Wine Quality and Varietal, Regional and Winery Reputations: Hedonic Prices for Australia and New Zealand

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ABSTRACT

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We estimate hedonic price functions for premium wine from Australia and New Zealand, differentiating implicit prices for sensory quality ratings, wine varieties, and regional as well as winery brand reputations over the vintages 1992 to 2000. For Australia, the results suggest regional reputations in general are becoming increasingly significant through time, indicating an intensifying regional quality differentiation. As well, some specific cool-climate regions (e.g. Adelaide Hills, Mornington Peninsula and Tasmania) are becoming increasingly preferred over other regions. Price premiums based on brand reputation also are shown to be significant. For New Zealand, regional quality differentiation is considerably less significant than is the case in Australia, which raises the question as to why. (Is there scope for more regional promotion there?) In each country, price premia associated with both James Halliday's and *Winestate* magazine's sensory quality ratings, and with Halliday's winery ratings and classis wine designations, are highly significant.

Key words: Wine quality, regional reputation, brand reputation, hedonic pricing

JEL codes: C50, D12, Q13

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1. Introduction

For more than a dozen years now the wine industry has been booming in Australia and New Zealand. Both the area planted to vineyards and the volume of wine produced have grown at about 7 per cent per year on average since the late 1980s, while the two countries' exports of wine have been growing at more than 20 per cent per year (from a low base). Simultaneously, wine exports from California, South Africa and the Southern Cone of Latin America have been soaring too, such that the share of global wine production that is exported has risen by more than 50 per cent (Anderson and Berger 1999). Yet the volume of wine consumption per capita in Australia, New Zealand and globally, has been static. Indeed consumption has been falling steadily in the traditional wine-consuming countries of Europe and the southern cone of South America, offsetting demand growth in the UK, the US, and (from a tiny base) East Asia. In each of these markets, however, as in Australia and New Zealand, there has been a dramatic substitution of quality for quantity: premium (bottled) wine sales are growing steadily while non-premium (cask) sales are in decline (Anderson 2001).

With global demand static and export supplies from the New World booming, the average price of internationally traded wine is bound to come under pressure to decline in the coming years. In this more-competitive and more-globalized environment, the extent to which the price declines (or rises) for a particular group of producers will depend very much on the quality upgrading of its product, absolutely and relative to that of other producer groups, as perceived by consumers at home and abroad. This raises the question of what determines the consumer's perception of quality when they buy wine.[1] In particular, what are the market

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[1] This is to be distinguished from the quality upgrading over time of super-premium wine as it matures in the bottle in the years following its initial sale by the winery, as captured by time series of prices in the secondary market. According to Ashenfelter (2000), Ashenfelter, Ashmore and Lalonde (1995) and Byron and Ashenfelter (1995), key determinants of the vintage-to-vintage variation in the ultimate quality of mature wine are a few

values of such things as the reputation of the producing region as distinct from corporate brand reputation, or grape variety reputation or the published ratings of wine writers/judges/ critics; and how have they evolved over time?

This paper addresses this question as it relates to Australian and New Zealand wines, using a hedonic pricing model. It begins by briefly reviewing the literature on such pricing models and their application to wine. It then presents the model and the two data sets used here and details the empirical results for prices in the Australian and New Zealand markets separately. The final section summarizes what has been learnt and suggests areas for further research.

2. Literature review

A number of studies apply hedonic price analysis to estimate implicit prices for wine *quality* attributes.[2] They are based on the hypothesis that any product represents a bundle of characteristics that define quality. Their theoretical foundation is provided in the seminal paper by Rosen (1974), which posits that goods are valued for their utility-generating attributes. Rosen suggests there are competitive implicit markets that define implicit prices for embodied product attributes, and that consumers evaluate product attributes (e.g. features of a car, indicators of air or water quality) when making a purchasing decision. The observed market price is the sum of implicit prices paid for each quality attribute. Rosen also recognizes an identification problem for supply and demand functions derived from hedonic price functions, because implicit prices are equilibrium prices jointly determined by supply and demand conditions. Hence, implicit prices may reflect not only consumer preferences but also factors that determine production. In order to solve the identification problem it is necessary to separate supply and demand conditions. Arguea and Hsiao (1993) argue that the identification problem is essentially a data issue that can be avoided by pooling cross-section and time-series data specific to a particular side of the market.

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straightforward weather variables in the growing season -- information that consumers appear to have been ignoring.

[2] This work builds on a long stream of agricultural econometric research on product quality. See, for example, Waugh (1928).

Since the quality of a particular bottle of wine cannot be known until it is de-corked and consumed, consumers' willingness to pay depends on reputations associated with that wine. In addition to quality ratings, the reputation of the winery, the wine region and the grape variety(-ies) used also affect wine prices. Shapiro (1983) presents a theoretical framework to examine reputation effects on prices. He develops an equilibrium price-quality schedule for high-quality products, assuming competitive markets and imperfect consumer information, to demonstrate that reputation allows high-quality producers to sell their items at a premium that may be interpreted as revenue for producer investments in building reputation. On the demand side of the market, it is costly for consumers to improve their information about product quality too. In such an environment of imperfect information, learning about the reputation of a product or of some of its attributes can be an effective way for consumers to reduce their decision-making costs.

Oczkowski (1994) provides one of the first empirical wine studies to adopt this reputation approach using a hedonic pricing model. He estimates a log-linear function for premium Australian table wine, relating retail prices to six attribute groups and various interaction terms.

Nerlove (1995) examines the Swedish wine market, which is characterized by no domestic production, a small share of global consumption, and government control of prices. This allows him to presume that prices are exogenous (as opposed to assuming supply is exogenous) and to estimate a reduced form hedonic price function, regressing quantities sold on various quality attributes and prices. Thus, Nerlove assumes that wine consumers in Sweden 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 wine grapes produced in Israel relative to California wine. That is, they analyze hedonic grape pricing of the input 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. Analogous to Nerlove, they also assume that prices are exogenous.

Combris, Lecocq and Visser (1997) estimate a hedonic price equation and what is referred to as a jury grade equation for Bordeaux wine to explain the variations in price and quality, respectively.[3] Landon and Smith (1997, 1998) also present empirical analyses of Bordeaux wine, focusing on reputation indicators in addition to sensory quality attributes. In both papers, they study the impact of current quality as well as reputation indicators on consumer behavior using hedonic price functions. Lagged sensory quality ratings define individual product reputation. Regional reputation indicators are government and industry classifications. In addition, their 1997 paper analyzes five individual vintages over the period 1987 to 1991. Their main conclusions are: reputation indicators have a large impact on consumer willingness to pay; an established reputation is considerably more important than short-term quality improvements; and ignoring reputation indicators will overstate the impact of current quality on consumer behavior. Their estimated coefficients vary substantially across the five vintages examined.

In another empirical application to Australian wines, Oczkowski (2000) estimates hedonic price functions for wine assuming attribute measurement errors. He finds significant reputation effects but insignificant quality effects.

A recent working paper by Roberts and Reagans (2001) examines market experience, consumer attention, and price-quality relationships for New World wines in the U.S. market. They argue that the attention paid to wine quality signals increases with the market experience its producer and, because of spillover effects, with the experience of associated producers.

In an analysis of the U.S. wine market, Schamel (2000) estimates a hedonic pricing model based on sensory quality ratings, individual wine quality and regional reputation indicators for two premium wine varieties: a white (Chardonnay) and a red (Cabernet Sauvignon). The paper examines seven regions (Napa and Sonoma Valley, Sonoma County, Oregon, Washington State, Australia, Chile, South Africa) and includes observations from a

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[3] On its own, the jury grade equation has no economic meaning, and no theoretical or empirical reason is presented as to why it is estimated in addition to the hedonic price equation. In a review of the above four empirical wine studies, Unwin (1999) stresses the difficulties associated with identifying appropriate variables to include, the varying definitions of wine quality used, and the possible inconsistencies in their data.

pool of eight vintages between 1988 and 1995. However, it does not estimate coefficients for individual vintages. The estimated price elasticity of sensory quality is larger for white wine, indicating that U.S. consumers were willing to pay a higher quality premium for white compared to red wine at that time. However, the results suggest both regional reputation and individual quality indicators seem to be more important to U.S. consumers of red wine. The results also suggest that the marketing of regional origin as a reputation attribute may have a higher payoff for regions primarily growing red wine. In other words, it seems that the public-good value of a regional appellation is higher for red wine regions and that individual producers in those regions may benefit more from collective marketing efforts.

The present paper extends the authors' recent hedonic pricing model used to analyze various reputation indicators for premium wines from Australia and New Zealand (Schamel and Anderson 2001). That earlier paper individually examined recent vintages (1992-1998) in addition to the data sets as a whole for each country, using a data set developed by Halliday (1999a,b). In the present paper, we extend that work by analyzing an additional data set of more than 12,500 tasting scores for premium wines for the same two countries (Winestate 2001). This enables us to compare for the first time hedonic pricing model results for two different data sets drawn from a similar base population of wines and consumers.

Because consumers are uncertain or have incomplete information about wine quality, we hypothesize that, in addition to their own perceptions of grape varieties used and each growing region's reputation as a supplier of premium wine, they use information on wine experts' ratings of particular wines and individual wineries when making their buying decisions.

3. The data and hedonic price model

The data

Table 1a provides an overview of the data set from well-known Australian wine critic James Halliday (1999a, b), which we have used to estimate a first set the hedonic price equations. This consistent set is available for each vintage from 1992 (1993 in the case of New Zealand) to 1998, amounting to 4,583 observations from Australia and 837 from New Zealand. In addition, we analyze the full data set for the '92-'98 vintages. [Two more years of

data will be available in May 2001, which will allow us to update the analysis.] For the Australian sample, the average quality rating is 87 points (range 65-97) and the average price is A$23.50 (range A$5-250). For New Zealand, the average quality rating is 88 points (range 73-97) and the average price is NZ$22.10 (range NZ$7-90). Halliday's value of sensory wine quality is defined by the variable *vintage rating* (100-point scale). He also provises a *winery rating* of the producer as a supplier of premium wine, and a *classic wine* classification in recognition of an outstanding wine. To evaluate differences in the willingness to pay for different grape varieties, we distinguish six different red and six white wine varieties or variety groupings, respectively. In order to assess the value of regional denominations in Halliday's sample, we distinguish wines from 27 different regions in Australia as well as six different regions in New Zealand. Separate equations are estimated for Australia and New Zealand.

Table 1b provides an analogous overview of our second data source from Australia's popular wine magazine *Winestate.* It provides wine ratings for 12, 625 combined observations for Australia and New Zealand. In contrast to the popular 100-point scale for sensory wine quality adopted by Halliday, Winestate uses a 5-star rating scheme, assigning between 3 and 5 stars but also using half-stars. (Some wines have no rating at all, which presumably implies less than 3 stars, so we assigned 2.5 stars for all non-rated wines.) For simplicity, we have given two points for every star, to avoid using decimals. From the Winestate tastings, a consistent set is available for each vintage from 1992 to 2000 (1994 to 1999 in the case of New Zealand), amounting to 11,251 observations from Australia and 1,374 from New Zealand. In addition, we analyze the full data set for the '92-'00 vintages ('94-'99 for NZ). For the Australian sample, the average quality rating is about 3.25 stars and the average price is A$19.56 (range A$5-385). For New Zealand, the average quality rating is 3.44 stars and the average price is NZ$20.59 (range NZ$9-90). In order to assess regional denominations, we distinguish wines from 28 different regions in Australia and six different regions in New Zealand in the Winestate sample.

The model

Following conventional hedonic models, we propose that a bundle of quality attributes defines any premium wine. Consumer willingness to pay is a function of that bundle of wine quality attributes, which include a critic's sensory quality ratings, winery ratings, grape varieties used, and indicators of regional reputation. Because consumers are uncertain about quality ratings, they use additional information available to judge the quality of a particular wine. Imagine yourself as a consumer looking for a bottle of (recently released) premium wine as a gift or to accompany a meal. You want to buy wine a particular grape variety (e.g., Shiraz) and you are using available information from wine experts about the sensory quality of a particular wine and the winery producing it. (Published vintage and winery ratings are commonly available for perusal in wine shops.) You adjust the expert quality rating and therefore your willingness to pay for a wine to reflect the regional reputation of the growing region as a reliable supplier of premium wine. For example, given an equal expert quality rating of 90 points for a Barossa Valley Shiraz and a Hunter Valley Shiraz, you may be willing to pay less for the Hunter Valley red because you are less certain about whether it will be as good as the expert rating promises. Moreover, an individual quality indicator such as a classic wine rating assigned by wine critics also affects your buying decision.

In general, suppose that a bundle of *n* different quality characteristics describe any bottle of premium wine: $\mathbf{Z} = z_1, \ldots, z_n$ (e.g. variety, sensory quality rating, regional origin). Associated with this bundle is a unit price $P(\mathbf{Z})$. A hedonic price function describes the price of any particular wine *i* (Pw_i) as a function of its characteristics:

(1) $$P_{w_i} ? P_w(z_{i1}, \ldots, z_{ij}, \ldots, z_{in})$$

We assume that the market is in equilibrium. That is, consumers 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 implicit markets.[4]

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[4] For a more detailed description of the underlying theoretical model, see Schamel (2000).

Hedonic price analysis relates the price of a good to its utility-generating characteristics and yields implicit prices for these characteristics. Thus, any quantitative or qualitative variable that affects consumer utility may be included in a hedonic price function. We formulate a model assuming that consumers, uncertain about the true sensory quality of a particular wine, adjust their willingness to pay using variety, expert quality and producer ratings as well as regional reputation as important criteria.

The theoretical model described so far does not restrict the functional form to be estimated, but it limits the type of explanatory variables. In the empirical literature on hedonic wine pricing, a variety of different functional forms have been explored and reported. For example, Landon and Smith (1997) examine five different functions choosing the reciprocal square root form, Oczkowski (1994) reports a log-linear form, and Nerlove (1995) compares log-linear, log-log and Box-Cox transformations. Heteroskedasticity is a potential problem given the nature of the data set. In our case, when we apply a simple Breusch-Pagan test to the linear, log-linear, and log-log functional forms and fix the level of significance for the critical χ^2 test statistic at 1%, we cannot reject the hypothesis of homoscedasticity for the log-linear form (Breusch and Pagan 1979). Hence log-linear is the functional form we use, with log(Price) as the dependent variable. Our examination of the correlation matrices for the coefficient estimates revealed no serious degree of multicollinearity is present in the data.

4. The results

Australia

Tables 2 and 4 present the estimation results for Australia from the Halliday and Winestate samples, respectively. Shiraz and Barossa Valley were chosen as the comparator variety and region (necessary to avoid the dummy variable trap). The first column reports implicit prices for the complete pooled sample. The other columns show the estimation results for each of the seven or eight sub-samples of individual vintages. For the Halliday sample, the coefficients for "vintage rating" and "winery rating" measure the percentage price premiums for a one-point increase (100 point scale), respectively. Dummy variable coefficients for variety and regional origin are to be interpreted as a percentage price impact relative to Shiraz

and Barossa Valley wines, respectively. The coefficient for "classic wine" reports the percentage premium for a wine that obtained this special recognition. For the Winestate sample, the coefficients for "rating" measure the percentage price premiums for a one-point increase (10 point scale), which may also be interpreted as the percentage price premium for a ½ star rating increase.

Consider first the estimates using the Halliday data (Table 2). The parameters for vintage rating are all significant and fairly constant over time. The price premium is 2.7% on average and varies between 2.4% to 3.8% for a one-point increase in the sensory quality rating for the '92-'98 vintages. That is, a one point increase in Halliday's quality rating would yield an increase in the price per bottle between 56 cents and $1.09 on an average–priced bottle of wine over that period (see last row in Table 2). The coefficients for producer reputation ("winery rating") are significant for all vintages except '92. The price premium averages 6% (or A$1.41) for another star in Halliday's winery rating. However, it ranges between 3.5% and 9.3% and there appears to be a downward trend over the period analyzed. Halliday's "classic wine" rating is significant for all vintages in Australia except '98 (which is an incomplete sample because many premium reds from that vintage were still to be released), and adds a price premium of about 27% (or A$6.50) on average, all other things equal. Again a downward trend in this coefficient is evident.

Turning to the wine variety dummies, the changes over time in the parameter values for varieties reflect relative changes in consumer tastes and preferences for the various varieties. For example, Semillon and Sauvignon Blanc parameters become less negative, that is, the price discount for them relative to Barossa Valley Shiraz decreases implying that these varieties have become less unpopular over the latter 1990s. On average they attract about a one-third discount relative to Barossa Shiraz, other things equal. For Chardonnay the discount was only half as large whereas for Riesling it averaged 50% (although less so in the late 1990s). Among the reds, Pinot Noir, Cabernet and Cabernet blends attracted similar prices to Shiraz, but Shiraz blends and other reds were sold at discounts of 10% to 20% below the Barossa Shiraz price, again all other things equal. Over time the variety parameters have become more significant.

When examining the regional dummies, notice that they become increasingly significant over time. For the '92 vintage, only one region (Eden Valley) is significantly different from Barossa Valley while for the '97 vintage, only 4 out of 26 regions are not significantly different. (Because the '98 Halliday data set excluded many super premium reds still awaiting release, less store can be put on the regression for that year.) This pattern is a clear indication of an intensifying regional quality differentiation in Australia, with coefficients for some regions trending down while others are trending up. For example, the Tasmanian coefficients increase which means that Tasmanian wines have become more popular with consumers relative to Barossa wines. Even stronger upward trends are evident for the newly developing super premium cool climate regions of the Adelaide Hills and Mornington Peninsula. By way of contrast, the wines of the warm-climate irrigated region of Riverina hasve become more discounted over time.

Now consider the estimates for the Winestate data (Table 4). The parameters for vintage rating are all significant but less constant over time compared to Halliday. The price premium is 6.9% on average and varies between 4.1% to 10.7% for a ½-star improvement in the sensory quality rating for the '93-'99 vintages. That is, a ½-star increase in Winestate's rating would yield an increase in the price per bottle between 66 cents and A\$2.28 on an average–priced bottle of wine for the '93-'99 vintages (see last row in Table 4). For the '92 vintage, the percentage price premium for a ½-star rating increase is even higher at 15.6% which would yield an increase of A\$3.12 for the average priced bottle of that vintage. Unfortunately, the different rating schemes do not allow a direct comparison of the price premia for both data sets.

Turning to the wine variety dummies, the Winestate data also confirms that the Semillon and Sauvignon Blanc parameters become less negative, that is, the price discount for them relative to Barossa Valley Shiraz decreases implying that these varieties have become more popular over the latter 1990s. On average, they attract about a one-third discount relative to Barossa Shiraz, other things equal. For Chardonnay the discount is slightly higher in the Winestate sample (22% vs. 16%) whereas for Riesling it averaged 44% vs. 50% with Halliday's data. However, both samples confirm that the discount has declined over the

1990s. Among the reds, Pinot Noir and Merlot attracted similar prices to Shiraz (less than 5% discount), but other red varieties including Cabernet, Cabernet blends and Shiraz blends show discounts between 6% to 21% below the Barossa Shiraz price, again all other things equal. More of these parameters have become significant as the past decade proceeded.

When examining the regional dummies, notice again that they become increasingly significant over time, although the trend is much less clear than in the Halliday sample. In the sample the only region significantly different from the Barossa Valley for the '92 vintage was Rutherglen, while for the '98 and '99 vintages half the regions are significantly different. Again, this pattern is an indication of an intensifying regional quality differentiation in Australia, with coefficients for some regions trending down while others are trending up. Strong upward trends are evident for the newly developing super premium cool-climate regions (e.g. Adelaide Hills, Mornington Peninsula and Tasmania).

New Zealand

The results for New Zealand, shown in Tables 3 and 5, differentiate 10 varieties and 5 regions. (Absence of an entry means there were no observations.) The Chardonnay variety and the region of Marlborough are chosen as the New Zealand bases to avoid the dummy trap. A number of interesting results, especially when compared with Australia's, are worth highlighting. For example, the parameters for Halliday's "vintage rating" are all significant and fairly constant over time, with almost the same price premium for New Zealand as for Australia (2.0% versus 2.7% for one additional quality point over the full sample period). For the individual vintages in Halliday's data set, the premiums vary between 1.8% and 2.9% (or 33 and 68 cents calculated at the average NZ price for each vintage). The "classic wine" parameter is almost equally significant with the premium averages 25% or NZ$5.52, about the same as for Australia. The parameters for "winery rating", however, are smaller and much less significant for New Zealand than for Australia. Variety differences are less pronounced in New Zealand, but note that Riesling is discounted by two-fifth and other whites by 24-30% relative to the base variety (Chardonnay), whereas Pinot Noir is at a slight premium and Cabernet and Merlot enjoy considerable premia, other things equal. Most strikingly, however, are the differences in the degree of regional differentiation between the two countries. For

New Zealand, only two regional dummies are significantly different from the base region (Marlborough) over the full sample period, and the degree of difference is not large. Nor is any trend in significance of coefficients over time evident.

As was the case for Australia, very similar findings emerge for New Zealand from the Winestate data (Table 5) as those from the Halliday data (Table 3): vintage ratings are nearly all significant with no obvious trend over time, variety and regional differences are not pronounced, and nor are they becoming more significant over time.

Finally on the results, note that the variation in prices explained by the model (R^2) in all sub-samples is always higher for New Zealand, despite much smaller sample sizes and fewer explanatory variables. Moreover, note that the estimation results are fairly consistent across the two different data sets for each country, and that the size of the price premia consumers are willing to pay for higher-rated wines is consistently less in New Zealand than in Australia (especially bearing in mind that the NZ\$ was worth only 70-85 per cent of the value of the Australian dollar in the 1990s).

5. Implications and areas for further research

At least three clear lessons can be drawn from these results. One is that vintage ratings, winery ratings, and classic wine categorization by independent writers/critics/judges (in this case those of James Halliday and, for vintage ratings also Winestate magazine's judges) each appear to have a significant positive impact on the prices consumers are willing to pay for premium wines, after taking region and variety of wine into account. This is equally true for Australia and New Zealand. It is consistent with Schamel's (2000) findings for the United States, based in that case on ratings published in *The Wine Spectator*, and suggests consumers value this information in their quest for greater knowledge about available wines.

Second, the premia consumers are willing to pay for higher-rated wines (both Halliday's and Winestate's) appear to have trended downwards slightly over the 1990s. This is true also for Halliday's winery ratings.

The third lesson is not unrelated to the second. It is that there is a clear trend towards greater regional and varietal differentiation, at least within Australia. Together these findings suggest consumers are becoming more discerning and less reliant on critics' ratings. Note,

however, the much weaker regional and varietal differentiation and the absence of any obvious price premia trend in New Zealand. The weaker varietal differentiation may reflect the relatively fewer varieties grown in New Zealand and (a point emphasized by Roberts and Reagans 2001) the newness of many of its premium wine producing regions. And the lower price premia New Zealanders seem willing to pay for higher-rated wines and wineries compared with Australians may simply reflect the lower per capita incomes in New Zealand and their weaker preference for wine (their per capita consumption being only half that of Australians).

The difference between the two markets in the degree of regional differentiation also may reflect the fact that Australia has more major premium regions that have been producing continuously for a long time than does New Zealand. The greater extent to which regional differentiation is increasing in Australia is partly a consequence of the rapid growth in the 1990s of new super-premium cool-climate regions, which are challenging the supremacy of the long-established regions. But another contributing factor is that, unlike New Zealand, Australia has introduced legislation (in 1993) to allow legal registration of regional names (technically, "geographical indications").[5] That legislation is providing stronger rights over the intellectual property value of regional names, thereby raising the rates of return on investments in regional promotion. Even though they cannot say anything about the profitability of such investments, the above results are not inconsistent with the view that price premia can be generated through such promotion. The European tradition of emphasizing region in addition to nation of origin would appear to be gradually taking hold in Australia. It remains to be seen whether regional reputation indicators become less important over time as individual wineries agglomerate with globalization and put more emphasis on building their own brand reputation.

As for the signs and sizes of the premia/discounts attached to variety, they are consistent with common knowledge. But the fact that there are distinct premia for particular varieties, over and above a premium or discount for region of origin, distinguishes the Antipodes from Western Europe where varietal distinctions are down-played.

There is much scope for further empirical work of this sort. The next version of this paper will include 1999 and 2000 vintage data from Halliday, which will show whether/to what extent the apparent trends suggested above have continued. Beyond that, two examples of other questions that might be addressed are mentioned by way of conclusion. First, to what extent are sub-national regions beginning to enjoy a price premium in markets abroad, or is it just national recognition ("Brand Australia") that matters in those export markets at this stage? An answer to this question would help to fine-tune the direction of promotional efforts of regional wine associations. It would also give the bodies responsible for national promotion[6] more scope in attracting (i) funds for their generic promotion and (ii) support for regulation of wine exports to ensure the national reputation for quality exports is not tarnished. Second, hedonic pricing models in principle could be applied to better understand the demand for winegrapes by wineries. Various technical features of grapes contribute to the quality of the wines made from them, but in ways that are not very transparent to grapegrowers. As quantitative measures improve for measuring those attributes winemakers are looking for, so will the scope for addressing this issue with hedonic price modeling, building on the work begun by Golan and Shalit (1993) with respect to Israeli grapes. If indeed weather variables during the grape growing season are crucial, as the empirical research by Ashenfelter (2000) and his colleagues suggests, those too would need to be included in addition to such variables and grape sugar level and acidity.

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[5] This was to enable Australia to fulfill its agreement with the European Union on trade in wine, following the Uruguay Round of multilateral trade negotiations. For details see www.awbc.com.au/arms/a_regions.html. An analysis of its possible effects can be found in Kok (1999).

[6] The Australian Wine and Brandy Corporation and the Wine Institute of New Zealand, respectively.

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Table 1a: Description of the Halliday (1999a, b) Data Set

Variable	Characteristic	
Log(Price)	Dependent Variable	Range: A$5-250, NZ$7-90
Vintage Rating	Sensory Quality	100 Point Scale (Range 65 - 97)
Winery Rating	Winery Ranking	5-Star Rating (2.5 – 5, NR = 2)
Classic Wine	Special Rating	1 = Classic Rating; 0 = Not
Cabernet Sauvignon Cabernet blend Shiraz # (AUS) Shiraz blend (AUS) Pinot Noir Merlot (NZ) Other Red	Red Varieties	Variety Dummies
Chardonnay † Riesling Gewurztraminer (NZ) Sauvignon Blanc Semillon (AUS) Sweet White Other White	White Varieties	
Adelaide Hills Barossa Valley # Clare Valley Coonawarra Eden Valley McLaren Vale Other SA	South Australia	Regional Dummies for Australia
Canberra Hunter Valley Mudgee Riverina Other NSW	New South Wales	
Bendigo Goulburn Valley Grampians Macedon Ranges Mornington Peninsula Pyrenees Yarra Valley Other VIC	Victoria	
Great Southern Margaret River Perth Other WA	Western Australia	
Northern Tasmania Southern Tasmania	Tasmania	
Queensland	Queensland	
Auckland Canterbury Hawke's Bay Marlborough † Wairarapa Other NZ	New Zealand	Regional Dummies for New Zealand

(Aus) and † (NZ) indicate the reference dummies, which we dropped from the regressions.

Table 1b: Description of the Winestate (2001) Data Set

Variable	Characteristic	
Log(Price)	Dependent Variable	Range: A$5-385, NZ$9-90
Star Rating	Sensory Quality	3, 3½, 4, 4½, 5-Stars (NR = 2½)
Vintage Rating	-------- " --------	=> 10-Point Scale (Range 5-10)
Cabernet Sauvignon Cabernet blends Shiraz [#] Shiraz blends (AUS) Pinot Noir Merlot Other Red	Red Varieties	Variety Dummies
Chardonnay [†] Riesling Sauvignon Blanc Semillon Sweet White (AUS) Other White	White Varieties	
Adelaide Hills Barossa Valley [#] Clare Valley Coonawarra Eden Valley McLaren Vale Other Limestone Coast Riverland Langhorne Creek Other SA	South Australia	Regional Dummies for Australia
Canberra Hunter Valley Mudgee Riverina Other NSW	New South Wales	
Goulburn Valley Mornington Peninsula Rutherglen King Valley Yarra Valley Central & West VIC Other VIC	Victoria	
Great Southern Margaret River Perth Other WA	Western Australia	
Tasmania	Tasmania	
Queensland	Queensland	
Auckland Canterbury Hawke's Bay Marlborough [†] Nelson Other NZ	New Zealand	Regional Dummies for New Zealand

[#] (Aus) and [†] (NZ) indicate the reference dummies, which we dropped from the regressions.

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Table 2: Regression results for Australia [Halliday Data Set]

Parameter	'92-'98	1998	1997	1996	1995	1994	1993	1992
CONSTANT	0.512*	0.333	0.330	0.632*	0.602*	0.651*	0.313	-0.347
Vintage Rating	0.027*	0.028*	0.027*	0.024*	0.027*	0.024*	0.028*	0.038*
Winery Rating	0.061*	0.035*	0.039*	0.086*	0.066*	0.093*	0.081*	0.070
Classic Wine	0.276*	0.037	0.210*	0.250*	0.219*	0.269*	0.354*	0.303*
Cabernet Sauvignon	-0.048*	-0.201*	0.037	-0.040	-0.083	-0.035	-0.113*	-0.027
Cabernet blends	-0.021	-0.286*	-0.024	-0.064	0.016*	0.026	0.004	0.003
Shiraz blends	-0.204*	-0.371*	-0.048	-0.053	-0.197*	-0.276*	-0.328*	-0.310*
Pinot Noir	0.008	0.039	0.019	-0.038	-0.028	-0.029	0.148	0.240
Other Red	-0.088*	-0.063	-0.009	-0.115*	-0.090	-0.149*	-0.134	0.006
Chardonnay	-0.160*	-0.128*	-0.124*	-0.206*	-0.181*	-0.177*	-0.108*	-0.054
Riesling	-0.496*	-0.439*	-0.390*	-0.539*	-0.552*	-0.527*	-0.364*	-0.459*
Sauvignon Blanc	-0.313*	-0.245*	-0.222*	-0.385*	-0.359*	-0.337*	-0.627*	-0.418
Semillon	-0.344*	-0.212*	-0.268*	-0.405*	-0.415*	-0.435*	-0.355*	-0.316
Sweet White	-0.273*	-0.053	-0.246*	-0.341*	-0.162	-0.258	-0.395*	-0.462*
Other White	-0.404*	-0.320*	-0.311*	-0.375*	-0.486*	-0.448*	-0.487*	-0.231
Great Southern	0.112*	0.259*	0.331*	0.171*	-0.012	0.062	0.062	-0.118
Margaret River	0.252*	0.319*	0.378*	0.314*	0.132*	0.246*	0.257*	0.118
Perth	-0.060	0.061	0.118	-0.206*	-0.035	-0.141	-0.065	-0.019
Other WA	0.240*	0.486*	0.400*	0.280*	0.192*	0.119	0.129	0.043
Adelaide Hills	0.175*	0.345*	0.383*	0.177*	0.095	0.142	0.018	-0.221
Clare Valley	0.043	0.221*	0.231*	0.090	-0.070	-0.012	0.007	-0.163
Coonawarra	0.061*	0.054	0.193*	0.041	-0.007	0.059	0.061	-0.048
Eden Valley	0.416*	0.472*	0.478*	0.463*	0.393*	0.360*	0.275*	0.498*
McLaren Vale	0.075*	0.383*	0.179*	0.041	-0.081	0.102	0.083	-0.114
Other SA	-0.039	0.115	0.190*	-0.091	-0.214*	-0.033	0.054	-0.290
Canberra	0.050	0.417*	0.232*	0.051	-0.040	-0.067	0.134	-0.325
Hunter Valley	-0.002	0.177*	0.201*	0.041	-0.083	-0.087	-0.158	-0.335
Mudgee	-0.178*	0.243	0.051	0.021	-0.353*	-0.367*	-0.402*	-0.452
Riverina	-0.294*	-0.274*	-0.194*	-0.258*	-0.497*	-0.163	-0.246	-0.105
Other NSW	-0.060	0.061	0.182*	-0.089	-0.147	-0.100	-0.098	-0.303
Bendigo	0.089*	0.272*	0.294*	0.023	0.061	0.090	0.098	-0.189
Goldburn Valley	0.00004	0.011	0.119	-0.050	-0.108	0.026	-0.019	-0.002
Grampians	0.179*	0.323*	0.341*	0.109	0.267	0.091	0.061	0.191
Macedon Ranges	0.220*	0.389*	0.384*	0.326*	0.159	0.098	0.141	-0.134
Mornington Peninsula	0.213*	0.340*	0.411*	0.286*	0.135	0.179*	0.073	-0.449
Pyrenees	0.235*	0.213	0.336*	0.202*	0.191	0.208	0.248	0.151
Yarra Valley	0.158*	0.217*	0.366*	0.172*	0.097	0.134	0.074	0.004
Other Victoria	0.050*	0.141*	0.166*	0.061	0.027	-0.002	0.018	-0.069
Southern Tasmania	0.135*	0.289*	0.287*	0.195*	0.065	0.123	-0.154	-0.078
Northern Tasmania	0.133*	0.293*	0.303*	0.220*	0.034	-0.046	0.218	-0.251
Queensland	-0.050	-0.060	0.100	0.198	-0.086	-0.197	-0.150	0.044
# of observations	4583	638	886	882	754	720	448	255
R^2 (%)	43	39	48	46	46	46	49	47
Average Price (A$)	23.54	20.83	22.18	23.21	23.86	24.66	25.30	28.92
Average Rating	87.0	87.3	87.3	86.7	86.4	87.1	86.5	87.9
1-Point Price Effect (A$)	**0.63**	**0.58**	**0.61**	**0.57**	**0.64**	**0.60**	**0.72**	**1.09**

* = significant at the 5% level.

Table 3: Regression results for New Zealand [Halliday Data Set]

Parameter	'92-'98	1998	1997	1996	1995	1994	1993
CONSTANT	1.198*	1.401*	1.071*	0.933*	1.255*	1.136*	0.751
Vintage Rating	0.020*	0.018*	0.022*	0.023*	0.019*	0.020*	0.029*
Winery Rating	0.036*	0.023	0.048*	0.034	0.037	0.056*	-0.054
Classic Wine	0.250*	0.261	0.316*	0.198*	0.306*	0.165*	0.134
Cabernet Sauvignon	0.161*	---	-0.009	0.229	0.161	0.179*	0.239
Cabernet blends	0.274*	---	0.326*	0.185*	0.476*	-0.038	---
Pinot Noir	0.093*	0.119	0.015	0.153*	0.065	0.045	0.133
Merlot	0.185*	-0.157	0.151	0.125	0.509*	0.123	-0.134
Other Red	0.202*	---	---	0.261*	---	-0.156	---
Riesling	-0.386*	-0.350*	-0.331*	-0.363*	-0.343*	-0.512*	-0.476*
Gewurztraminer	-0.242*	-0.250	-0.134	-0.192	-0.056	-0.363*	-0.587
Sauvignon Blanc	-0.302*	-0.268*	-0.370*	-0.267*	-0.254*	-0.324*	-0.290
Sweet White	0.022	0.223	0.004	0.000	0.056	-0.020	-0.057
Other White	-0.272*	-0.225*	-0.215*	-0.191*	-0.252*	-0.360*	-0.471
Auckland	-0.040	-0.040	-0.085	-0.036	-0.054	-0.013	0.057
Canterbury	0.046	0.022	0.003	0.072	-0.101	0.195*	0.116
Hawke's Bay	-0.001	0.317*	0.002	-0.008	-0.096	-0.036	0.058
Wairarapa	0.117*	0.017	0.170*	0.126	0.091	0.107*	0.200
Other NZ	0.071*	0.128*	0.022	0.094	0.141	0.020	0.067
# of observations	837	112	183	215	117	143	53
R^2 (%)	59	53	65	51	76	70	56
Average Price (NZ$)	22.07	18.63	21.14	23.14	23.70	22.09	23.45
Average Rating	88.1	88.8	88.7	87.3	86.7	89.0	88.35
1-Point Price Effect (NZ$)	**0.44**	**0.33**	**0.46**	**0.54**	**0.45**	**0.44**	**0.68**

* = significant at the 5% level.

Table 4: Regression results for Australia [Winestate Data Set]

Parameter	'92-'00	1999	1998	1997	1996	1995	1994	1993	1992
CONSTANT	2.586*	2.550*	2.641*	2.767*	2.699*	2.634*	2.419*	2.432*	2.183*
Vintage Rating	0.069*	0.041*	0.045*	0.044*	0.060*	0.073*	0.092*	0.107*	0.156*
Cabernet Sauvignon	-0.063*	-0.003	-0.019	-0.062*	-0.054	-0.125*	-0.042	-0.012	-0.238*
Cabernet blends	-0.141*	-0.149*	-0.094*	-0.141*	-0.161*	-0.199*	-0.112*	-0.103	-0.315*
Shiraz blends	-0.212*	-0.307*	-0.254*	-0.063	-0.258*	-0.140	-0.012	-0.322*	-0.240
Pinot Noir	-0.041*	0.105*	0.087*	-0.022	-0.111*	-0.138*	-0.077	-0.011*	-0.357*
Merlot	-0.001	-0.068	0.067*	-0.016	0.021	-0.097	0.083	0.219	0.039
Other Red	-0.194*	-0.115*	-0.076*	-0.254*	-0.187*	-0.282*	-0.155*	-0.239*	-0.215
Chardonnay	-0.225*	-0.143*	-0.167*	-0.247*	-0.258*	-0.249*	-0.124*	-0.136*	-0.530*
Riesling	-0.439*	-0.250*	-0.371*	-0.440*	-0.491*	-0.525*	-0.417*	-0.347*	-0.567*
Sauvignon Blanc	-0.319*	-0.121*	-0.253*	-0.396*	-0.418*	-0.401*	-0.250*	-0.088	-0.504*
Semillon	-0.332*	-0.192*	-0.253*	-0.416*	-0.442*	-0.393*	-0.226*	-0.276*	-0.419*
Sweet White	-0.283*	-0.001	-0.116	-0.223*	-0.507*	-0.800*	-0.548*	---	---
Other White	-0.415*	-0.220*	-0.379*	-0.450*	-0.471*	-0.495*	-0.394*	-0.335*	-0.690*
Adelaide Hills	0.145*	0.248*	0.231*	0.173*	0.121*	0.083	0.064	-0.110	0.122
Clare Valley	-0.029	0.103*	0.047	0.010	-0.043	-0.052	-0.082	-0.300*	-0.125
Coonawarra	0.097*	0.089	0.186*	0.112*	0.105*	0.015	0.078	-0.053	0.068
Eden Valley	0.245*	0.147*	0.081	0.316*	0.377*	0.598*	0.905*	-0.414	0.088
McLaren Vale	0.012	0.038	0.156*	0.058	0.007	0.008	-0.152*	-0.318*	-0.159
Oth. Limestone Coast	0.062*	0.127*	0.146*	0.067	0.025	0.345*	0.070	-0.667	---
Riverland	-0.396*	-0.254*	-0.312*	-0.288*	-0.454*	-0.626*	-0.609*	-0.644*	-0.429
Langhorne Creek	-0.026	0.059	0.039	0.090	-0.118	0.073	-0.193	-0.129	-0.253
Other SA	-0.131*	0.121	-0.048	-0.057	-0.164*	-0.208*	-0.280*	-0.237*	-0.128
Canberra	-0.004	0.313	0.130	0.154	0.030	-0.115	-0.141	-0.306	-0.294
Hunter Valley	0.065*	0.179*	0.123*	0.058	0.057	0.019	0.036	-0.085	0.007
Mudgee	-0.113*	0.009	0.033	0.092	-0.201*	-0.264*	-0.427*	-0.754*	-0.252
Riverina	-0.341*	-0.407*	-0.321*	-0.328*	-0.222*	-0.351*	-0.239*	-0.230	-0.018
Other NSW	-0.049*	-0.011	-0.003	-0.011	-0.099	-0.073	-0.015	-0.225	---
Goulburn Valley	-0.096*	0.063	-0.113	-0.021	-0.143*	-0.066	-0.133	-0.081	-0.303
Mornington Peninsula	0.212*	0.300*	0.325*	0.231*	0.211	0.249*	0.053	-0.259	0.181
Rutherglen	-0.121*	0.051	-0.019	-0.105	-0.154*	-0.103	-0.132	-0.296	-0.277*
King Valley	0.058	0.157	0.063	-0.069	0.003	0.085	0.129	0.424	0.226
Yarra Valley	0.155*	0.068	0.253*	0.212*	0.128*	0.161*	0.167*	0.004	0.082
Central & West VIC	0.124*	0.187*	0.197*	0.161*	0.090	0.068	0.060	0.000	0.129
Other Victoria	-0.078*	0.094	0.019	-0.069	-0.024	-0.192*	-0.204*	-0.302*	-0.073
Great Southern	0.062*	0.219*	0.159*	0.133*	0.112*	-0.031	-0.084	-0.020	0.058
Margaret River	0.250*	0.287*	0.270*	0.363*	0.347*	0.182*	0.084	0.131	0.069
Perth	-0.047	-0.013	0.020	0.017	-0.022	-0.072	-0.170	---	-0.103
Other WA	0.040	0.186*	0.128*	0.035	-0.042	0.071	0.048	-0.280*	-0.357
Tasmania	0.205*	0.292*	0.269*	0.208*	0.190*	0.199*	0.118	-0.162	0.411
Queensland	-0.075*	0.080	0.013	-0.102	0.047	-0.219	-0.008	-0.280	-0.329
# of observations	11251	1345	2154	1993	2001	1551	1186	489	367
R^2 (%)	29	36	32	31	31	32	289	36	47
Average Price (A$)	19.56	15.87	19.29	20.22	20.31	20.03	20.75	21.33	19.98
Average Rating	6.50	5.91	6.41	6.59	6.68	6.65	6.70	6.70	6.21
Average Star Rating	3.25	2.96	3.20	3.29	3.34	3.32	3.35	3.35	3.11
1/2✍ Price Effect (A$)	1.36	0.65	0.86	0.88	1.21	1.456	1.92	2.28	3.12

* = significant at the 5% level.

Table 5: Regression results for New Zealand [Winestate Data Set]

Parameter	'92-'99	1999	1998	1997	1996	1995	1994
CONSTANT	2.761*	2.530*	2.963*	2.782*	2.608*	2.760*	2.800*
Vintage Rating	0.044*	0.048*	0.014	0.042*	0.065*	0.041*	0.047
Cabernet Sauvignon	0.063	---	0.032	0.031	0.170	0.000	0.038
Cabernet blends	0.140*	---	-0.107	0.269*	0.289*	0.174*	-0.024
Shiraz	0.091	---	---	---	0.156	---	0.077
Pinot Noir	0.232*	---	0.352*	0.291*	0.218*	0.090	0.134
Merlot	0.078*	---	0.032	0.150*	0.047	0.184*	0.007
Other Red	0.031	0.115	-0.179*	0.014	0.145	0.178	---
Riesling	-0.239*	-0.037	-0.212*	-0.256*	-0.220*	-0.282*	-0.342*
Sauvignon Blanc	-0.255*	-0.095	-0.223*	-0.258*	-0.255*	-0.304*	-0.027
Semillon	-0.142*	---	-0.073	-0.096	-0.135	-0.335*	---
Other White	-0.256*	0.195*	-0.227*	-0.266*	-0.309*	-0.369*	-0.415
Auckland	-0.087*	-0.061	-0.063	-0.099*	-0.067	-0.089	-0.050
Canterbury	-0.091*	---	---	-0.157*	-0.041	-0.002	-0.137
Hawke's Bay	0.058*	-0.111	0.005	0.147*	0.042	0.001	0.139
Nelson	-0.103*	-0.088	-0.118	-0.105	-0.023	-0.098	---
Other NZ	0.064*	0.124	-0.054	0.076	0.109*	0.116	0.043
# of observations	1374	126	248	344	362	194	90
R^2 (%)	37	28	33	48	41	47	26
Average Price (NZ$)	20.59	17.70	19.62	20.30	21.23	21.14	24.43
Average Rating	6.88	7.09	6.66	6.75	6.97	6.90	7.31
Average Star Rating	3.44	3.54	3.33	3.38	3.49	3.45	3.66
1/2✍ Price Effect (NZ$)	**0.90**	**0.85**	**0.27**	**0.84**	**1.37**	**0.87**	**1.14**

* = significant at the 5% level.