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# The relation between Australian wine show results and prices\*

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This paper assesses wine show results and their relation with wine prices across seven Australian shows. Consistent with previous studies, only a moderate degree of agreement for medals exists among shows. The correlation of wine show points across shows is also only moderate. Hedonic wine price functions, which employ show medal/points as direct measures of quality, indicate that for some shows estimated premiums are statistically significant and may possibly be practically important. The relation of show opinion with prices, however, is reduced for models which recognise the separate impact of objective quality and show opinion on prices. The results imply that producers should seek to improve the objective quality of their wines to achieve price premiums. Producers could also selectively target some wine show opinions to gain additional higher prices.

**Key words:** wine prices, wine experts, Australian wine shows.

**JEL classifications:** L66, L15, D12

## 1. Introduction

Wine shows and competitions are commonly held throughout the world. Wine producers send wines to competitions where independent experts act as wine show judges to provide a comparative evaluation of a wine's quality based on a series of sensory factors relating to colour, bouquet, and palate. Wine shows provide information to producers and consumers on wine quality and styles. The award of show medals is often used by producers in marketing and promotion activities. In the historical context of the Australian show system (Dunphy and Lockshin 1998a), the dissemination of information on wine quality, faults, and styles throughout the industry has in part 'built the breed' which underpins the success of the Australian wines throughout the world.

Within this context, significant research exists on the importance of wine show results, such as awarded medals, for consumer choice (Lockshin *et al.* 2006). Also, evidence on the lack of consensus of wine show assessments has been well documented (Gawel and Godden 2008). It appears that an under-researched issue is the relation between show outcomes and wine prices.

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Identifying the show medal-price relationship is important for producer strategic decision making in determining whether to devote additional resources to produce show medal awarded quality wines.

In general, a large body of literature exists on the application of 'hedonic wine price functions' which estimate empirical models of why individual wine prices vary based on a wine's characteristics (Oczkowski and Doucouliagos 2015). Only a few studies, however, have estimated the impact of show medals on prices for international markets such as Germany (Schamel 2003) and California (Lima 2006). It appears that Allen and Germov (2010) is the only Australian study which has examined the relation between Australian show medals and prices.

This paper extends the literature by developing a more comprehensive hedonic wine price function for Australian wines, which recognises that other supply and demand factors may also impact prices in addition to the award of show medals or points. Further, recent advances in developing models which disentangle the effects of objective quality (based on weather and individual producer effects) from the unique impact of subjective quality (such as show points) will be employed to estimate the impact of show outcomes on prices. Show outcomes will also be matched with the ratings from the influential Halliday (2017) wine-guide, to provide comparison with an industry benchmark.

The next section provides a review of some literature relating to the purpose of wine shows, the impact of show medals on consumer choice and the degree of consensus typically identified across shows. The small body of previous literature on the relation of show outcomes with prices is also outlined. Section 3 analyses results from seven major Australian wine shows and makes an assessment of their degree of consensus. Sections 4 and 5 present results from hedonic wine functions which estimate the relation between prices and show outcomes, while controlling for other demand and supply factors. In particular, Section 4 provides estimates which use show outcomes as a direct measure of quality, while Section 5 uses models which attempt to disentangle the show effect from the impact of objective quality on prices. Section 6 provides some concluding comments.

## 2. Prior literature

Wine shows have a number of objectives. Dunphy and Lockshin (1998b) and Dalitz (2009) interviews with Australian industry experts suggest that the show system plays many roles including wine quality and style guidance; information dissemination; expert and independent judgement; marketing and promotion; winemaker learning; social learning; and the validation of winemakers; inputs and innovations. In an Australian historical context, Dunphy and Lockshin (1998a) and Allen and Germov (2010) argue that the success of the Australian wine industry in part is due to the show system and how it promotes competition among producers and knowledge sharing about

styles and quality. The important role of shows for marketing, promotion, and brand building is also validated through interviews with producers in New Zealand (Beverland 2000), Chile (Kunc 2007), Greece (Vlachvei *et al.* 2012), and the United States (Chaudhury *et al.* 2014; Triana 2015). This marketing and promotion role effectively establishes the potential of a relationship between the award of a show medal and price.

Two important and related issues have emerged from the conduct and outcomes of shows: (i) the importance of wine show outcomes for consumer purchasing behaviour; and (ii) the degree of consensus among wine judges across shows. There appears to be mixed evidence on the impact show medals have on consumer behaviour. For example, Australian research by Lockshin *et al.* (2006, 2009) suggests that brand, price, and show medals were among the main drivers of consumer wine choice compared to other factors such as region, label colour, and style and price discounts. In contrast, Herbst and von Arnim (2009) find for South African consumers that show awards are less important than other factors such as variety, vintage, reputation, place of origin, packaging, and price in driving wine choice. While Goodman (2009) in analysing consumer choice across many countries identified that show medals were only the eighth most important factor out of 13 drivers of wine choice. In part, differences in findings may be driven by the individual consumer's level of involvement/expertise in purchasing, with less involved consumers more likely to use show medal information in purchasing decisions (Lockshin *et al.* 2006; Herbst and von Arnim 2009; Neuninger *et al.* 2017).

The scepticism held about show medals by high involvement wine consumers (Neuninger *et al.* 2017) may in part be due to the general lack of consensus held by wine judges at shows. A number of studies have documented the lack of consensus exhibited by wine judges, see for example Gawel and Godden (2008), Hodgson (2008, 2009), and Bitter (2017). Of most relevance to our study, Allen and Germov (2010) assessed the level of show medal agreement across the Sydney, Melbourne, Adelaide, Perth, and National shows for 2007. Pairwise weighted Kappa measures of agreement were estimated to be between 0.244 and 0.357 with an average of 0.285. At best, this represents only moderate agreement. The highest levels of agreement appear to occur for varieties such as pinot noir and shiraz and the lowest for sauvignon blanc and riesling.

In general, the relation between prices and wine quality has been estimated using hedonic wine price functions, see Oczkowski and Doucouliagos (2015). A small part of this literature employs wine show medals as an indicator of wine quality. In a non-Australian context, some evidence for the direct relation between the award of a show medal and price has been identified for the following: Californian wine shows (Schamel 2002; Lima 2006); the German Agricultural Society competition (Schamel 2003); and various competitions for Bordeaux wines (Paroissien and Visser 2018). However, for various New Zealand wine shows, Bicknell and MacDonald (2009) estimate that medals may have little economic and statistical impact on prices

after controlling for quality using a wine-guide measure. It appears that the only systematic study of the relation between Australian show medals and prices is that by Allen and Germov (2010). Based on all data from four shows (Sydney, Melbourne, Adelaide and Perth), important medal impacts were estimated for shiraz and chardonnay, but only silver medals had an important impact for cabernet sauvignon. Using a linear specification, the premium for a gold medal for both shiraz and chardonnay is estimated to be approximately \$10, irrespective of the wine’s price. It is noteworthy that no other independent variables were employed in the price regression models other than the award on each medal type.

3. Australian wine show comparisons

The Australian wine show system consists of approximately 70 shows broadly categorised as capital city, state, regional, and special purpose shows, see ASVO (2015). To facilitate meaningful statistical analysis and comparisons across shows, the focus rests with the largest shows.<sup>1</sup> The analysis of show scores relates to the Royal six capital city shows and the National wine show in Canberra, for 2016. Table 1 outlines the point and medal systems employed at the seven shows. Four shows (Melbourne, Sydney, National, and Queensland) employ the 100 point system, two shows (Adelaide and Perth) use the twenty point system, while Hobart scores out of 60 points based on three separate judges who each employ the 20 point system. Some of the show catalogue documentation suggests scores are awarded on the basis of 15 per cent colour and clarity, 35 per cent bouquet, and 50 per cent palate. It is noteworthy that some shows do not publish scores in catalogues for wines which do not receive medals, that is, Melbourne, Adelaide, and Perth.

Table 1 Australian wine show scoring systems

	Maximum	Gold	Silver	Bronze	Points disclosed below bronze
Melbourne	100	95–100	90–94	85–89	No
Adelaide	20	18.5–20	17–18.4	15.5–16.9	No
Sydney	100	95–100	90–94	85–89	Yes
Perth	20	18.5–20	17–18.4	15.5–16.9	No
Hobart	60	55.5–60	51–55	46.5–50.5	Yes
National	100	95–100	90–94	85–89	Yes
Queensland	100	95–100	90–94	85–89	Yes
Halliday	100	95–100	90–94	86–89	Yes

<sup>1</sup> The inability to adequately assess smaller wine shows in our analysis implies the results are not generalisable to all Australian shows. In practice, this implies these other minor shows may have different impacts on prices to those identified for the analysed shows.

We employ Halliday (2017) as the benchmark data set which provides price information and an alternative to show system rating scores. Halliday (2017) is seen as the industry standard and most comprehensive wine-guide for Australian wines. The associated Wine Companion website (<https://www.winecompanion.com.au/>) provides price and ratings information for over 9,000 current releases on an annual basis. Some wines are rated by James Halliday but others are rated individually by five other tasters. It appears that some tasters employ elements of 'blind' tasting procedures when assessing wines (personal communication). Show wine scores are only analysed for those wines in the Wine Companion database. This does slightly reduce the number of assessed wines from shows; however, it permits the comparison with an influential wine-guide, the matching with price information, and a focus on wines widely available.

The distribution of medals from the shows is provided in Table 2. Across the seven shows, the medal distributions are reasonably similar: gold medals are awarded for between 6 per cent and 9 per cent of wines; silver 10-19 per cent; bronze 33-40 per cent; and no medals in 34-48 per cent of cases. Royal Melbourne appears to be the most demanding show with 6 per cent gold and over 50 per cent of wines not awarded a medal, while the National show appears to be the least demanding awarding over 9 per cent gold and < 35 per cent receive no medals. In comparison with the shows, Halliday equivalent medals appear to be generous with 29 per cent of wines being of gold standard and only 4 per cent of wines not rated as medal standard. The comparison of show medals to Halliday medals is not based on all Halliday wines assessed but only those that have been assessed by at least one show.

The summary statistics of the awarded points from the shows are provided in Table 3. Meaningful comparisons are difficult to make given the use of different ratings scales and also that some shows only report scores for medal awarded wines. What is clear, however, are the higher quality scores awarded by Halliday compared to the other 100 point show scores. The average price of \$34.22 indicates that premium wines are typically assessed at shows. The range of prices from \$7 to \$350 indicates the assessment of both very cheap

**Table 2** Australian wine show 2016: distribution of medals

	<i>N</i>	Gold	Silver	Bronze	None
Melbourne	1907	6.0	10.3	30.4	53.4
Adelaide	1444	9.3	13.5	38.4	38.9
Sydney	1402	7.3	13.9	33.1	45.7
Perth	1340	7.0	10.3	35.0	47.7
Hobart	968	6.0	10.3	39.7	44.0
National	697	9.3	19.2	37.0	34.4
Queensland	681	7.5	15.1	36.3	41.1
Halliday	3846	28.6	45.2	22.7	3.5

Note: Per cent of medals awarded out of total identified wines (*N*). Halliday medals based on wines which were assessed by at least one show.



**Table 3** Australian wine show 2016: ratings summary statistics

	<i>N</i>	Mean	SD	Min	Max
Melbourne†	890	88.7	3.37	85	97
Adelaide†	883	16.6	1.03	15.5	18.8
Sydney	1402	86.1	4.17	65	98
Perth†	701	16.5	1.00	15.5	18.8
Hobart	968	47.0	3.47	37.5	56.5
National	697	87.1	4.12	75	97
Queensland	681	86.3	4.24	63	96
Halliday	3076	92.0	3.28	79	99
Price (RRP)	3076	34.22	20.81	7	350

Notes: †Points unpublished for wines not awarded a medal for Melbourne, Adelaide, and Perth. Statistics based on published points only. Halliday ratings and price based on wines which were awarded points by at least one show.

and very expensive wines. As is typical of most hedonic wine price data sets, the sample consists of prices which are highly positively skewed.

To explicitly recognise the categorical nature of the medal data, weighted Kappa (Allen and Germov 2010) measures of rater agreement are provided in Table 4 for the medals data. All the pairwise measures for comparison among shows are statistically significant at the 5 per cent level, but are relatively small in magnitude ranging from 0.138 (Hobart and Adelaide) to 0.301 (Melbourne and Queensland) and averaging 0.215. The average weighted Kappa of 0.215 reflects only a moderate level of agreement and is only slightly less than the average pairwise estimate of 0.285 from Allen and Germov (2010) for 2007 shows. It is noteworthy that the levels of agreement are much lower between the shows and Halliday with all estimates less than 0.1, which is classified as only ‘fair’ agreement. The level of agreement between Halliday and the Perth and Hobart shows is particularly small at 0.02. Again the Halliday comparison reflects the relatively generous nature of the Halliday rating scores.

To assess the relations between the awarded show rating scores, Pearson correlations are presented in Table 5. All the pairwise correlations among the shows are statistically significant at the 5 per cent level. However, the magnitudes are low ranging from 0.152 (Perth and Adelaide) to 0.410 (Queensland and Sydney) and averaging 0.271. This average correlation is low compared to Ashton’s (2012) average correlation of 0.340 across five international wine studies and Oczkowski’s (2017) average correlation of 0.435 for four Australian wine-guide experts. The pairwise correlations between the shows and Halliday ratings are even lower and average 0.17, and the correlation between Halliday and Perth is particularly low at 0.073 which is statistically insignificant.

Table 5 also reports on the pairwise correlation between price and the rating scores. The price-rating correlations are only indicative of potential relationships as other variables also impact price variations, as will be discussed later. All price-show score correlations are very low and average 0.095. Two of the price-show score correlations are statistically insignificant,

**Table 4** Australian wine show 2016: weighted kappa medal agreements

	Melbourne	Adelaide	Sydney	Perth	Hobart	National	Queensland	Halliday
Melbourne	-	0.390	0.452	0.464	0.450	0.401	0.460	0.154
Adelaide	0.170 (830)	-	0.407	0.408	0.374	0.349	0.433	0.212
Sydney	0.277 (558)	0.258 (540)	-	0.413	0.381	0.388	0.457	0.197
Perth	0.246 (724)	0.199 (696)	0.223 (501)	-	0.392	0.386	0.427	0.158
Hobart	0.208 (624)	0.138 (551)	0.143 (336)	0.192 (531)	-	0.421	0.400	0.161
National	0.195 (486)	0.175 (473)	0.241 (335)	0.164 (420)	0.210 (371)	-	0.360	0.215
Queensland	0.301 (350)	0.257 (363)	0.288 (374)	0.229 (340)	0.190 (260)	0.204 (214)	-	0.220
Halliday	0.037 (1907)	0.060 (1444)	0.068 (1402)	0.024 (1340)	0.023 (968)	0.070 (697)	0.090 (681)	-

Notes: Weighted Kappa based on linear weights provided in left lower diagonal and number of wines listed in parentheses. Proportion of unweighted agreement provided in right upper diagonal. All weighted kappa estimates are statistically significant at the 5 per cent level.

**Table 5** Australian wine show 2016: ratings pearson correlations

	Melbourne	Adelaide	Sydney	Perth	Hobart	National	Queensland	Halliday
Melbourne	1.0	—	—	—	—	—	—	—
Adelaide	0.179† (311)	1.0	—	—	—	—	—	—
Sydney	0.306† (301)	0.354† (358)	1.0	—	—	—	—	—
Perth	0.241† (266)	0.152† (304)	0.301† (285)	1.0	—	—	—	—
Hobart	0.288† (338)	0.230† (378)	0.234† (336)	0.250† (311)	1.0	—	—	—
National	0.291† (308)	0.276† (378)	0.362† (335)	0.172† (295)	0.315† (371)	1.0	—	—
Queensland	0.284† (185)	0.212† (252)	0.410† (374)	0.210† (189)	0.274† (260)	0.368† (214)	1.0	—
Halliday	0.197† (890)	0.116† (883)	0.215† (1402)	0.073 (701)	0.128† (968)	0.193† (697)	0.287† (681)	1.0
Price (RRP)	0.118† (890)	0.090† (883)	0.106† (1402)	0.066 (701)	0.108† (968)	-0.002 (697)	0.177† (681)	0.468† (3076)

Note: Number of wines listed in parentheses. Statistics based only on published points only. Halliday and price correlation based on wines which were awarded points by at least one show. †Statistically significant at the 5 per cent level.

and one is negative ( $-0.002$ ) for the National show. In contrast, the price-Halliday rating correlation is reasonably high at 0.468.

A number of features of Halliday scores compared to show results are apparent. Halliday medal agreements and score correlations are much smaller with shows than the agreements and correlations among shows. Also,



Halliday scores are more correlated with price than are the show scores. In part, the identified difference in assessments and correlations may be due to the rigours processes that shows use to assess wines. Australian wine shows use complete blind tasting, typically conducted over a few days and develop consensus scores based on multiple judge assessments (ASVO 2015). In contrast, it appears that for Halliday ratings each wine is assessed by one of six experts separately, and this is done at different times of the year and in some cases with knowledge of some wine bottle information.

#### 4. Prices and Australian wine show medals and points

##### 4.1 Hedonic price function estimates: Wine show medals and points

To assess the relationship between show medals/points and wine prices, we employ the theory and accumulated empirical evidence of hedonic wine price functions, see Oczkowski and Doucouliagos (2015) for a meta-analysis. Theoretically, prices for a heterogeneous product are postulated to be driven by demand and supply determinants such as consumer preferences and producer production costs. Concepts around the ‘quality’ of a wine, play a major role in employed empirical specifications. In the context of wine shows, show medals and awarded points can be viewed as a measure of quality which captures both consumer preferences and costs of production. To accurately assess the relationship between prices and show results, other demand and supply determinants also need to be specified in the hedonic price function. This motivation suggests the following specification:

$$\ln(\text{Price})_i = \beta_0 + \gamma(\text{Show Medals or Points})_i + \beta_1(\text{Vintage})_i + \beta_2'(\text{Region})_i + \beta_3'(\text{Variety})_i + u_i \quad (1)$$

where *Price* is the recommended retail price in 2016 measured in Australian dollars (Halliday 2017); show medals and show points are those awarded at the seven individual 2016 shows; *Vintage* is the year of grape harvest; *Region* is a series of dummy variables depicting the region from where the grapes were sourced; *Variety* is a series of dummies representing the variety, blend or style of wine. For benchmarking results, Equation (1) is also estimated for points (and categorised medals) from Halliday (2017).<sup>2</sup> The natural log of prices is employed to recognise the highly positively skewed nature of prices. This implies that parameter estimates are interpreted as approximate proportional (percentage) effects on prices.

<sup>2</sup> Note, endogeneity tests for the Halliday models (using weather data as instruments) indicate that ratings can be considered as exogenous for Equation (1).

Employing the Halliday (2017) sample which captures all wines assessed at shows, the wines analysed have the following characteristics. For vintage: 2016 (15.6 per cent); 2015 (34.1 per cent); 2014 (29.2 per cent); and 2013 (14.1 per cent) with the remaining 7 per cent of wines being vintages earlier than 2013. The main regions assessed are as follows: Margaret River (13.2 per cent); McLaren Vale (11.6 per cent); Adelaide Hills (8.1 per cent); Barossa Valley (6.6 per cent); and Yarra Valley (5.3 per cent). The main varieties in the sample are as: shiraz (24 per cent); cabernet sauvignon (12.5 per cent); chardonnay (11.5 per cent); riesling (6.7 per cent); and pinot noir (6.3 per cent).

The employed variables have been identified as important price determinants in previous Australian studies, for example, Schamel and Anderson (2003) and Oczkowski (2016a). The wine show and Halliday quality measures capture both the intrinsic objective quality of the wine and subjective expert opinion. The impact of weather and unique producer characteristics are better captured through their impact on quality ratings rather than directly on price (Oczkowski 2016a). As such, weather and producer variables are not directly specified in Equation (1).

For the other variables in Equation (1), vintage captures the additional costs associated with ageing (oak barrels), storing wine, and the time value of money. Vintage also captures the value of consumers' desires for older wines. In addition to consumer preference differences, both region and variety/style capture production cost variations. Estimates of production cost variations across regions can be found in Oliver *et al.* (2006) and Chambers (2008).

To permit the valid comparison of show score impacts on prices across shows which employ different rating systems, some standardisation is required. We follow the approach of Cardebat and Paroissien (2015) who standardise Bordeaux wine scores using equipercetile equating (Kolen and Brennan 2014). We use scores from Halliday (2017) as the numeraire and employ a non-parametric distribution transformation on the show scores such that the show scores reflect the Halliday (2017) distribution. Effectively, the show scores are transformed to have the same quantiles as Halliday (2017). Even though a number of shows employ the same 100 point scale as Halliday (2017), there is evidence to suggest that on average, Halliday (2017) rates wines higher than other experts (Oczkowski 2017). As a consequence, all show scores whether they employ the 20 or 100 point system are scaled to Halliday (2017) ratings. These standardised ratings are employed for subsequent analysis.

Table 6 presents estimates for Equation (1) using show medal data. For the shows (compared to no awarded medals), statistically significant premiums are identified for the award of gold medals at the Melbourne, Adelaide, Sydney, and Queensland shows. These four premiums average 14.2 per cent with Sydney being the greatest at 17.6 per cent. Statistically significant silver medal premiums exist for Hobart and Queensland, again exceeding 10 per cent, while the only statistically significant premium

Table 6 Hedonic price models: australian show medals

	Melbourne	Adelaide	Sydney	Perth	Hobart	National	Queensland	Halliday
Gold medal	0.116† (2.75)	0.114† (2.95)	0.176† (3.68)	0.083 (1.90)	0.025 (0.39)	-0.014 (-0.23)	0.161† (2.77)	0.548† (13.1)
Silver medal	0.033 (1.04)	0.040 (1.18)	0.020 (0.62)	0.065 (1.92)	0.110† (2.51)	0.058 (1.20)	0.108† (2.45)	0.204† (5.10)
Bronze Medal	0.013 (0.64)	0.037 (1.51)	0.023 (0.97)	0.034 (1.42)	0.089† (3.22)	-0.012 (-0.29)	0.047 (1.35)	0.039 (0.98)
Vintage	-0.146† (-13.3)	-0.170† (-14.1)	-0.130† (-12.8)	-0.161† (-12.0)	-0.140† (-10.4)	-0.161† (-10.4)	-0.158† (-5.51)	-0.110† (-18.2)
R <sup>2</sup>	0.376	0.391	0.384	0.413	0.446	0.464	0.433	0.503
N	1907	1444	1402	1340	968	697	681	3846

Notes: †Statistically significant at the 5 per cent level. Dependent variable is the log of price. Medals' premiums compared to no awarded medal. Robust t-ratios reported in parentheses. Models also include regional and varietal dummy variables.

estimated for a bronze medal is 8.9 per cent for Hobart. Interestingly, none of the medal premiums are statistically significant for Perth and the National show, with the latter exhibiting some small but negative medal impacts. For Hobart, results for gold medals are not significant but silver and bronze medals are statistically significant.

In a general sense, it appears that some of these show medal premiums may possibly be practically important. At sample median prices (\$28), the average gold medal premium (for the four significant premiums) of 14.2 per cent translates to approximately \$4. For lower price wines (\$22, 25 per cent percentile), the premium translates to \$3.10, and for higher priced wines, (\$40, 75 per cent percentile) the premium is \$5.70. For producers, the additional costs of producing a gold medal wine will need to be compared these additional benefits to determine whether strategies for pursuing gold medal quality wines at shows should be followed.

Various strategies exist for improving wine quality including sourcing better quality grapes, using new oak for maturation, the use of improved yeast strains, and controlling malolactic fermentation, see Reynolds (2010). There appears to be some scope for accessing better quality grapes. The National Vintage Report (Wine Australia 2017) points to the significant variation in grape prices for some specific varieties in individual regions. However, with the various margin markups (winery, wholesaler, and retail) and tax rates (WET (29 per cent) and GST (10 per cent)), the costs of inputs make only a small contribution to retail prices. Richardson and Denniss (2011) report that for a \$15 bottle of wine, grape costs make up only 86 cents (or 6 per cent of the retail price) and winery costs \$4.69 (31 per cent of the retail price). For oak maturation, Wine Australia (2015) suggests that the depreciation of oak barrels only contributes to 5 per cent of total processing costs. Efforts devoted at improving quality to achieve medals need to account for these relative cost contributions to retail prices. The small relative costs of grapes and oak maturation may imply that some of the premiums for gold medals may be economically attractive. However, given our finding about the lack of consensus of show outcomes, there is no guarantee that the use of higher priced grapes and/or new oak use will result in better outcomes for all shows.

Table 6 also reports vintage impacts are reasonably similar across shows, averaging 0.152. This suggests for each additional year a wine is held back a premium of 15 per cent is received. Estimates for regional and varietal/style impacts are not presented but available from the author upon request. It transpires that the region/variety premiums and discounts are reasonably similar across all employed specifications, and these are summarised in Table 7. In general, cool climates tend to dominate the premiums and warm climates the discounts. These results are similar to some identified from other Australian studies, for example, Schamel and Anderson (2003) using data from the late 1990s, identified important premiums for Mornington Peninsula and Southern Tasmania, and discounts for Riverina and warm

**Table 7** Main regional and variety/style price impacts

	Premiums	Discounts
Region	Mornington Peninsula Hunter Valley Canberra District Western Victoria Zone Southern Tasmania	Riverina Murray Darling Limestone Coast Multi-Regions Australia Central Victoria Zone
Variety/Style	Cabernet Shiraz Pinot Noir Chardonnay Cabernet Blend Shiraz	Sparkling Semillon Sauvignon Blanc Cabernet Merlot Sauvignon Blanc Semillon Merlot

climate regions of South Australia. Also, these results are qualitatively similar to estimates from other temperate climate countries where cool climate wines attract premiums (e.g. Troncoso and Aguirre (2006) for Chilean wines). In terms of variety and style, it appears that pinot noir, chardonnay, and shiraz remain popular and sparkling, semillon, and sauvignon blanc based wines less so. Again, these results appear to have held up over time as Schamel and Anderson (2003) also identified premiums for pinot noir and shiraz and discounts for sauvignon blanc and semillon. Premiums for pinot noir and chardonnay have also been estimated for other countries, for example Priilaid and van Rensburg (2012) for South Africa, and Roma *et al.* (2013) for Italy.

Table 6 also presents the results for Halliday and show medal data. As expected, the premiums for gold (55 per cent) and silver (20 per cent) medals far exceed those for the shows. In this case, the gold wine premium at median wine prices translates to \$15.30, a premium of more importance than those estimated for wine shows.

Table 8 presents estimates for Equation (1) using standardised show points data. These results largely align with the results based on medals.<sup>3</sup> For the shows, points have a statistically significant impact for all seven shows except for the Perth and National shows. The significant impacts range from 0.009 for Sydney to 0.014 for Queensland with an average 0.012. This implies that for each standardised point a premium of 1.2 per cent accrues, at sample median prices this translates to 34 cents per rating point. Once again these impacts are low compared to Halliday's estimate of a 6.1 per cent (\$1.70 at median prices) price increase per point. This estimate is broadly consistent with estimates from previous studies, see Oczkowski (2016a).

<sup>3</sup> For standardised points, the movement from no medal to a gold medal is 10 or more points. Multiplying the estimated point impacts in Table 8 by 10, equates approximately to the gold medal impacts in Table 6.

Table 8 Hedonic price models: Australian standardised show ratings

	Melbourne	Adelaide	Sydney	Perth	Hobart	National	Queensland	Halliday
Standardised rating	0.013† (2.69)	0.012† (2.39)	0.009† (2.45)	0.010 (1.81)	0.010† (2.48)	0.001 (0.10)	0.014† (2.82)	0.061† (27.7)
Vintage	-0.140† (-10.1)	-0.178† (-11.8)	-0.132† (-13.0)	-0.143† (-8.06)	-0.139† (-10.4)	-0.161† (-10.4)	-0.159† (-5.55)	-0.104† (-17.2)
R <sup>2</sup>	0.425	0.441	0.379	0.434	0.442	0.462	0.430	0.502
N	890	883	1402	701	968	697	681	3846

Note: †Statistically significant at the 5 per cent level. Dependent variable is the log of price. Show ratings standardised to Halliday ratings. Robust t-ratios reported in parentheses. Models also include regional and varietal dummy variables.



#### 4.2 Hedonic price function estimates: Objective and subjective quality measures

A drawback of these previous estimates, which employ show quality scores directly in the hedonic price function, is these scores effectively capture both the intrinsic (objective) quality of the wine and the relation of a show's opinion with price. There is significant ongoing debate (Storchmann 2012) in the wine pricing literature about whether the fundamentals (weather, soil, and production methods) and/or expert opinion influence prices. For example, Ashenfelter (2008) suggests the fundamentals matter most for Bordeaux prices, while Ali *et al.* (2008) found the expert Robert Parker may have some impact on Bordeaux prices. In our case, we attempt to identify the unique association that show outcomes have with prices which are independent of the objective fundamentals.

Building upon the framework developed by Cardebat *et al.* (2014), Oczkowski (2016b) advocates the following framework to disentangle the relative impacts of objective and subjective (show) opinion on wine prices.

$$P_i = \gamma Q_i + \theta \varepsilon_i + \beta' x_i + u_i \quad (2)$$

$$S_i = Q_i + \varepsilon_i \quad (3)$$

$$Q_i = \alpha' w_i \quad (4)$$

where  $P$  is the (log) price;  $Q$  is objective wine quality;  $S$  is the show quality score;  $\varepsilon$  is the opinion of the show, defined as the difference between the show quality score  $S$  and objective quality  $Q$ ;  $x$  represents additional price influencing regressors;  $w$  represents regressors which determine objective quality;  $\varepsilon$  and  $u$  are random error terms; and  $\gamma$ ,  $\theta$ ,  $\beta$ , and  $\alpha$  are parameters to be estimated.

Equation (2) specifies that both objective quality and the opinion of shows directly influence prices. The specification permits the determination of the additional impact that the show may have over and above objective quality on price. By design, the regressors in Equation (2) are uncorrelated ( $\text{cov}(Q, \varepsilon) = 0$ ) and so the influence of objective quality and the unique additional impact of the show on prices can be assessed.

Employing the classical measurement error model, Equation (3) assumes that the measured variable equals its latent counterpart plus a random measurement error. This assumption has previously been used for measured and latent wine quality by Oczkowski (2001), Lecocq and Visser (2006) and Cardebat *et al.* (2014). Equation (3) recognises that show judges and experts seek to assess the intrinsic quality of a wine, but by nature the sensory evaluation of wine involves human error (Jackson 2002). In the context of U.S. wine competitions, Hodgson (2009) demonstrates how the award of gold models among some shows is statistically random. Cardebat *et al.* (2014)

refer to the measurement error as the ‘personal’ opinion of the expert. In our model, it is important to recognise the difference between objective quality and the show score appears as the opinion regressor in Equation (2), rather than the show score itself. Including the show score directly in Equation (2) effectively double-counts the impact of objective quality on price, as objective quality appears as a separate regressor and is also part of the show score, see Oczkowski (2016b) for more details.<sup>4</sup>

To estimate the system described by Equations (2)-(4), substitute Equation (4) into Equation (3):

$$S_i = \alpha' w_i + \varepsilon_i \quad (5)$$

The estimable observable form of Equation (2) is given by:

$$P_i = \gamma \hat{Q}_i + \theta \hat{\varepsilon}_i + \beta' x_i + u_i \quad (6)$$

Where  $\hat{Q}$  and  $\hat{\varepsilon}$  are the predictions and residuals, respectively, from Equation (5). Since Equation (6) contains generated regressors, then bootstrap procedures can be used to estimate accurate standard errors.

The framework can be extended to two or more show or expert opinions for commonly assessed wines. Additional show/expert opinion regressors are added to Equation (6). With more than one show/expert, objective quality is estimated using a seemingly unrelated regressor estimator (SURE) which constrains the parameters across experts to be equal for Equation (5). This ensures that objective quality estimates are based on all show/expert ratings and that only a single objective quality estimate is generated for each wine. This objective quality estimate is then compared to the individual show/expert ratings to estimate the opinion regressors. Effectively, a constrained SURE is used for Equation (5) for all commonly wines assessed to generate a single prediction variable but residuals for each show/expert. These predictions and residuals are then employed in Equation (6).

As in Cardebat *et al.* (2014) and Oczkowski (2016b), we employ three sets of variables for determining objective quality ( $w$  in Equation (4)): weather variables; time (vintage of wine); and fixed effects for the influence of producers. For weather, we use rainfall and temperature data as identified and employed in Oczkowski (2016a). The vintage variable also captures weather variation and the impact of quality improvements due to technological and other advances over time. Producer fixed effects capture a series of factors unique to each producer, such as soil types, vine exposure, use of

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<sup>4</sup> A potential limitation of the proposed approach is it assumes the opinions of show judges or experts are random errors. Cao and Stokes (2017) and Bodington (2017) and others suggest that there may exist some systematic or idiosyncratic expert bias, in addition to random errors in wine assessment. We comment below on how, in our case, adding additional variables to Equation (3) to capture systematic biases do not demonstrably affect estimates.

irrigation, fertiliser application, maturation techniques, and storage facilities.<sup>5</sup>

In terms of Equation (5), we employ:

$$S_i = \alpha_0 + \alpha_1(Rain)_i + \alpha_2(Diff)_i + \alpha_3(Temp)_i + \alpha_4(Temp)_i^2 + \delta(Vintage)_i + \pi'(Prod\_id)_i + \varepsilon_i \quad (7)$$

where  $S$  is the subjective quality rating;  $Rain$  is the average monthly rain (mls) during the harvest months (January to March);  $Diff$  is the average difference between the maximum and minimum temperatures (degrees Celsius) over the growing season (October to March);  $Temp$  is average temperature over the growing season based on monthly averages (October to March);  $Vintage$  is the year in which the grapes were harvested; and  $Prod\_id$  is a series of dummy variables identifying each individual producer.

Similar to Equation (1), we employ the following specification for Equation (6) to model prices:

$$\ln(Price)_i = \beta_0 + \gamma\hat{Q}_i + \theta\hat{\varepsilon}_i + \beta_1(Vintage)_i + \beta'_2(Region)_i + \beta'_3(Variety)_i + u_i \quad (8)$$

where  $\hat{Q}$  and  $\hat{\varepsilon}$  are the predictions and residuals, respectively, from Equation (7), and the other variables are as defined for Equation (1).

Due to the large number of producers entering wine shows, precise estimates for the specific regressors in Equation (7) are difficult to obtain and hence are not reported. The average number of wines per producer varies across the shows from 3.6 for Queensland to 5.3 for Hobart and Perth. However, given our main interest in results from Equation (8), then the focus on prediction from Equation (7) is only important and that is not influenced by the lack of precise individual parameter estimates.

The estimates for Equation (8) based on the individual standardised show points, and Halliday data are provided in Table 9. The structure of the model is such that the employed show score plays an important role in determining the objective quality measure. As a consequence, show scores which do not highly correlate with prices are also likely to produce objective quality measures which also do not highly correlate with price. This is evidenced

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<sup>5</sup> To evaluate possible systematic assessment biases of show judges, variables are added to Equation (7) and recognised as making up part of the opinion regressor in Equation (8). Oczkowski (2017) identifies some systematic differences among four Australian wine-guide experts in terms of varietal and regional preferences. Adding the regional and variety variables to Equation (7) adds only, on average, an additional 7% explanatory power. Recognising these additional variables as part of the opinion variable in Equation (8) makes no demonstrable difference to the presented estimates. It appears the systematic expert wine-guide variation identified in Oczkowski (2017) is captured by the weather, vintage and producer effects already specified in Equation (8) and/or may not apply to wine show judges.

Table 9 Hedonic price models: objective quality with single opinion

	Melbourne	Adelaide	Sydney	Perth	Hobart	National	Queensland	Halliday
Objective quality	0.024† (3.70)	0.017 (1.94)	0.033† (5.16)	0.001 (0.09)	0.019† (2.30)	0.020† (1.96)	0.028† (3.60)	0.061† (17.4)
Opinion	0.005 (0.92)	0.010 (1.84)	-0.002 (-0.53)	0.014† (2.08)	0.006 (1.38)	-0.006 (-0.94)	0.006 (1.19)	0.062† (21.5)
Vintage	-0.140† (-10.4)	-0.178† (-12.4)	-0.135† (-11.7)	-0.144† (-7.94)	-0.137† (-11.4)	-0.163† (-10.4)	-0.164† (-5.84)	-0.104† (-16.8)
R <sup>2</sup> (1 <sup>st</sup> Stage)	0.441	0.308	0.347	0.306	0.298	0.316	0.398	0.469
R <sup>2</sup> (2 <sup>nd</sup> Stage)	0.428	0.442	0.389	0.435	0.443	0.466	0.434	0.502
N	890	883	1402	701	968	697	681	3846

Note: †Statistically significant at the 5 per cent level. Dependent variable is the log of price. Show ratings standardised to Halliday ratings. Wild bootstrap t-ratios reported in parentheses. Models also include regional and varietal dummy variables.

in Table 9 where for the shows only the objective quality measures for Melbourne, Sydney, Hobart, Queensland, and National are statistically significant. This is broadly similar to the results in Table 8<sup>6</sup>. The objective quality impacts are greater than the rating impacts in Table 8. The statistically significant impacts range from 0.019 to 0.033 with an average of 0.025, which at median prices translates to 70 cents per point. Interestingly, the only statistically significant impact of show opinion is for Perth with a premium of 1.4 per cent per point. At median prices, this translates to 39 cents per point. Once again the results for Halliday are much more practically important, with approximately equal prices impacts for objective quality and subjective opinion of 6 per cent per point.

The most accurate assessments of the impact of show points on prices are possibly gained by using two expert assessments in determining objective quality. Table 10 reports results for the constrained SURE estimator for Equations (7) and (8) where two subjective opinion regressors are included, that is, the Halliday score and standardised points for each show in turn.<sup>7</sup> The objective quality impacts are all important and average 6.8 per cent per point which translates to \$1.90 per point at median prices. Three of the show opinion impacts are statistically significant (Melbourne, Adelaide, and Perth) averaging 1.1 per cent per point, implying a 30 cents average impact per point. Interestingly, the show opinion impacts for Sydney and the National show are slightly negative. For each of the models in Table 10, objective quality and Halliday opinion impacts are again approximately equal. The only deviation from this general conclusion occurs for Perth where the Halliday opinion impact is much larger than that of objective quality. The average Halliday opinion impact is 7.5 per cent, implying \$2.10 per point. These impacts appear to be very important.

It is of interest to compare our findings on the relative importance of objective and subjective quality on prices to other relevant studies. For Bordeaux wines, Dubois and Nauges (2010) estimate that Robert Parker scores have a significant additional impact of 1.6–2.8 per cent per point on prices. Cardebat *et al.* (2014) using scores from nine experts and wines from France, Spain, and the United States suggest that prices are determined more by the fundamentals than the opinions of experts. Oczkowski (2016b) employed the approach used in this paper for Halliday scores and wines available in 2014. Similar to our results, Oczkowski (2016b) also estimated approximately equal impacts of objective quality and Halliday's opinion on price. It is important to note that these studies use different specifications to separate objective quality from subjective opinion price impacts and that the posited specification may make a significant difference to estimates, see Oczkowski (2016b).

<sup>6</sup> The only differences being the significance of the National show's objective impact and the insignificance of objective quality for Adelaide, which, however, has a t-ratio of 1.94.

<sup>7</sup> Given the previous estimates and the resulting significant reduction in sample sizes, extending results to more than one show proved to be unproductive.

**Table 10** Hedonic price models: objective quality with show and Halliday opinion

	Melbourne	Adelaide	Sydney	Perth	Hobart	National	Queensland
Objective Quality	0.068† (10.1)	0.064† (7.57)	0.072† (12.2)	0.051† (6.33)	0.066† (7.27)	0.071† (6.63)	0.082† (9.78)
Halliday Opinion	0.080† (14.4)	0.073† (13.6)	0.065† (18.0)	0.087† (16.8)	0.062† (12.5)	0.086† (14.4)	0.072† (14.4)
Show Opinion	0.010† (2.31)	0.009† (2.20)	-0.004 (-1.13)	0.013† (3.08)	0.002 (0.52)	-0.007 (-1.56)	-0.001 (-0.25)
Vintage	-0.099† (-6.97)	-0.135† (-10.8)	-0.100† (-10.5)	-0.109† (-7.16)	-0.103† (-9.34)	-0.106† (-7.28)	-0.124† (-5.33)
$R^2$ (1st Stage Halliday)	0.417	0.401	0.396	0.370	0.337	0.359	0.464
$R^2$ (1st Stage Show)	0.214	0.084	0.182	0.080	0.119	0.165	0.216
$R^2$ (2nd Stage)	0.586	0.574	0.532	0.616	0.559	0.634	0.616
$N$	890	883	1402	701	968	697	681

Note: †Statistically significant at the 5 per cent level. Dependent variable is the log of price. Show ratings standardised to Halliday ratings. Wild bootstrap t-ratios reported in parentheses. Models also include regional and varietal dummy variables.



## 5. Conclusions

This paper presents results on the consensus among Australian wine show outcomes and their relation with wine prices. Results confirm previous findings (Allen and Germov 2010) that the degree of consensus among Australian wine shows both in terms of medals and points is only moderate at best. The paper's more substantial contribution relates to the use of hedonic wine price functions to examine the relation between both show medals and awarded points and wine prices.

Hedonic wine price functions were developed using wine show results as direct measures of quality and also to separate objective quality from wine show opinion. When show outcomes are employed as a direct measure of quality, it appears for all shows (except for Perth and the National show) medals and points have a statistically significant relation with price. These impacts may possibly be practically important with premiums being over 10 per cent for gold medals. These premiums are small, however, compared to Halliday's gold medal premiums of over 50 per cent.

When models disentangle objective quality effects from show effects on prices, the impacts of shows are reduced. Only the impact of Perth show's points is statistically significant for models which use only a single opinion (Table 9). For models which use two subjective opinions (Table 10), show opinion is statistically significant for the Melbourne, Adelaide, and Perth shows only, with an average estimated price impact of 1.1 per cent per point. This potentially implies that in addition to efforts at improving the objective quality of wine, producers may seek to align the characteristics of their wines with the opinions of the Melbourne, Adelaide, and Perth shows to gain further premiums. In other words, higher prices appear to accrue to producers through both improved weather conditions and individual producer practices, and higher show points for the Melbourne, Adelaide, and Perth shows when they differ from objective quality. However, efforts in pursuing improvements in objective quality (premium of 6.8 per cent per point) far exceed alignment with show opinions (premium of 1.1 per cent per point). Again, compared to the Halliday opinion impacts of 6 per cent per point, the show opinion impacts averaging 1.1 per cent per point appear to be small.

In conclusion, faced with inconsistent show quality scores which in some cases relate weakly with prices, practical recommendations for consumer choice may be difficult to develop. As recommended by Robinson (1997) and further developed by Oczkowski (2017), consumers may best be advised to find a wine show whose medal awarded wines best align with their own preferences. The observation that some wine show outcomes weakly correlate with prices implies that potential bargains may be readily attainable. Stating the obvious, buy a very cheap gold medal awarded wine you like!

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