# Hedonic Modelling for Australian Wine

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**Abstract**

The Australian wine industry has been under the pressure of oversupply for many years. Export promotion appears to potentially serve as an effective strategy to partially address this problem. An Hedonic price function is employed to estimate premia and discounts for various varieties, regions and vintages of Australian wine, within the US retail market. Some preliminary results are presented. These results may be used to develop an optimal allocation of Australian wine to various overseas and domestic markets.

*Keywords: Wine exports, Hedonic pricing, surplus disposal*

# 1. Introduction

Currently the Australian wine industry finds itself suffering the effects of oversupply. This paper seeks to show how Hedonic price analysis could be used to gain a better understanding of how consumers abroad view Australian wine. In current times, where exports are vital to the industry's progress, such information would be of significant value to Australian wine producers and marketers. Classical surplus disposal policies that recommend the use of world markets (with corresponding price discounting) have the potential to negatively affect an industry's reputation and appeal. This is of particular concern to the Australian wine industry, which has strived to build its reputation as a premium producer. It is hypothesised that through the analysis of consumer preferences for the attributes of Australian wine, in export markets around the world as well as the domestic market, a more efficient and effective surplus disposal policy could be determined.

Section 2 presents some background information to the current industry situation. Section 3 includes an overview of relevant literature in this area. Section 4 outlines the theory underlying the empirical estimation. Section 5 presents a model of the US market for Australian wine. Section 6 presents the results from this model, with the corresponding implications being discussed in Section 7.

# 2. Background

From 1985 to 2002, wine production has increased approximately 188%. In the same period, Australian wine consumption increased nearly 23% (Winetitles 2004; Anderson 2000). Even when export markets are included as a source of demand, production still exceeded consumption by 43% in 2002 (Winetitles 2004). Future growth of the Australian wine industry relies on a careful and comprehensive solution to this oversupply problem.

There are a variety of reasons that may explain why the industry is in its current position of oversupply. Causes may include increased investor popularity and public exposure, lifestyle factors attracting new producers and lucrative grape contracts. In

reality, it is most likely a combination of all of these factors that has led to the current situation.

From the industry's current position there are several directions that could be taken. Firstly, excesses could be liquidated on whatever market possible, at whatever price necessary, in an effort to bring the industry back into equilibrium. Secondly, supply could be physically reduced via crop thinning or by decreasing area under vine. Thirdly, the situation could lead to a supply side correction, where many producers simply bow out of the market. All of these outcomes have negative ramifications for the industry's growth and reputation.

This paper seeks to present a fourth alternative. Through careful and comprehensive research into the relative preferences for Australian wine in both domestic and foreign markets, it would be possible to solve the current problem of oversupply, whilst also minimising the adverse effects that surplus disposal policies often produce. The current market situation of the wine industry may present an opportunity for growth, rather than consolidation. That is, the key to the industry's problems, it is suggested here, may lie in demand side, rather than supply side, policies.

## 3. Literature Review

Several papers have been written in the area of Hedonic modelling of wine markets. The intention of such studies was to gather information on consumer preferences for the various attributes of wine in the domestic market. No previous studies appear to have specifically modelled the demand for a domestically produced product in a foreign market using Hedonic methods[1].

Despite specific differences among the many Hedonic analyses of wine markets, all are based on the theory set out by Rosen (1974), the pioneering paper on Hedonic pricing. This analysis, along with other underlying theoretical considerations, will be covered in the following section.

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[1] Schamel (2000) studied Australian (and other) wine within the US domestic market, but did so using a different framework and objective to that of this paper. Labys (1976) modelled the demand for imported wine in the US market, but did not do so with hedonic methods, and did not distinguish between the different import source countries.

Of the wine-specific hedonic studies that have been conducted, the majority set out to determine whether quality ratings have a significant effect on price[2]. Despite the fact that this paper does not include quality ratings in its model, the topic is of likely interest to Australian producers, and justifies some discussion here. Many papers have attempted to examine a single nominated wine critic's influence on price; however, a potentially more valuable area of research would be to determine how much influence different wine critics had in relative terms. Anderson and Schamel (2003) attempt a task similar to this, despite it not being their primary objective. Two different wine critics (James Halliday and Winestate Magazine) were used to determine the effect of quality ratings on price. A direct comparison between these critics is difficult as the other variables used in the two models were not the same. However, some idea can be gained from the results as to which wine critic has the greater influence over the decisions of consumers.

The specifications of the model used in Anderson and Schamel (2003) provided the basis of the model that is presented in this paper. In contrast to some previous studies (for example, Combris et al (1997); Nerlove (1995)), Anderson and Schamel (2003) used relatively objective characteristics for independent variables. Characteristics such as vintage, region and variety are found on almost every bottle of wine sold at retail level, no searching or unreasonable levels of prior knowledge is required by the consumer. This is in contrast to research cited above, which uses sensory characteristics such as "astringency" and "volatile acidity" as factors on which consumers would base their decisions. These factors are commonly discussed in winemaking and wine-connoisseur circles; however, there is a low likelihood that the average wine consumer would consider such factors consciously, when choosing which wine to buy. These are also factors that can only be determined and gauged after the wine is bought and tasted, implying that the consumer has already made his/her decision whether or not to buy the bottle based on some other factors. For these reasons, this paper follows the work of

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[2] Such studies include, but are not limited to, Anderson and Schamel (2003), Combris et al (1997), Combris et al (2000), Fogarty (2002), Ling and Lockshin (2003), Oczkowski (1994), Oczkowski (2001) and Schamel (2000).

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Anderson and Schamel (2003) by only analysing attributes that are available for the consumer's appraisal at time of purchase.

The previous studies outlined above were used predominantly in constructing the model used in this paper. Therefore, despite the previous studies' differing objectives from that of this paper, their contribution is still directly relevant. Past literature has predominantly been involved with determining a quality-price relationship using hedonic price analysis, while this paper focuses on that same methodology but with the objective of analysing Australia's wine oversupply problem.

## 4. Theory

The theory, on which this paper's analysis is based, stems from an economic school where products are not themselves the focus, but rather it is the attributes of those products that are of interest. This is linked closely to the theory of derived demand, but in terms of attributes rather than production inputs as is more classically the case. Lancaster (1966) provided a new way of thinking about consumer theory based on this theory of derived demand. This paper also paved the way for the development of hedonic pricing theory. The paper postulated that traditional consumer theory had been honed and refined so that it can "extract the minimum of results from the minimum of assumptions" (Lancaster 1966, p.132). Lancaster (1966) suggested that it was not the good itself that dictated consumer behaviour toward it, but rather its intrinsic or implicit characteristics within that good. This theory leads on directly to the work of Rosen (1974) on hedonic pricing. Therefore, any study of consumer behaviour is better to focus on a good's characteristics, rather than the good itself.

The model outlined by Lancaster (1966) is strikingly similar to later developed hedonic pricing models, except that only implicit characteristics themselves were discussed rather than the prices of these characteristics, as is the case in hedonic price analysis. The study postulated that a product can be defined as the sum of its intrinsic characteristics; more clearly:

$$x_j = \sum_k a_{jk} y_k$$

where *a* is determined by the intrinsic properties of the good, *x*
and *y* represents the relationship between the level of activity *k,*
and the goods consumed within that activity.

In the above condition, simply letting $x_j = p(x_j)$ and $a_{jk} = p(a_{jk})$, we can obtain the hedonic model implied by Rosen (1974); more specifically that the sum of the prices of the implicit characteristics of a product will be equal to the overall price of that good.

Rosen (1974) was the pioneering study that utilised hedonic price analysis in its modern form. Price is regressed against various product attributes to find the implicit prices of the individual attributes. The fundamental description of an Hedonic pricing model is where a premium or discount is estimated for each attribute of a given product. The sum of these attributes' coefficients will equal the estimated observed price for a product that possesses those attributes. By conducting this research, is it possible to see what attributes of a product are valued more highly by consumers. The implications of such analyses include the potential for more efficient marketing and production decisions by producers. On the consumer side, more accurate matching of products to consumer preferences will be possible. In this way, analysis of implicit characteristics of products allows for benefits to be derived by both producers and consumers.

The assumptions set out by Rosen (1974) require mention here as many of them relate to the wine industry and provide the foundation underlying Unwin (1999)'s critique of the use of Hedonic methods to analyse wine markets. The main assumptions of the model are based on perfect competition and the use of only objectively measured characteristics of a good to explain price.

The assumption of perfect competition implies that all prices are purely demand-driven, that is, producers are price takers[3]. The results of an Hedonic model reflect consumer preferences only, rather than those of the producer *and* consumer. Although there are arguably no such markets in reality, however, there are different levels of competition. At first glance the wine market is far from being perfectly competitive.

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[3] Epple (1987) expands on this issue by arguing that market structures other than perfect competition may create an endogeneity problem in the econometric model.

However, the variety in different brands and the number of specific wines within those brands is substantial in the current market climate. The problem of using these models for the wine industry is not in the level of competition, but rather on what scale it is analysed. In reality, producers do not compete with all other brands. Segments are formed, usually by price, according to different demographics and consumption characteristics. Within each segment competition is fierce, prices are tightly bunched and judging by the high propensity of price discounting, prices could be viewed as being highly demand driven. This assumption is much harder to make when looking at the market as a whole, due to these segments somewhat shielding some producers from the competitive actions of those in other segments.

Rosen (1974) explicitly recommends the use of only objectively measured characteristics as explanatory variables in an hedonic model. This is an important assumption as the characteristics used in the model have to be viewed equally by all consumers for them to provide an accurate description of the average consumer. If the attribute was subjectively measured, that is, it contained some form of bias, that attribute would potentially mean something different to one consumer than it would to another. A critic's rating is a prime example. The fact that it would be almost impossible for a critic not to include some bias in their ratings due to their own preferred styles and flavours, some "number" that quantifies the wine's quality cannot be an objectively measured attribute. If a particular wine gained a high rating because it was of a variety that was a favourite of that judge, that rating may not be an accurate description of quality for another wine consumer who happens to dislike that variety. Although it is possible for a critic's *description* of a wine to be purely objective, it is much more difficult to assume a quantified rating does not include a degree of opinion or subjectivity. This is an issue covered by many previous studies, including Oczkowski (2001) and Unwin (1999). It is important to acknowledge the theoretical background when undertaking analyses in this field. This is required in order to assure the relative viability of the model and its results, even despite the unlikely event of all the assumptions of the theory being satisfied.

## 5. Data, Empirical Model and Procedures

The data required for such a model includes retail prices for Australian wine in the United States, and objective characteristics of these wines that are hypothesized to determine the ultimate store price. The sample used for this model consisted of 920 observations. All fortified, sweet and sparkling wines were excluded from the sample. The data was obtained from price lists of Australian wine published by US online liquor stores. A benefit of using such a source of data is that by sorting available wines according to country of origin, it is assured that all wines that appear in the sample are in fact Australian wines currently available in the US retail market. However, despite the prices quoted being legitimate retail-level prices, it does appear that with many products, prices quoted on the internet are often lower than "regular" store prices. Wines randomly chosen from the sample which were compared to recommended retail prices, however, did not show any considerable disparity. Data was obtained from a number of sources and therefore should be well diversified and a good overall representation of the market.

The dataset used for this analysis consists of predominantly dummy variables indicating the various attributes that each wine in the sample exhibits. The sample is cross-sectional, but contains wines from six vintages, all of which are broken up using dummy variables. The varieties included in the model include Shiraz, Cabernet Sauvignon, Cabernet Merlot blend, Cabernet Shiraz blend, Merlot, Grenache, Pinot Noir, Other Red blend, Chardonnay, Semillon, Riesling, Semillon Chardonnay blend, Other White and Other White Blend. The vintages included in the model are those from 1998 to 2003 (inclusive) with another variable included for non-vintage or multi-vintage wines.

The regions included in the model include Adelaide Hills, Barossa Valley, Clare Valley, Coonawarra, Eden Valley, McLaren Vale, Limestone Coast, Riverland, Other South Australia, Hunter Valley, Other NSW, Yarra Valley, Other Victoria, Margaret River, Other Western Australia, South Eastern Australia and a Miscellaneous Region variable for wines that do not specify their region of origin.

To avoid the dummy variable trap, the model requires a "base" variable, against which all estimated dummy variable coefficients are compared. The base variable used was South Eastern Australia (S.E.A.) Shiraz from the 2001 vintage. In this way, the results presented will not contain coefficient estimates for the S.E.A region, the Shiraz

variety or the 2001 vintage. These attributes will be expressed through the estimated constant term.

Regional Output is the only slope variable included in the model. This variable is defined as the total harvest (in tonnes) of grapes in the 2002 vintage for each of the analysed regions. The estimated coefficient of this variable will therefore be a form of price flexibility of supply. The reason for this variable's inclusion was two-fold. It could be hypothesised that regional output could be positively related to retail price. Consider a consumer who has the choice of two wines. One wine's region of origin is known to the consumer, and the other is not. Holding all other factors constant, it would be expected that the consumer would choose the wine with the more familiar region. This would be the case even if the unknown region had in fact yielded a more superior wine. Therefore, one might expect to see a "familiarity premium" included in the estimated coefficient for regional output. The second reason for this variable's inclusion is to estimate the price flexibility of supply for wine. This is of particular interest to the industry in current times of oversupply. The estimated coefficient will show if greater supply on a more micro regional level adversely affects the price of that wine. Price flexibilities of supply are traditionally negative in sign.

Each wine is classified in the model according to its variety, region from which the grapes used to make the wine were grown, the vintage of the wine, and a regional output variable.

The regression equation that is to be estimated can be written as follows:

$$\ln P = \beta_0 + \sum_h \beta_h Variety_h + \sum_i \beta_i Vintage_i + \sum_j \beta_j Region_j + \beta_{37} Regional\ Output + \varepsilon$$

where, $Variety_h$ is one of 13 grape varieties

$Vintage_i$ is a vintage from 1998 to 2003

$Region_j$ is one of 16 grape-growing regions from around Australia

$Regional\ Output$ is the volume of grapes (in tonnes) harvested in the 2002 vintage for each region.

The estimatior used in this paper will be OLS. The case for 2SLS, as outlined by Oczkowski (2001), is not of concern here, since quality ratings have not been included.

It was suspected that the data may suffer from heteroskedasticity, which was confirmed using a modified form of White's Test. The results presented in the following section are those estimated by the corrected model.

## 6. Analysis of Results

The results from this model are presented in Table 1. The interpretation of these results should be conducted in the following way. Each coefficient can be interpreted, on average, as the premium or discount of that respective attribute, relative to the base classification: 2001 South Eastern Australia (S.E.A.) Shiraz. For example, taking the variety of chardonnay, the results suggest that on average, and holding all other variables constant, a generic chardonnay wine (with no influence of a specific vintage or region) will yield a 30% discount to a 2001 S.E.A. Shiraz. Similarly, a generic wine from the 1998 vintage, on average and holding all other variables constant, will command a premium of 128% over a 2001 S.E.A. Shiraz. To compare complete wines with complete wines, the coefficients should be added. For example, the effective coefficient for a 1998 Coonawarra Cabernet Sauvignon would be 0.73; that is, the addition of the individual coefficients of each of those attributes (0.83, 0.05 and –0.15 for vintage, region and variety respectively). Converted to a percentage, this represents a 108% premium over 2001 S.E.A Shiraz. For any individual with knowledge of wine, this result is in line with expectations. For a graphical interpretation of this process, see Figure 1.

The results indicate that relative to 2001 S.E.A. Shiraz, all varieties except Grenache justify a discount. The fact that Shiraz is a popular wine variety from this area, could explain why other less prominent varieties from this region faired less favourably in comparison. The results, on average, suggest that Australian white wines are not valued as highly by US consumers than red wines. However, these results could have been biased by the fact that there are more ultra-premium, high priced red wines than there are white wines.

Australian vintage reports are consistent with the premiums/discounts estimated (Winetitles 2004). All vintages except the statistically insignificant 2002 vintage exhibit

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price premiums relative to 2001. The 2001 vintage's consistently low implicit price could also be explained by consumer psychology. One could hypothesise that old wines are higher in quality, as they would have matured in the bottle over time. Further, since young wines are newly available, assuming the vintage was not poor, they would be expected to be in high demand. This is especially the case for young white wines. There would be an expected price premium for the "freshness" that is inherent in younger wines. In relative terms, this leaves a middle range – wines that are neither "old" nor "young". Consumers may be concerned that the reason this wine is still available is because it was not of high enough quality to justify a price similar to surrounding vintages, thereby justifying a discount. The 2001vintage falls into this category as possibly suffering from this psychological effect of a vintage that falls into this middle ground. In addition to this, the 2001 vintage, although not a "bad" vintage, was not considered to be as superior as 1998, 1999 or 2000 in terms of the general harvest quality. The 2003 vintage was also highly regarded in comparison.

The results also indicate that there is little impact of not naming the vintage from which the wine was sourced. The coefficient for non-vintage is insignificant and relatively small in magnitude. Apart from sparkling wines, not naming the vintage is most likely a legal requirement. That is, the wine is likely to have been made from many different vintages' fruit, disallowing any one vintage being named on the bottle.

**Figure 1. Graphical Representation of the Results**
**Example of 1998 Coonawarra Cabernet Sauvignon[#]**
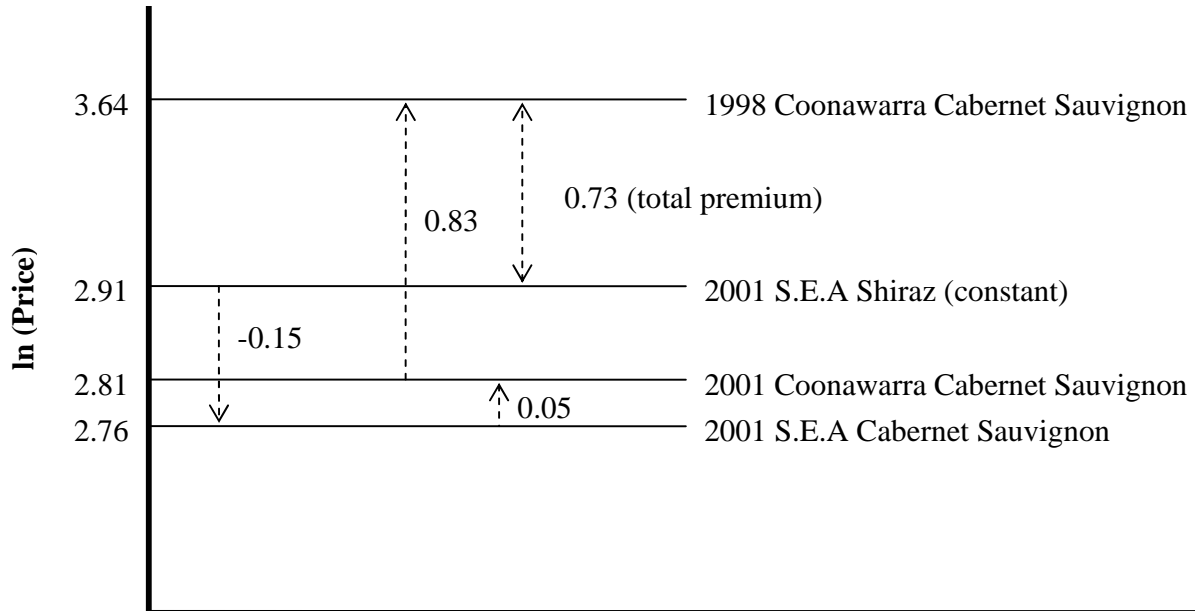


[#] To determine the premium or discount associated with a "complete" wine, begin with the estimated intercept (2.91 in the above case), being the coefficient for the base variable, 2001 S.E.A. Shiraz. Using the example of 1998 Coonawarra Cabernet Sauvignon and applying the estimated discount for Cabernet Sauvignon of -0.15 provides the coefficient for a 2001 SEA Cabernet Sauvignon. Applying the estimated premium for Coonawarra of 0.05 provides the coefficient for 2001 Coonawarra Cabernet Sauvignon. Finally, applying the estimated premium for the 1998 vintage of 0.83 yields the coefficient for 1998 Coonawarra Cabernet Sauvignon. The difference between this final position and the constant is the total premium associated with a 1998 Coonawarra Cabernet Sauvignon, compared with the base variable, 2001 S.E.A. Shiraz.

# Table 1. Results

| Variety | Estimated Coefficient (relative to 2001 SEA Shiraz) | Actual Percentage Premium / Discount |
|---|---|---|
| Cabernet Sauvignon | -0.15** | -0.14 |
| Cabernet Shiraz | -0.38*** | -0.32 |
| Cabernet Merlot | -0.35*** | -0.30 |
| Merlot | -0.45*** | -0.36 |
| Grenache | 0.47*** | 0.59 |
| Pinot Noir | -0.23 | -0.20 |
| Other Red Blend | -0.04 | -0.04 |
| Chardonnay | -0.36*** | -0.30 |
| Semillon | -0.56*** | -0.43 |
| Riesling | -0.46*** | -0.37 |
| Semillon Chardonnay | -0.76*** | -0.53 |
| Other White | -0.41 | -0.33 |
| Other White Blend | -0.56*** | -0.43 |
| | | |
| **Vintage** | | |
| 1998 | 0.83*** | 1.28 |
| 1999 | 0.60*** | 0.81 |
| 2000 | 0.29*** | 0.33 |
| 2002 | -0.01 | -0.01 |
| 2003 | 0.20** | 0.23 |
| Non-Vintage | 0.05 | 0.05 |
| | | |
| **Region** | | |
| Adelaide Hills | -0.20 | -0.18 |
| Barossa Valley | 0.54*** | 0.72 |
| Clare Valley | 0.13 | 0.14 |
| Coonawarra | 0.05 | 0.05 |
| Eden Valley | 0.92*** | 1.51 |
| McLaren Vale | 0.36** | 0.44 |
| Limestone Coast | -0.40** | -0.33 |
| Riverland | -0.28 | -0.25 |
| Other SA | 0.00 | 0.00 |
| Hunter Valley | -0.39** | -0.32 |
| Other NSW | -0.28 | -0.24 |
| Yarra Valley | 0.41** | 0.51 |
| Other VIC | -0.14 | -0.13 |
| Margaret River | 0.44*** | 0.56 |
| Other WA | -0.31* | -0.26 |
| Misc Region | -0.72*** | -0.52 |
| | | |
| Regional Output | -0.0000011*** | 0.00 |
| Constant | 2.91 | 17.39 |

*** Significant at 1%
** Significant at 5%
*Significant at 10%

It is worth noting that there are some differences between the model used here and that of Anderson and Schamel (2003). One of the more obvious differences is that Anderson and Schamel (2003) conduct a separate model for each vintage, compared to this model's use of dummy variable to segregate vintages. Another distinction between the two models is the chosen "base" variable. Anderson and Schamel (2003) use Barossa Shiraz and this paper uses 2001 South Eastern Australia Shiraz. For this reason direct comparison of the results is difficult. However, a more general commentary on how the results of Anderson and Schamel (2003)'s domestic market analysis and the current analysis of the US market is possible and provides some insight into how consumers in these different markets view the same product. In very loose terms, it appears that US consumers view Australian grape-growing regions in a similar way to Australian consumers. Exceptions to this rule include that US consumers are only willing to buy Hunter Valley wines if they are at a discount, in contrast to Australian consumers who will pay a premium. Also, the Adelaide Hills appear to be looked upon more favourably by Australian consumers than US consumers – perhaps due to a lower knowledge base abroad for Australia's more boutique growing regions. As would be expected, both markets demand a considerable discount on wines produced from Riverland grapes, and will pay an equally impressive premium for wines from Eden Valley and Margaret River. They also view varieties of Australian wine in similar ways. Almost all varieties in both models demand a discount relative to their respective base variable. Vintages are difficult to compare due to the different model specifications. However, Anderson and Schamel (2003)'s results show that the average price increases in general as the wine becomes older. A similar general conclusion can be drawn from the results reported in Table 1. This is an expected result due to a combination of wine generally improving, as well as an increase in scarcity, as it becomes older.

Further research in this specific area will require the construction of a model with the same base variable and a separate model for each vintage. The independent variables used should also be as similar as possible. This would enable direct comparison of the results from both the US and Australian markets.

## 6. Policy Implications

The results reported here suggest that varieties such as Grenache, Cabernet Sauvignon and Shiraz would be best exported to the US retail market, shown by their relative premium (even though cabernet sauvignon exhibits a discount, it shows a premium relative to most other varieties). Grenache is the most valuable variety. However, this variety is not greatly common and is often in the form of a highly priced, full bodied South Australian red wine. This may help to explain the premium that it commands. As a consequence, it is unlikely that Australian producers of lower quality, lower priced Grenache, will attract the same premiums in the US market. Upon the appraisal of expected returns in alternative markets for the varieties examined, it will be possible for producers to determine an optimal marketing strategy to best dispose of their inventory (including surpluses), whilst also potentially improving profitability.

The policy implications of vintage are less clear. At first glance, it would be easy to suggest that producers who have access to or stock of wine from 1998 or 1999 to sell these wines to the US market immediately (negating all other markets). However, there are many considerations that need to be made before this simple recommendation is stated. Firstly, the distinction must be made between red and white varieties and how they respectively react to time in the bottle. Perhaps with the exception of a small number of older Semillons or Rieslings in the sample, the high premiums associated with the 1998 and 1999 vintages could be almost solely attributed to red wines. Therefore, a producer who has a high inventory of 1998 Chardonnay cannot expect to attain the full premium.

Secondly, the vintage results must be treated with caution since the higher premiums associated with older vintages may be associated with scarcity as well as improvements in quality. It may, therefore, be more beneficial to the producer to store such wine until its optimal age is reached, based both on scarcity and quality. Indeed, the price of a bottle of 1951 Grange Hermitage is likely to be based almost entirely on scarcity. Therefore there are many factors that lie beneath the results presented here.

Generally speaking, it appears that older wines attract greater premiums, on average, than younger wines, the different reaction to age of various wines make it difficult to make such a broad statement. Some intuition must, therefore, be applied when making recommendations from the vintage results of this study.

The Barossa Valley, McLaren Vale, Eden Valley, Yarra Valley and Margaret River appear to be the most desired grape-growing regions in the eyes of US consumers. It is important to note, however, that the majority of Eden Valley wines in the sample were made by Henschke, a brand known for its premium wines. This may have biased the reported premium somewhat upward.

It is interesting to note that, compared with Anderson and Schamel (2003)'s analysis of the Australian domestic market, the Hunter Valley is looked upon unfavourably by the US market. This illustrates how overseas consumers have the potential to think quite differently about some characteristics of Australian wine, compared to consumers in the domestic market. For Australian consumers, the Hunter Valley is a popular weekend retreat, where although wine may be the primary reason for the visit, it is but one of the many attractions. Because of this increased tourism-related exposure, it is not unexpected that Australian consumers look more favourably on the wine it producers. From a US consumer's perspective, however, the Hunter Valley has no ulterior appeal other than the wine. In terms of output, the Hunter Valley has a much smaller profile than many of the larger South Australian grape growing regions. Indeed, it is interesting to note that the discount associated with "other NSW" regions is less than the Hunter Valley[4], indicating that producers of Hunter Valley wine for export to the United States would be better off labelling their wine's region generically as "NSW". This could be due to the fact that the state of New South Wales is more likely to be known by the average US consumer than a small grape-growing region within it.

The recommendations and implications provided above should be interpreted as "on average" figures. For example, since Grenache is often more in a premium mould (explaining the relative premium it attracts in the US market), an exporter of low quality Grenache could not expect to gain the full premium as predicted by this paper. Similarly, some of the varieties that are predicted to yield a relative discount, may in fact earn a premium if they are of sufficiently high quality, or are highly acclaimed.

This leads to a possibility of further research. Depending on how quality is defined, the market could be segmented into different quality-related brackets. Price segments are a logical method, as this is a commonly used method by wine marketers in

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[4] "Other NSW" was statistically significant at a 12% level of significance.

reality. By re-modelling the wine market in such a way, more specific recommendations can be made to producers, depending on their chosen price or quality segment. If critics' ratings can be assumed to be legitimate measures of quality, the market could similarly be segmented according to their quality scores. This would allow the results not only to recommend which varieties, regions and vintages on average are preferred by US consumers, but also would do so for an array of different quality levels. Given data were sufficiently available, this would not be a difficult task.

Therefore, in their raw form, the results presented here provide a guide to exporters and marketers of what attributes of Australian wine are more valuable in the eyes of US consumers. However, the United States is just one of many markets to which Australia sells wine. If similar studies were undertaken for other markets, as well as the Australian domestic market, a truly holistic marketing recommendation could be made. Such a marketing strategy would provide the possibility to clearly determine what specific wines (or "SKU's" as the industry refers to them[5]) should be distributed to each market that is available. Since this allocation would likely be more efficient than that being currently employed in the industry, it would allow for a greater amount of Australian wine to be sold overall, thereby also easing the problem of oversupply. By the same token, a greater level of satisfaction for consumers and more profit for producers and marketers of Australian wine would also be achieved.

## 7. Concluding Comments

The analysis presented in this paper provides some insight into the preferences of US wine consumers with respect to the different varieties, regions and vintages of Australian wine. In times of oversupply, where export markets are of particular importance to the industry, such information proves instrumental to devising a marketing strategy that will help to eradicate this market disequilibrium. Further research needs to be conducted to develop an optimal distribution strategy.

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[5] The acronym, "SKU", stands for "shelf keeping unit", and refers to a packaged unit of wine with a specific variety, vintage and region.

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