely fully on the information available about current quality, the observed market price may be explained exclusively by expert sensory quality rating (score). On the contrary, if wine consumers do not rely on the expert quality rating, they will refer to other individual and/or collective reputation attributes as additional quality indicators (reputation model).

Although the coefficients in the information model exhibit the expected signs and are highly significant, only about 35-38 percent of the variation in prices is explained by variations of the explanatory variables. Thus, we may conclude that the information model is not well suited to explain the observed price differences for premium quality wines. It appears that the sensory quality rating (score) has a relatively large and significant impact on price. As a consequence, using the information model would lead to the incorrect conclusion that the purchase decision depends significantly on the sensory quality rating and that this effect is larger for premium white wine.

5. Marketing and Policy Implications

Our empirical results contain some important marketing and policy implications. Sensory quality (score) is a highly significant and price elastic attribute for wine consumers. The estimation suggests that a higher sensory quality rating would benefit producers of white wine more than producers of red wine with elasticities equal to 3.76 and 2.15, respectively. Another highly significant although price inelastic individual indicator is the scarcity or "snob" effect for cases made. Variety is another important quality attribute to consumers. On average, producers can get 13.8 % more for a red wine than for a white wine of identical origin and sensory quality rating.

Interesting conclusions can be drawn from categorizing regional origin across premium wine varieties. All collective reputation indicators in the full sample and for red wines are significant and negative, suggesting that Napa Valley wine is a benchmark for regional reputation. However, for white wines with a Sonoma label and South Africa wines, there is no significant price difference relative to Napa Valley. This suggests that they enjoy similar reputation to consumers. It appears, at least for white wines, that regional reputation within the wine country of Northern California does not matter to consumers. It also indicates, that producers of Sonoma County white wines may get away with receiving a premium for their wine even if not grown there. The result for white wines from South Africa is somewhat surprising and may include a novelty effect, given the fairly recent market entrance and thus limited time to build a reputation as a reliable supplier of premium wines. As expected, wines from Oregon and Washington State are regarded less favorably than comparable Californian wines. However, it is surprising that consumers are willing to pay only about the same for premium wine from Australia compared to Oregon and Washington

State wines given the great success of many Australian wines in international wine competitions and auctions. The reputation of Chilean red wines represents the low end in our analysis with a 68% discount relative to Napa Valley wines. However, it is interesting to note that white wines from Chile are valued significantly higher than Chilean red wines and comparable to wines form Oregon and Washington State.

The estimated hedonic price function may also have important policy implications. Because regional reputation is a public good, it may be desirable for governments and/or regional marketing boards to engage in activities to enhance the reputation of particular wine growing areas or varieties from a region. For example, Australian producers of red wine may want to foster the reputation of their wines in North America given that they lag significantly behind Californian wines despite very favorable ratings in international auctions. Emphasizing a great potential to improve with age (cellar selection) may be one strategy for individual producers to pursue with premiums of almost 50%. Similarly, producers from South Africa may what to strengthen and improve their reputation as a reliable supplier of premium wines. If indeed, their current success is due to novelty, they may use this "bonus" as a strategic advantage over producers from other region.

In conclusion, we emphasize that sensory wine quality is a significant factor that influences the willingness to pay for premium wine. However, the information model is rather limited in explaining the variation in prices. Thus, consumers seem to not fully rely on sensory quality attributes when making their buying decision. The reputation model includes other factors that seem to affect the consumer-buying decision. In addition to wine quality, collective reputation indicators for the wine growing areas as well as individual indicators for particular wines are crucial determinants influencing the consumer's willingness to pay for premium wine. However, significant regional differences exist across wine varieties for all reputation indicators.

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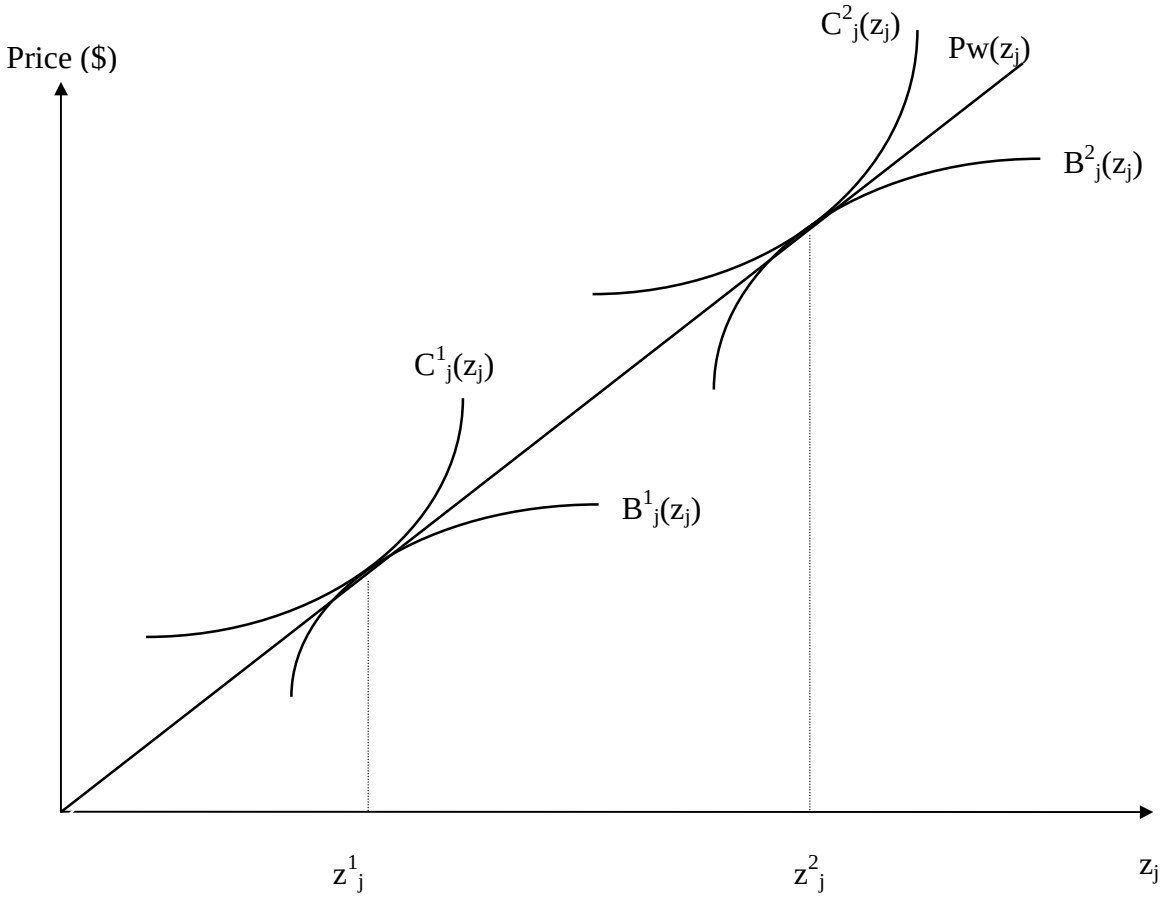

Figure 1: Bid curves $B_j(z_j)$ for two consumers and offer curves $C_j(z_j)$ for two producers in a hedonic market.

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