Expert opinion and cuisine reputation in the market for restaurant meals

James Joseph Fogarty

School of Agricultural and Resource Economics
University of Western Australia
35 Stirling Highway, Crawley
W.A. Australia, 6009

Email : James.Fogarty@uwa.edu.au
Phone: +61 8 6488 3419
Fax: +61 8 9322 3955

Abstract. As food is an experience good, the market for restaurant meals is a market where the cost of acquiring information regarding quality is relatively high. In such markets consumers often turn to reputation measures to guide purchase decisions. As Australia does not have a longstanding cuisine style of its own, and given Australia has been open to substantial immigration inflows since federation, it represents an especially appropriate market to study regarding the impact of individual restaurant reputation and collective cuisine reputation on meal prices. The following study uses the hedonic price approach to investigate the implicit price of individual reputation indicators, cuisine type reputation indicators, and other objective indicators in the market for restaurant meals. The empirical findings presented suggest that both individual restaurant reputation and cuisine type reputation are important. Other important factors are shown to include the quality of the restaurant wine list, the availability of private dining rooms, and whether or not there is an outdoor dining option.

Key Words: Expert Opinion, Food, Hedonic Pricing
JEL: D12, Q18, Z10

1. Introduction

The hedonic price approach has been used extensively to study the relationship between wine prices, objective wine attributes, expert opinion, and collective reputation; with relevant Australian examples including, but not limited to Oczkowski (1994; 2001) and Schamel and Anderson (2003), and international examples including but not limited to Nerlove (1995), Combris, Lecocq and Visser (1997; 2000), and Landon and Smith (1997; 1998). Although Chossat and Gergaud (2003) examine the relationship between restaurant quality ratings and objective restaurant attributes in France, the ability of the hedonic approach to provide insights into the value of restaurant meal attributes, and the role of expert opinion and cuisine reputation in the market for restaurant meals does not yet appear to have been fully explored. The wide variety of cuisine types available in Australia, combined with the fact that Australia has no long standing food tradition of its own, means that Australia represents an excellent country for a study of the value of restaurant meal attributes, and in particular the reputation effect for different cuisine types.

For Australia, which has welcomed migrants since the time of federation, a further interesting question can be investigated; namely the length of time since the establishment of a substantial migrant population and the relative cuisine type reputation. Table 1 provides a snapshot of the population born overseas at key points in time for Australia, and as can be seen, at the time of federation the vast majority of the population born overseas was from the UK. Post WWII migration from Europe to Australia was substantial, and this impact can be seen in the increase in the relative importance of migrants from Italy, Germany, the

Netherlands, and Poland in the details shown for 1954. Although there have been changes in the relative importance of some European countries (especially Greece and the former Yugoslavia), Europe continues to be an important source of migrants for Australia. The relative importance of Europe as a source of migration has however fallen; and in recent decades migration from the Asian region has increased. The rise in the relative importance of Asia as a source of migrants can be seen in the 2006 data that shows a significant proportion of the overseas born population was from mainland China, Vietnam, India, Philippines, Malaysia, and Hong Kong.

Table 1 Total overseas born population and important migrant countries

Country	Unit	1901	1954	1981	2006
United Kingdom*	(%)	78.5	51.6	35.8	23.3
New Zealand	(%)	3.0	3.4	5.1	9.6
Italy	(%)	0.7	9.3	8.8	4.4
China (excl. SAR, Taiwan)	(%)	3.5	0.8	0.8	4.1
Vietnam	(%)	n.a.	n.a.	1.3	3.6
India	(%)	0.9	0.9	1.3	3.1
Philippines	(%)	0.1	0.0	0.5	2.7
Greece	(%)	0.1	2.0	4.7	2.5
South Africa	(%)	0.1	0.5	0.8	2.4
Germany	(%)	4.4	5.1	3.5	2.3
Malaysia	(%)	n.a.	0.2	1.0	2.1
Netherlands	(%)	0.1	4.0	3.0	1.8
Lebanon	(%)	n.a.	0.3	1.6	1.7
Hong Kong (SAR of China)	(%)	0.0	0.1	0.5	1.5
United States of America	(%)	0.9	0.6	0.9	1.5
Sri Lanka	(%)	0.1	0.2	0.5	1.4
Poland	(%)	n.a.	4.4	1.9	1.3
Former Yugoslavia	(%)	n.a.	1.8	4.8	1.0
Total overseas born population	(%)	22.9	14.3	21.5	24.1
Total overseas born population	('000)	865.5	1,286.5	3,128.1	4,956.9
Total Australian population	('000)	3,774	8,987	14,517	20,606

Note: * includes Ireland for 1901 and 1954
Data source: ABS (2009; 2001)

The following paper uses the hedonic price approach to investigate the role of expert opinion, cuisine reputation, and the value of different objective attributes in the market for restaurant meals in New South Wales and Victoria, Australia;

and the remainder of the paper is structured as follows. Section 2 describes very briefly the theoretical approach used to study the market for restaurant meals and how the data set was created. Section 3 outlines the estimation approach and discusses the empirical findings, and concluding comments are presented in Section 4.

2. Approach and data

Given Triplett (2004) is a comprehensive reference for the theory of hedonic price equations, the overview of the approach presented here is relatively brief. The hedonic approach to consumer demand analysis assumes that there exists some function that relates the price of a good to the underlying attributes of the good, and that consumer utility depends not on the good actually purchased, but on the underlying attributes of the good. With respect to restaurant meals, a hedonic price function might be written as $P = P(\boldsymbol{Z})$, where P is the price of a restaurant meal, and $\mathbf{Z}$ is a vector of observable product attributes such as cuisine type, restaurant reputation, etc., that appears directly in the consumer utility function. The hedonic approach has been widely used, but does impose some restrictions on the nature of the demand relationships across and between goods, and it is worth being clear about these restrictions. The main restriction is that the approach requires that, at least across the attributes in the hedonic good, the utility function be weakly separable, and that consumers engage in multi-stage budgeting. Once the weak separability condition is imposed on the consumer utility function, and as shown in Triplet (2004), it is possible to retrieve the hedonic price function, although not the specific form of the function. In the case of restaurant meals, multi-stage budgeting and weak separability are not thought to impose any especially troubling restrictions. The approach does however imply that for

restaurant meals, the trade-offs the consumer makes between different restaurant meal attributes is independent of the level of consumption of all other goods. It is also worth emphasising the result shown in Rosen (1974) that for the case of many buyers -- which is the case for restaurant meals -- the distribution of buyers across the attribute space determines the form of the hedonic price function.

The data for the current study were taken from *The Age Good Food Guide* and *The Sydney Morning Herald Good Food Guide*. For reasons described below, the sample was restricted to restaurants that appeared in both the 2006 and the 2007 editions of the respective guides. Additionally, restaurants that offered only a degustation menu were excluded from the sample. In terms of restaurant ratings, the critics that write reviews in the various *Good Food Guides* visit unannounced and pay for their meal in full. Although, as some of the writers are well known Australian food and wine critics, it is not clear that the visit will always have been an anonymous visit. Similar to wine, restaurants listed in the guides are scored out of 20, with the total score comprised of: ten points for food, five points for service, three points for ambiance, and two additional points for excellence in any particular food or service aspect. Any restaurant that receives a score of below 11 is excluded from the guide. In addition to awarding each restaurant a numerical score, a range of awards for such things as: restaurant of the year, chef of the year, etc., are also reported in each edition of the guide.

Regarding the wine list at each restaurant, the guides provide a comment rather than a specific score. To determine a wine list rating therefore involved the creation of a ranking based on the nature of the comment made about the wine list at each restaurant. The process of developing a wine list rating was as follows.

Where the wine list was described in unflattering terms such as "..some obscure choices in a badly spelled, almost exclusively Australian list, not very well matched to the food…" the wine list was given a score of minus one. Where the restaurant had no wine list they received a score of zero. When the wine list description was along the lines of "…an unremarkable but well-chosen list that suits the food at predictable mark-ups…" the wine list was given a score of one. For moderately positive wine list comments along the lines of "…good range featuring boutique Australian labels…" the wine list was given a score of two. There were also several occasions where the wine list comment was extremely positive, for example "…a Francophile's heaven; dauntingly long, exhaustive and with a terrific selection by the glass…" For restaurants that received a wine list comment that was overwhelmingly positive the wine list was given a score of three.

In terms of meal prices, each guide generally specifies a range of prices for entrées, mains, and desserts. For example, an entry for a restaurant may read something like $19 to $23 for entrées, $28 to $34 for mains, and $14 to $16 for desserts[1]. The guides make some attempt to exclude observations that would skew the range of values reported, but the processes used are not perfect. Here the process used to determine an average price at each restaurant was as follows. First, the mid-point of the range specified for each meal category was calculated for both 2006 and 2007. The values reported for 2007 were then compared to the values for 2006, and cases where the difference between the two years appeared substantial were investigated further. This process was used to identify any

[1] It is difficult to determine an appropriate exchange rate for converting Australian dollars into US dollars or Euros, but the 10 year average US-Australian and Euro-Australian exchange rates to July 2009 were .69 US dollars per Australian dollar and .59 Euros per Australian dollar.

coding errors in the classification of data to each meal type. Next, any very large or very low average values were investigated further. The process involved checking the restaurant website to see if the range of values specified was an accurate reflection of the average meal price for that category of meal. This process identified several cases where a single dish, such as a 350 gram Kobe beef steak, resulted in the mid-point of the meal price range reported in the guide being an inappropriate indicator of actual average meal price. For such cases the actual average meal price based on the advertised online menu was calculated. Where the range specified in the guide appeared to possibly represent a distorted picture, if it was not possible to confirm meal prices at the restaurant via reviewing an actual online menu the observation was deleted from the sample. Additionally, if there was only one restaurant of a specified cuisine type, which was the case for Burmese cuisine, the observation was also deleted from the sample. The various data cleaning processes left 1,616 observations; consisting of 533 entrée meal price observations, 546 main meal price observations, and 537 dessert meal price observations. A summary of some of the key elements of the data set is provided in Table 2.

Table 2 Data summary statistics for restaurant meals

Indicator	Entrée ($)	Mains ($)	Dessert ($)	Score (No.)	Capacity (Seats)
Mean	15.71	27.24	11.76	13.79	98.01
Median	15.50	27.00	12.00	14.00	80.00
Max	38.00	47.00	30.00	19.00	800.0
Min	3.50	8.75	3.00	12.00	16.00
St. Dev.	5.07	6.57	3.99	1.18	72.03

3. Estimation and empirical results

Details on the explanatory variables in the model are provided in Table 3. Regarding the specific functional form of the hedonic price relationship, Triplett (2004) argues authoritatively that functional form is to be determined empirically.

As such, a series of Box-Cox transformations on the dependant variable with lambda values ranging between minus two and two were considered, and the square root transformation on the dependent variable could not be rejected as the optimal transformation (see appendix for details). Although such a test is not necessarily conclusive, it can be noted that in the current application both the linear functional form and the log-linear functional form failed a RESET test, while the hedonic price regression specification with the square root transformation on the dependent variable passed a RESET functional form test. The actual hedonic price equation estimated therefore has the square root of meal price as the dependant variable.

Table 3 Description of the explanatory variables

Column	Description
(1)	Intercept
(2-3)	Dummy variables for entrée and dessert
(4)	Restaurant rating in 2007 (Range 12 to 19)
(5)	Dummy variable for wining an award in the previous year
(6)	Wine list score (Range -1 to 3)
(7)	Dummy variable for regular BYO wine option
(8-10)	Dummy variables for location (Melbourne, Sydney, Regional Vic, Regional NSW)
(11-32)	Dummy variables for cuisine type (French, Italian, Chinese etc.)
(33)	Dummy variable for modern cuisine
(34-36)	Venue capacity, venue capacity squared, and venue capacity cubed
(37)	Dummy variable for private room dining option
(38)	Dummy variable for outdoor dining option

With respect to individual firm expert opinion or reputation ratings, Oczkowski (2001) has shown that for wine ratings there is a potential endogeneity problem. Conceptually, there would seem strong similarities between expert opinion reputation ratings for meals at individual restaurants and expert opinion reputation ratings for wine. As such, before proceeding to the estimation of the hedonic price relationship the issue of engogeneity with respect to the restaurant rating variable was investigated. Formal testing indicated that endogeneity was a

problem. As such, to obtain consistent estimates the approach used here was IV, where the restaurant rating in 2006 has been used as the instrument for the restaurant rating in 2007 (see appendix for details).

Empirical results for the hedonic price regression where endogeneity is appropriately considered are reported in Table 4. In terms of interpreting the information in the table, the meal type, location, and cuisine type variables are a series of dummy variables, and therefore require a base category for interpretation. For the meal type dummy variables the interpretation of results relative to the base category of a main meal is both relatively straight forward, and intuitively reasonable. Specifically, the reported meal type coefficients for entrées and desserts represent the meal type discount relative to main meals, controlling for all other factors.

With respect to the location and cuisine type dummy variables it is less clear that simply dropping a cuisine type and a venue location from the regression and interpreting all results relative to the base cuisine type and base location provides the most useful information. As such, for these two groups of dummy variables, rather than drop a cuisine type and location category, the approach taken has been to follow Kennedy (1986) and use the average cuisine type and location effect as the base category. The point estimates for cuisine type and restaurant location are therefore interpreted as deviations from the average.

Although the approach of using the deviation from the average as the base category was outlined in Kennedy (1984), the approach used to obtain the estimates here was based Oczkowski (1994), and can be understood by

considering the following example. Consider the equation $Y_i = \alpha + \beta_1 D_{1i} + \beta_2 D_{2i} + \beta_3 D_{3i} + \beta_4 D_{4i} + e_i$, where the D_j are location dummy variables such that $\sum_{j=1}^{4} D_j = \boldsymbol{I}$ so that there is perfect multicolinearity. If P_j is used to denote the proportion of non-zeros associated with location D_j, then, if the constraint $\sum_{j=1}^{4} \beta_j P_j = 0$ is imposed on the above equation the least squares estimates can be interpreted as deviations from the average. To obtain these estimates note that the constraint can be re-written as $\beta_1 = -\sum_{j=2}^{4} \beta_j \frac{P_j}{P_1}$, which when imposed on the original equation and written out in full gives $Y_i = \alpha + \beta_2 \left(D_{2i} - \left(\frac{P_2}{P_1}\right) D_{2i}\right) + \beta_3 \left(D_{3i} - \left(\frac{P_3}{P_1}\right) D_{3i}\right) + \beta_4 \left(D_{4i} - \left(\frac{P_4}{P_1}\right) D_{4i}\right) + e_i$. The choice of β_1 for writing the constraint is however completely arbitrary, and so the one remaining point estimate and associated standard error can be obtained by re-defining the constraint, as, for example, $\beta_4 = -\sum_{j=1}^{3} \beta_j \frac{P_j}{P_4}$, and imposing this constraint on the original equation and re-estimating.

Heteroskedasticty also appeared to be a problem with the data, and as there did not appear to be any ready data transformation available to obtain spherical errors, the reported standard errors are based on White's heteroskedastic consistent co-variance matrix. An additional implication of heteroskedastity relates to the way the regression results can be interpreted. Following the square root transformation of the dependant variable the unbiased back transformation for predicted values incorporates the standard error of the regression (Gregoire et al., 2008). Given heteroskedasticty of an unknown form, there is no ready bias correction for the back transformation to the original scale, and so it is not possible to discuss the results in terms of prices. As such, the discussion of the

empirical findings is presented in terms of the square root of prices only. With a generalised R^2 value of .805, the hedonic price specification used appeared to fit the data reasonably well.

Table 4 Summary regression results

Variable	Estimate	Std Err.	Variable	Estimate	Std Err.
Intercept	1.702**	(.217)	Italian	.161**	(.028)
Meal Type			Japanese	-.102	(.072)
Entrée	-1.276**	(.027)	Lebanese	-.623**	(.093)
Dessert	-1.810**	(.026)	Malaysian	-.591**	(.094)
Expert Opinion			Mediterranean	-.063	(.048)
Food Rating	.221**	(.016)	Mexican	-.110	(.096)
Previous award	-.088	(.073)	Middle Eastern	.018	(.122)
Wine			Moroccan	-.250*	(.138)
Wine list	.079**	(.014)	Wood Fired Pizza	-.408**	(.136)
BYO option	-.050*	(.029)	Regional Australian	-.369**	(.103)
Location			Seafood	.335**	(.049)
Melbourne	-.083**	(.016)	Spanish	-.226	(.168)
Sydney	.018	(.033)	Steakhouse	.170*	(.096)
Regional Victoria	.052**	(.014)	Thai	-.292**	(.061)
Regional NSW	.042	(.027)	Vegetarian	-.657**	(.153)
Cuisine Type			Vietnamese	-.506**	(.075)
Asian	-.178**	(.068)	Modern	.094**	(.034)
Chinese	-.469**	(.057)	*Other Measures*		
Contemp. Australian	.176**	(.018)	Capacity × 100	.539**	(.077)
European	.242**	(.038)	$Capacity^2$ × 10,000	-.153**	(.032)
French	.273**	(.035)	$Capacity^3$ × 1,000,000	.011**	(.004)
Greek	-.283**	(.074)	Private room	.043*	(.026)
Indian	-.561**	(.042)	Outdoor dinning	-.045*	(.024)
GR^2	.805		Regression SE	.439	
			DoF	1,578	

Note: ** significant at the 5 percent level, * significant at the 10 percent level

Unsurprisingly both desserts and entrées are significantly cheaper than main meals. Regarding the relative discount to main meals for entrées and desserts, given many restaurants offer two course business lunch options where the diner can select either an entrée and a main meal, or a dessert and main meal, it would not have been surprising to find the discount for entrées and desserts relative to main meals, other factors constant, to be approximately the same. The results do however indicate that, on average, desserts are significantly cheaper than entrées. For the value conscious diner this suggests that when selecting two

courses from a two course business meal special, they should favour the option of an entrée and a main meal. Having dessert as the cheapest item on the menu may also reflect strategic behaviour on the part of restaurants. For example, those patrons purchasing dessert are also likely to be attracted to purchasing a hot beverage such as a coffee, where restaurant margins are very high.

Receiving an award from one of the rating books in the previous year did not appear to have an impact on prices, but the impact of expert ratings for individual restaurants was statistically significant, and large in practical terms. Food is an experience good where the consumer might naturally look to individual restaurant and cuisine type reputation indicators to guide their decisions. Expert opinion ratings can be thought of as a reputation indicator, and in this regard the analysis presented in Shapiro (1983) regarding firm reputation is both interesting and relevant. The framework Shapiro develops generates equilibrium conditions for the case of perfect competition with free entry and exit, but imperfectly observed quality; conditions which would seem to approximate those observed in the market for restaurant meals. The essential propositions of Shapiro can be simplified and outlined as follows.

Assume there are various quality levels a firm may choose to produce at, including some minimum quality level which is the regulated minimum quality level. In the current example the regulated minimum quality level would be the standard prescribed by the relevant health and safety standards for food preparation. As the regulated minimum quality level is guaranteed, this level of quality is known to potential diners with certainty. Now, consider a restaurant wanting, in period *t*, to produce in the high quality segment of the market. To

produce high quality meals the restaurant purchases high quality produce and skilled staff and so incurs costs above those associated with the cost of producing a meal consistent with the minimum regulated quality level. Yet, as quality is revealed and acknowledged in the market with a lag of say *n* periods, for all periods up to *n*-1, where $n > 1$, the restaurant must sell the high quality meal at the minimum quality price. So, for *n*-1 periods the restaurant earns a return below zero economic profit, where the lower return can be thought of as equivalent to the restaurant's investment in the asset reputation. To make this investment worthwhile, the restaurant must enjoy a return on this investment in period *t+n* and subsequent periods. Further, the return to the investment in reputation must represent a fair return, otherwise the investment will not take place. As such, meals from restaurants with a reputation for quality -- measured in this instance by the expert opinion rating -- must, in equilibrium, attract a premium.

The results for restaurant location were somewhat surprising. Due to the cost difference in land prices the expectation prior to estimation was that the cost of restaurant meals in Melbourne and Sydney would be above the average, while the cost of restaurant meals in regional Victoria and regional New South Wales would be below the average. The results indicate that, other factors constant, restaurant meals in regional Victoria are more expensive than average; restaurant meals in Sydney and regional New South Wales are not different to the average; and restaurant meals in Melbourne are cheaper than average. A somewhat speculative explanation for the result could be that it reflects the interplay between both costs and the extent of competition in each spatially separate market. With this interpretation, the implication is that competition for patrons in Melbourne is

the most intense, and competition for patrons in regional Victoria is the least intense.

To develop a comprehensive wine list at a restaurant involves substantial costs. There are direct wine storage costs and sommelier labour costs, plus substantial opportunity costs in terms of the capital tied up in holding stock. The margins on wine sold at restaurants are typically substantial, and so could be expected to appropriately compensate for these costs. However, the point estimate for the wine list comment indicates that investing in a wine cellar also allows the restaurant to command higher meal prices which suggests a possible positive spill-over effect from the investment in developing a wine list to restaurant meal prices.

In addition to considering the wine list comment, whether or not BYO wine was allowed on a regular basis at the restaurant was also considered. Margins on wine are relatively high, and so it was thought that, other factors constant, restaurants that allow BYO wine on a regular basis may need to charge slightly higher prices to compensate. Given patrons are aware that margins on wine are high, it was thought that, holding other factors constant, diners would also be willing to pay slightly more for their meal at a BYO restaurant knowing that they could make a substantial saving on the cost of alcoholic beverages. The point estimate for the regular BYO option dummy variable was significant only at the 10 percent level, but the sign was negative, suggesting that other factors constant, restaurants that allow BYO wine on a regular basis charge less for meals than restaurants that do not allow BYO wine on a regular basis. Interpretation of the result is again somewhat speculative, but it should be remembered that

restaurants allowing BYO wine still charge patrons to consume alcohol in the restaurant. Specifically, restaurants charge customers either a per bottle or per patron amount to consume the wine they bring with them. As such, the slight discount to meal prices in restaurants that allow BYO wine relative to restaurants that do not might suggest that the economic return to this practice more than adequately compensates owners for glass breakage and additional glass cleaning costs such that they reap a pure profit from BYO charges for wine.

A series of dummy variables were used to identify cuisine type reputation effects, however, on some occasions the cuisine at a restaurant was given the additional descriptor of being modern so that rather than the cuisine being identified as say Italian or Vietnamese it was identified as Modern Italian or Modern Vietnamese. Cuisine identified as modern attracts a statistically significant price premium. This suggests that there is a reward for those restaurants that are prepared to allow fresh new meal creations to appear on the menu. In terms of cuisine reputation effects, other factors constant, it appears seafood and French cuisine attract the highest premium compared to the average, while vegetarian and Lebanese food attract the greatest discount relative to the average.

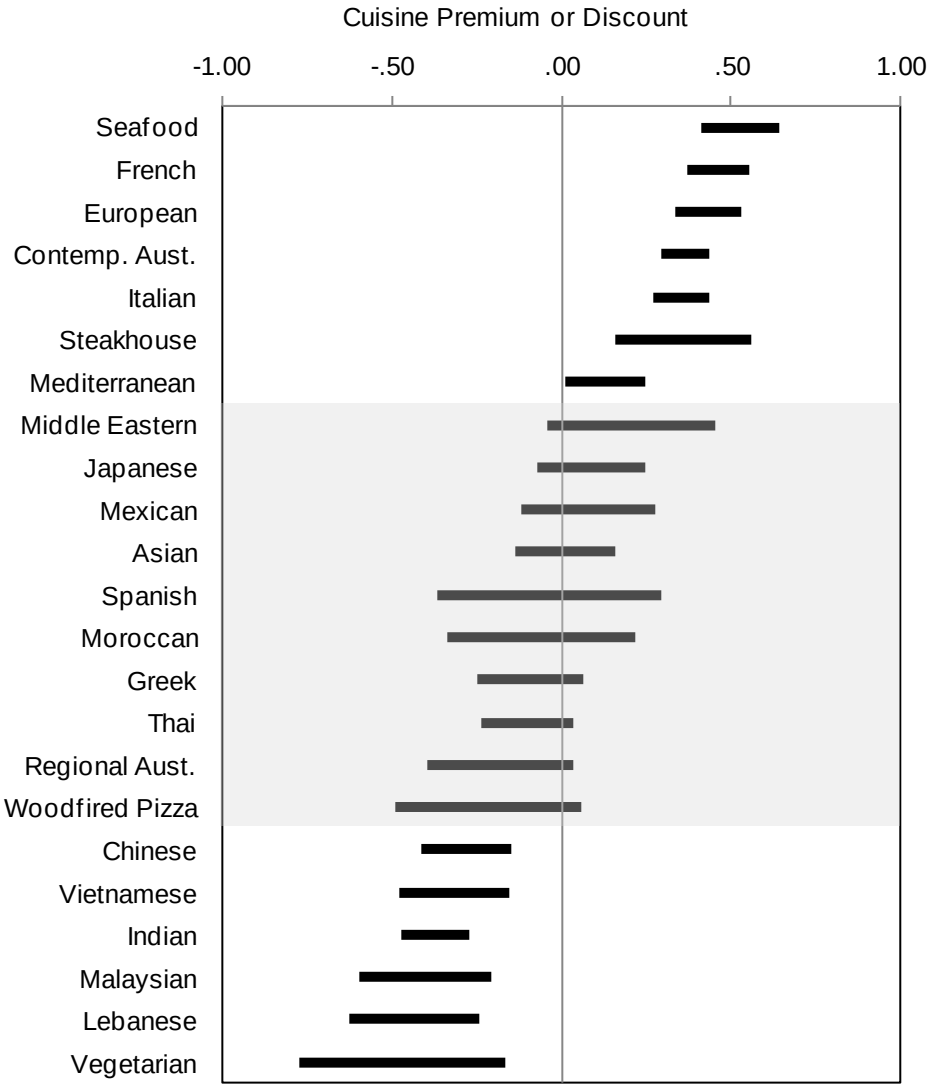
The results presented in Table 4 have the average cuisine type effect as the base, and the average effect reflects the relative importance of each cuisine type in the data set. In terms of understanding the cuisine type reputation effects it is worth considering differences based on an equally weighted sample of the data. Following the approach of Suits (1981) allows for cuisine premiums and discounts to be calculated where the base category is an equally weighted sample

of cuisine types. Here the specific approach used to obtain the estimates was similar to that outlined above for calculating deviations from the mean. Specifically, the approach differs from the approach of calculating deviations from the mean only in terms of the constraint imposed. In the case of deviations from the mean the constraint was constructed to reflect the number of observations in each dummy variable category. To obtain estimates that represent deviations from an equally weighted average the constraint imposed simply ignores the number of observations in each category and so is $\sum_{j=1}^{4} \beta_j = 0$, which is then imposed on the original equation in the same manner as discussed previously. The cuisine reputation effect, where the base is an equally weighted average of cuisine type effects has been plotted in Figure 1. In the figure the solid bars for each cuisine type represent the heteroskedastic robust two standard error range of values for each cuisine type point estimate. This type of data representation makes it easy to identify the cuisine types that, other factors constant, attract a price premium, attract a price discount, or are average.

As can be seen in Figure 1, in broad terms it seems European cuisine has a reputation for quality and attracts a price premium, while Asian cuisine does not have a high reputation and attracts a price discount. This result could in part reflect the history of immigration to Australia with the cuisine of more recent migrants trading at a discount to the cuisine of more established migrant communities. It is however interesting to note that contemporary Australian cuisine, which is generally a fusion of Asian and European cuisine, attracts a price premium, and this may suggest an increasing awareness of the quality of Asian cuisine in Australia. The results may also provide some pointers for those

thinking of opening a restaurant in terms of the type of cuisine mostly likely to attract the highest prices.

Figure 1 Cuisine premiums and discounts



There were no prior expectations regarding the impact of a restaurant offering dining in an outdoor setting or in a private room. The empirical results suggest that, other factors constant, restaurants with a private dining room have higher meal prices than restaurants without private dining rooms, and that meal prices in restaurants that have outdoor seating are lower than in restaurants that do not have outdoor seating. Again these finding provide useful information for those in the business of providing restaurant meals. In many circumstances the configuration of a restaurant venue could easily accommodate private dining.

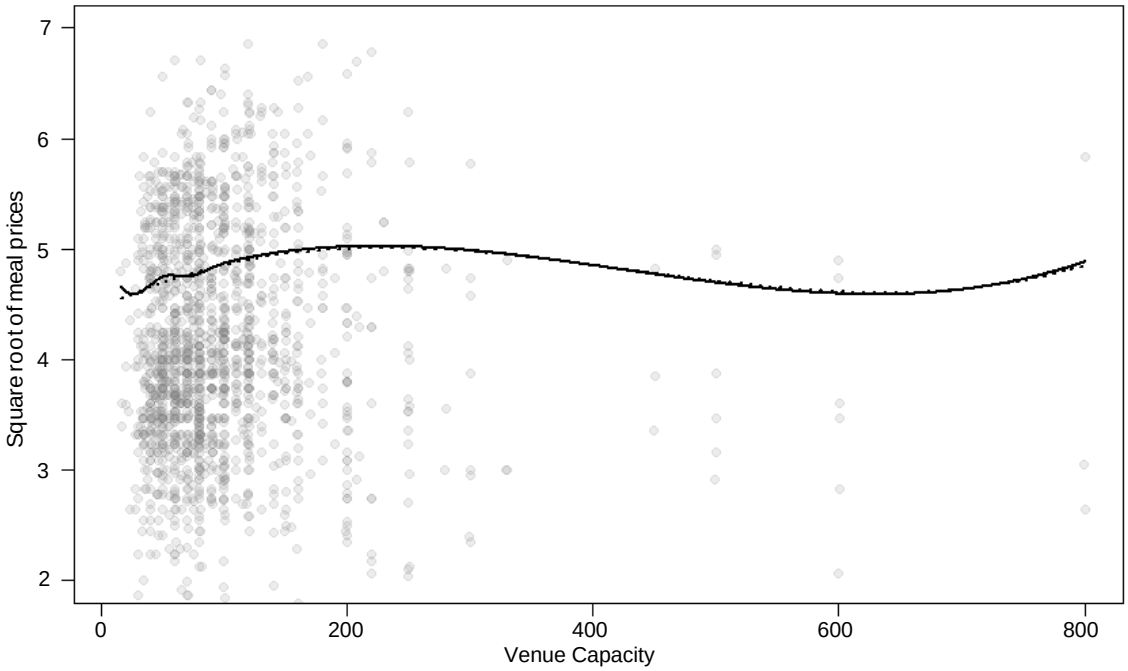
Where this is the case, the empirical results suggest that incorporating such an option will be rewarded in the market with higher average meal prices. Additionally, if a restaurant is considering renovations or refurbishments, the results suggest that an investment in indoor dining renovations would be a better investment than adding an outdoor dining area.

A final area of investigation was into the implied impact of venue size. Venues in the sample ranged in size from 16 seats to 800 seats, although most venues catered for between 30 and 200 patrons. With no prior expectations for the effect of venue capacity, higher order terms were also considered, and a cubic polynomial for venue capacity appeared to allow enough flexibility to adequately describe the effect of venue size. The point estimates for venue capacity imply increasing meal prices as venues increase in size up to 227 seats, then falling prices as venues further increase in size up to a capacity of 637. After this point prices again increase with larger venue size, but there are very few observations for restaurants this large.

To test the reasonableness of the cubic polynomial specification for venue capacity, a model was also fitted using a spline function with four knots and a cubic polynomial for each segment. To evaluate the performance of the spline model compared to the standard model, predicted values from both models were generated for venues of different capacity, where to generate the predicted values mean values were used for restaurant rating, location, and cuisine type, the wine rating is one, the cuisine type is modern, and there is no private dining room or outdoor dining. The results are shown in Figure 2, where the shading in the figure shows the distribution of the observations in the sample. The main

difference between the standard model and the spline model appears to be for venues with a very small capacity. As there are very few observations in this range, it is thought that the standard model performs adequately. As an additional check the point estimates for all other variables generated when using the spline model were compared to the point estimates from the standard model, and none of the point estimates were found to be statistically different, and in general most point estimates were almost identical.

Figure 2 Venue size impact linear model vs spline model



Note: Due to difficulty fitting a spline within the R software package *ivreg*, the approach taken to generate the comparison was to use a two-step OLS estimation approach to deal with the endogeneity issue.

4. Conclusion

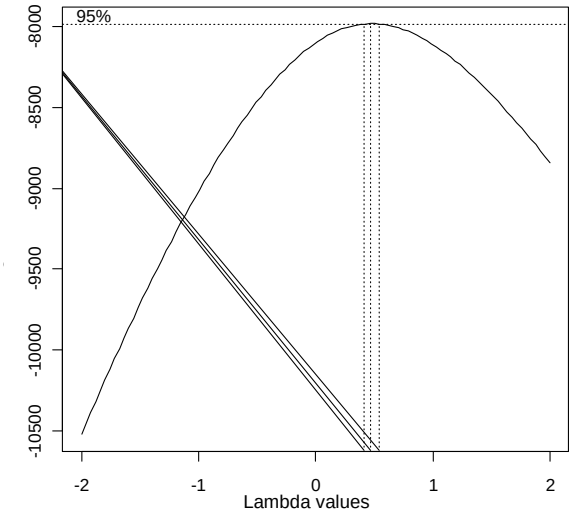
Since federation in 1901 Australia has been a nation that has welcomed migrants from across the globe. In addition to the valuable economic contribution these migrants have made, they have also brought with them the cuisine of their country of origin. This means that today there is a wide variety of cuisine types to select from when dining out in Australia. The current study used the hedonic price approach, and controlled for endogeneity with respect to individual restaurant

reputation ratings, to provide insights into the Australian market for restaurant meals. Key findings were that restaurant critic ratings are important; investing in the restaurant wine list is rewarded with higher prices; and that other factors constant, European food tends to attract higher prices than Asian food. It was hypothesised that the cuisine reputation effect is in part related to the length of time a substantial migrant community from the country of each cuisine type has been established in Australia.

Appendix

Formally, the approach to determining functional form can be understood as follows. Let **Y** be the (1,616 × 1) vector of meal prices, let **e** be a (1,616 × 1) vector of zero mean error terms, and let **Z** be the (1,616 × 38) matrix of regressors such that the columns of **Z** are as described in Table 3 of the main paper. The regression $\boldsymbol{Y}^{\lambda_i} = \boldsymbol{Z\beta} + \boldsymbol{e}$ was estimated via the method of maximum likelihood where the λ_i values varied between minus two and two with steps of 0.1. The log-likelihood values for each λ_i were then plotted along with the 95 percent confidence interval for the optimal λ_i. The result is shown in Figure A1, and as can be seen, the square root transformation cannot be rejected as the optimal transformation.

Figure A1 Selecting a functional form transformation



The approach to testing for endogeneity was as follows. Let the matrix **X** be identical to the matrix **Z** except for column (4), where the restaurant rating for 2007 has been replaced by the restaurant rating for 2006, which is exogenous. Additionally, let **s** denote the (1,616 × 1) vector of restaurant ratings in 2007, and let **y** be the (1,616 × 1) vector representing the square root of meal prices. First, the regression $\boldsymbol{s} = \boldsymbol{X\phi} + \boldsymbol{v}$ was estimated, where $\boldsymbol{v}$ is a zero mean error term, and the residuals $\widehat{\boldsymbol{v}}$ were saved. Next, the regression $\boldsymbol{y} = \boldsymbol{Z\beta} + \delta\widehat{\boldsymbol{v}} + \boldsymbol{e}$ was estimated, where the statistical significance of the δ term was used as the basis for determining whether endogeneity was a problem. The heteroskedastic robust t-statistic for the δ term was 13.1, which indicates that $plim\ \frac{\acute{\boldsymbol{Z}}\boldsymbol{e}}{N} \neq \mathbf{0}$ so that the OLS estimator $\left(\acute{\boldsymbol{Z}}\boldsymbol{Z}\right)^{-1}\acute{\boldsymbol{Z}}\boldsymbol{y}$ is not consistent. Regarding the strength of the instrument, note that in the regression $\boldsymbol{s} = \boldsymbol{X\phi} + \boldsymbol{v}$ the $\hat{\phi}_4$ term provides an indication of the strength of the relationship between the restaurant rating in 2007 and the restaurant rating in 2006, controlling for the influence of all other exogenous variables. As the heteroskedastic robust t-statistic for $\hat{\phi}_4$ was 42.06, the instrument is considered a strong instrument, and so the variances associated with

the consistent IV estimator $\left(\acute{\boldsymbol{X}}\boldsymbol{Z}\right)^{-1}\acute{\boldsymbol{X}}\boldsymbol{y}$ are unlikely to be substantially greater than those associated with the inconsistent OLS estimator.

References

ABS (2008) *2008 Year Book Australia*, Australian Bureau of Statistics, ABS Catalogue No. 1301.0.

ABS (2001) *2001 Year Book Australia*, Australian Bureau of Statistics, ABS Catalogue No. 1301.0.

Chossat, V. and O. Gergaud (2003) Expert Opinion and Gastronomy: The Recipe for Success", *Journal of Cultural Economics*, Vol. 27, No. 2, pp. 127-141.

Combris, P., S. Lecocq and M. Visser (1997) "Estimation for a Hedonic Price Equation for Bordeaux Wine: Does Quality Matter?", *Economic Journal*, Vol. 107, No. 441, pp. 390-402.

Combris, P., S. Lecocq and M. Visser (2000) "Estimation for a Hedonic Price Equation for Burgundy Wine", *Applied Economics*, Vol. 32, No. 8, pp. 961-967.

Evans M. and S. Thomsen (eds) (2005) *The Sydney Morning Herald Good Food Guide 2006*, Penguin Group, Camberwell, Victoria.

Gregoire, T.G., Q. F. Feng, J. Boudreau, and R. Nelson (2008) "Regression Estimation Following the Square-Root Transformation of the Response", *Forrest Science*, Vol. 56, No. 6, pp. 597-606.

Grundy, R. (ed.) (2005) *The Age Good Food Guide 2006*, Penguin Group, Camberwell, Victoria.

Kennedy, P. (1986) "Interpreting Dummy Variables", *Review of Economics and Statistics*, Vol. 68, No. 1, pp. 174-175.

Landon, S. and C.E. Smith (1998) "Quality Expectations, Reputation, and Price", *Southern Economic Journal*, Vol. 64, No. 3, pp. 628-647.

Landon, S. and C.E. Smith (1997) "The use of Quality and Reputation Indicators by Consumers: The Case of Bordeaux Wine", *Journal of Consumer Policy*, Vol. 20, pp. 289-323.

Letherlean J. and N. Wilden (eds) (2006) *The Age Good Food Guide 2007*, Penguin Group, Camberwell, Victoria.

Livat, F. and N. G. Vaillant (2006) "Expert Opinion and Brand Reputation: An Analysis from a French Cuban Cigars Guidebook", *Applied Economics*, Vol. 12, No. 2, pp. 97-100.

Nerlove, M. (1995) "Hedonic Price Functions and the Measurement of Preferences: The Case of Swedish Wine Consumers", *European Economic Review*, Vol. 39, No. 9, pp. 1697-1716.

Oczkowski, E. (1994) “A Hedonic Price Function for Australian Premium Table Wine”, *Australian Journal of Agricultural Economics*, Vol. 38, No. 1, pp. 93-110.

Oczkowski, E. (2000) “Hedonic Wine Price Functions and Measurement Error”, *Economic Record*, Vol. 77, No. 239, pp. 374-382.

Rosen, S. (1974) “Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition”, *Journal of Political Economy*, Vol. 82, No. 1, pp. 34-55.

Schamel, G. and K. Anderson (2003) “Wine Quality and Regional Reputation”, *Economic Record*, Vol. 79, No. 246, pp. 357-369.

Shapiro, C. (1983) “Premiums for High Quality Products as Returns to Reputations”, *Quarterly Journal of Economics*, Vol. 98, No. 4, pp. 659-679.

Suits, D.B. (1984) “Dummy Variables: Mechanics v Interpretation”, *The Review of Economics and Statistics* Vol. 66, No. 1, pp. 177-180.

Thomsen S. and C. Keenan (eds) (2006) *The Sydney Morning Herald Good Food Guide 2007*, Penguin Group, Camberwell, Victoria.

Triplett, J 2004. Handbook on Hedonic Indexes and Quality Adjustments in Price Indexes: Special Application to Information Technology Products. STI Working Paper, OECD.