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The valuation of market information from livestock selling complexes[†]

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The efficient operation of livestock markets is contingent upon producers accessing relevant market information which assists adjustment to production and distribution. This article provides an analysis of the value of market information gleaned by producers attending public livestock auctions. The article uses the Travel Cost Method to quantify the value of this information and notes the limitations of applying the Travel Cost Method in this context.

1. Introduction

This article represents an attempt to value the information livestock producers gain from direct access to public saleyards. While we recognise that the information from livestock marketing reports has many public good characteristics and, in some respects, is illustrative of the government's responsibility to provide an environment where transaction costs are minimised, we contend that direct visits to saleyard venues provide the opportunity for visual comparison of outputs and the inclusion of qualitative assessments inaccessible from market reports.

Traditional valuations of market information have focused on the outcome of employing that information (see, for example, Groebner and Shannon 1992, pp. 659–63). However, this study has adopted a different approach. Effort has been directed to uncovering the value of market information gained by saleyard visits by applying the Travel Cost Method (TCM) usually reserved for valuing environmental goods. It has been assumed that users of saleyards would reveal their demand for market information through their travel frequency to the saleyard venue. Moreover, the rational 'consumer' of this information would disclose their reservation price via travel expenditure.

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The article is divided into seven sections. Section 2 presents the background to the market information generated by livestock selling complexes. Section 3 examines the theoretical framework which underpins this study while the application of this framework is described in section 4. The results of the TCM are presented in section 5. Section 6 analyses these results, and the article concludes with a review of other issues which derive from this analysis.

2. Background to livestock market information

Studies have shown that less volatile saleyard prices are attained where the volume of livestock is sufficient to generate considerable buyer interest (Hall and Todd 1981; Saleyard Working Party 1986). Of special importance in the present context is the capacity of well-attended saleyards to generate market information for the benefit of producers, including those who choose not to use the saleyard system to transact in livestock. However, such information may not be evenly distributed, particularly where the number of buyers and sellers is reduced. Indeed, where the sale is restricted to only one buyer and one seller, a bilateral monopoly could develop where price, rather than reflecting the opportunity costs of production or the preferences of buyers, may simply reflect the relative strengths of the two parties. Information may be distributed asymmetrically between the two parties, especially where livestock are sold directly to processors. Processors generally employ agents who act on their behalf, securing livestock that possess predetermined characteristics. Such agents interact frequently in both the direct selling and saleyard markets and are generally armed with current market intelligence. Producers, on the other hand, may sell livestock only once or twice per year. The information base available to such producers may be significantly less than that available to buyers. The findings of recent research funded by the Meat Research Corporation (MRC) supports this view observing that 'the selling decision is particularly difficult for direct sellers who must confront unknowns about the competitiveness of price and grading in relation to the consignee's particular livestock' (AACM International 1995, p. vi). Moreover, the same research indicates that competitive quotes gained from saleyards are the penultimate source of information for producers involved in direct selling (ibid., p. 10). The point is that market information gained from saleyards thus has value to all livestock producers whether they choose to buy and sell livestock in saleyards or not.

3. Theoretical framework

3.1 The benefits of perfect information

Carlton and Perloff (1994, pp. 555–6) identify several reasons why imperfect information may arise. First, the information itself may be inaccurate and unreliable. Second, the cost of collecting information implies that even rational market participants will not access all available information. Third, it is not possible for human market participants to retain all information due to bounded rationality (Williamson 1964). Finally, the limitations of human beings may be such that they lack the skills, knowledge or intelligence to process information on products even within a bounded rationality framework.

The consequences of imperfect information on market outcomes has also been well explored. A variety of models have been presented to trace the impact on prices where information is less than perfect. For example, in his classic study of the market for used cars Akerlof (1970) showed that a bias of information in favour of sellers leads to either the collapse of the market altogether or transactions in lower quality goods. Moreover, this information asymmetry and the consequent adverse selection result in a divergence from the efficient outcomes typical of competitive markets. In effect, imperfect information makes it impossible or impractical for the producers of high quality outputs to internalise the benefits of quality production. In these circumstances quality becomes an expensive externality which places a given producer at a cost disadvantage relative to the producers of inferior outputs.

Modelling of the costs involved in the collection of information and the effect of limited information on market power is also a theme within the literature. For example, tourist-trap models suggest that firms will maintain sales at prices in excess of the competitive price where search costs are positive (Carlton and Perloff 1994, p. 569). Such conclusions imply that firms gain market power from imperfect asymmetric information and may be well served to generate price and quality dispersions within the market. These dispersions raise search costs and thereby increase market power (Scitovsky 1950). Only when search costs are completely eliminated can the efficiencies generated by the neo-classical competitive market be captured (Carlton and Perloff 1994, p. 571).

The modelling of 'tourist' behaviour has been extended by considering markets where uninformed 'tourists' operate alongside informed 'native' market participants (Carlton and Perloff 1994, p. 572). In general, these models emphasise the relative size of the two categories of market participants. As the proportion of 'native' market participants increases, the market price converges on the competitive equilibrium price. However, market power can again be derived from imperfect knowledge. Sellers, by raising search costs, can effectively alter the slope of their respective demand curves and approach monopoly price settings.

In many agricultural markets the distribution of information favours buyers of agricultural outputs rather than the producers. In these markets, it may be more appropriate to address the asymmetry of information in terms of monopsony power rather than monopoly power. For example, in reviewing the operation of the Flemington fresh fruit and vegetable market, Tunstall (1992) noted that control of market information by buyers or wholesalers was crucial to the maintenance of market power by buyers. This market power related directly to the private treaty method of sale and the absence of a competitive and open auction system.

There is a similarly perceived bias in favour of buyers in livestock markets. If the theoretical treatment of this bias is correct, there will be a resultant shift of market power towards buyers. Presumably, this will be particularly significant where there are relatively few buyers and collusive behaviour becomes practicable. Under such circumstances producer gains from any increase in market information will be significant since such information provides a degree of countervailing power against potential monopsony or oligopsony. However, rational producers will not access all information. Rather, their preference will be to access information up to the point where the marginal benefits of that information equate its marginal costs. Accepting this theoretical framework permits an assessment of the value of market information derived from saleyards.

3.2 Valuing market information from saleyards

Studies of livestock market intelligence on behalf of the MRC indicate that producers recognise the value of market information, expressing a mean willingness to pay (WTP) of $79 per producer annually for additional market information (AACM 1995, p. 13). However, such estimates show no deliberate effort to disaggregate the value of current sources of livestock market information. Empirical research into non-market environmental goods reveals two broad approaches which may be useful in the current context. First, the Contingent Valuation Method (CVM) could be used to ascertain the mean WTP for the information that producers currently gain from saleyards. Second, the TCM could be employed to reveal such valuations.

CVM uses survey methodology to construct a scenario where respondents reveal their preferences via WTP questions. While most applications of CVM have concentrated on valuing environmental amenities (see, for example, Bishop and Heberlein 1986; Carson 1991; Hill 1994), a number of recent studies point to a wider acceptance of CVM in other fields of research. For example, McLeod, Roberts and Syme (1994) used CVM to value the provision of extension services provided by the Western Australian Agricultural Protection Board. Similarly, CVM was used by Anaman and

Lellyett (1996) to value the provision of weather information to the Sydney metropolitan area. However, the application of CVM in this case faces significant limitations.

In the current context WTP questions would require respondents to disaggregate their WTP for saleyard information from other sources of livestock market information. This creates operational constraints partly because the value set surrounding such issues is unlikely to be well defined by the individual. Questions asking respondents their WTP for saleyard information also seem likely to invoke strategic biases and protest zero responses because of the anxiety created by such questions. Finally, WTP questions about saleyard information are also likely to be subject to problems of embedding where respondents, unable to disaggregate the value of saleyard information, aggregate other issues within the valuation framework. This could manifest itself in the aggregation of all market information within the valuation or the aggregation of all services provided by the saleyard in question. (For a complete treatment of issues surrounding embedding within WTP responses, see, for example, Lockwood 1992.)

An alternative approach is to use the TCM. This technique was first suggested by Hotelling in 1947 as a method of estimating the value of environmental services (Johansson 1991, p. 128). Later Clawson (1959) and Clawson and Knetsch (1966) developed the first empirical models along the lines suggested by Hotelling (Bateman 1993, p. 192). In its simplest form the TCM uses the expenditure incurred by individuals in visiting a particular site as a surrogate for the price paid to acquire the benefits available at that site. Survey responses from site visitors are used to source data on travel distances, trip information, and socioeconomic features of respondents. These data are then used to construct a Marshallian demand curve with estimates of consumer surplus used to derive a total value of the site. The TCM could be employed in this case by surveying producer visits to saleyard venues and assuming that visits are primarily for the purpose of gathering market intelligence.

The TCM generates a trip generation function similar to that described by:

$$V = f(C, X) \tag{1}$$

where V is the number of visits to a site, C is the cost of the visit and X represents other socioeconomic variables which explain the number of visits. Changes to the visitation rate, V, can then be mapped against changes in the cost, C, by assuming that visitors would respond to increments in a hypothetical entrance fee. Bennett (1996, p. 4) notes that the TCM methodology requires an acceptance of three basic assumptions. First, the benefit arising from any visit by one individual is equivalent to that of another who has incurred similar travel costs. Second, the consumer surplus attributed to the most distant visitor to a site is zero. Third, visitors from a particular zone or region bear similar travel costs to other visitors from the same region. The last of these assumptions is most significant when employing the zonal TCM rather than the individual TCM.

The zonal TCM redefines equation 1 by constructing concentric travel distances around the site and transposing information to the total population within these zones. The generalised form for a zonal TCM can be represented by:

$$V_{hi}/N_h = f(C_h, X_h) \tag{2}$$

where V_{hi} represents visits from zone h to site i, N_h is the total population of zone h, C_h is the cost of travel from zone h, and X_h are other socioeconomic variables in zone h. The visitor rate, V_{hi}/N_h, is often expressed as visitors per thousand. A second stage estimation is applied to equation 2 which maps the impact of a hypothetical entrance fee on the visits. Since this version of the TCM requires the aggregation of data into zones, important explanatory variables provided by visitors may be diluted within the model (Bennett 1996, p. 4). Alternatively, use of the individual TCM enables the modelling procedure to be expanded to encompass a wider range of factors which help explain the behaviour of individuals.

The individual TCM allows for the inclusion of a host of individual-specific variables relevant to the site visitor. An example of an individual trip generation function described by Bateman (1993, p. 203) is represented in equation 3.

$$V_{ij} = f(C_{ij}, E_{ij}, S_i, A_i, Y_i, H_i, N_i, M_i) \tag{3}$$

where V_{ij} is the number of visits made per year by individual i to site j, C_{ij} is individual i's costs of visiting site j and E_{ij} represents the estimate by individual i of the proportion of the day's enjoyment attributable to site j. The other explanatory variables, S_i, A_i, Y_i, H_i, N_i and M_i reflect the availability of substitute sites as assessed by the individual, age, income, household income, size of travelling party and membership of outdoor organisations relevant to individual i respectively. Since the demand curve in the individual travel cost method relates the site visits directly to the cost of visits, there is no need to undertake the second stage estimation used in the zonal travel cost method through the application of a hypothetical entrance fee. The choice between the individual TCM and the zonal TCM is determined largely by the frequency of site use by surveyed individuals. Where a large proportion of those surveyed make recurrent visits to the site, the individual TCM is likely to be more appropriate (Bennett 1996, p. 4).

Issues of functional form are also prominent in discussions on the application of the TCM. In the absence of any pressing theoretical constraints, most researchers have opted to experiment with a variety of functional forms to depict the relationship between travel cost and visitations. Linear, quadratic, semi-log and log-log specifications are all found in the literature. None would appear to be superior on theoretical grounds alone although 'log forms may be useful for elasticity estimates and have the advantage of avoiding negative values for the dependent variable' (Bateman 1993, p. 223).

Finally, it is worth noting that the TCM cannot produce a total value for the aggregate information generated by saleyards. First, attendance at livestock markets is not always necessary to access livestock market information. Second, it has been assumed throughout that producers gain the largest benefit from saleyard information since buyers and processors have access to a wider and more refined network of market intelligence. However, part of this network is saleyard information. Isolating the population of information beneficiaries to livestock producers discounts any benefits accruing to livestock buyers and processors.

4. Administration of TCM

A survey was designed to provide data suitable for modelling the value of market information using the TCM. The Wodonga saleyard was selected since it was the largest saleyard in Victoria (Municipal Saleyards Association 1996) and had a relatively comprehensive data set, including a list of clients selling cattle comprising approximately 7 000 individuals and firms. A pilot survey was designed and mailed to 35 saleyard clients. After one month only five valid responses had been returned representing a response rate of just 14 per cent. This led to the use of a telephone survey instead. The telephone survey comprised three parts examining the livestock holdings of respondents, trading patterns and visits to the Wodonga saleyards, and spending by individuals in the Wodonga area. Once again, a pilot sample was randomly drawn from the client list supplied by the Wodonga saleyards.

In the full survey, respondents were questioned about their frequency of visits to the saleyard, travel distance, travel time to the saleyard, and other activities undertaken during the course of a typical saleyard visit. Questions were also asked about the respondents' perceptions of market information from saleyards and exposure to alternative livestock selling methods. The travel costs of respondents were considered to be of paramount importance. Thus, variability in the travel distance of respondents in the pilot was used to estimate an appropriate sample size. Given the saleyard's location is approximately 10 km from the city centre, it was expected that the estimated travel distance would lie within 10 km of the mean. Assuming a 95 per cent confidence interval produced a sample size of 98. The combined proportion of those to whom the survey was not relevant and those who could not be identified or contacted was approximately 60 per cent. Thus, to achieve an appropriate sample size, 300 clients were randomly selected from the client list with interviews being administered via the same methodology employed in the pilot study.

5. Results

Details of the contact and response rates in the larger telephone survey appear in table 1. Some 34 per cent of those identified from the client list were contactable and 92 per cent of those contacted provided valid responses.

It was assumed that travel costs included the opportunity cost of labour since the direct utility derived from the journey was assumed to be of little importance. Moreover, the primary motive for the saleyard visit was assumed to be work-related. The wage rate was assumed to be $12.00 per hour since this is the approximate cost of casual agricultural labour (Elton 1997, p. 47). It is important to note, however, that the opportunity cost of time for many farmers not employing labour would be significantly less than this value. Vehicle running costs were set at a rate equivalent to a Ford Falcon, less than five years old, and estimated at 54.87 cents per km (NRMA 1996, p. 24).

Almost 70 per cent of respondents indicated that they undertook other activities during the course of a saleyard visit with the majority taking the opportunity to purchase groceries or farm supplies. Anecdotally, some producers are also attracted to livestock sales by the social intercourse at sales as well as the information benefits. One technique to account for the problem of multiple purpose travel is to weight travel costs according to the relative importance of the destination. However, in the context of the current research this may simply deflate the value of travel expenditure for those producers who are predisposed to coordinate multiple tasks with a single visit to town. Moreover, a review of the data revealed that those producers

Table 1 Response and contact rates for telephone survey of saleyard users, Wodonga, 1997

Response	Number of respondents
Valid responses	106
No listing	88
Unable to contact	34
Not using saleyards in last 12 months	64
Non-response	8

who are more distant from the saleyard were more likely to coordinate a number of activities with their attendance at the saleyard. Weighting travel costs according to other activities may seriously undervalue the significance of the market intelligence gained by these producers if the sale was the principal stimulus for the journey. This is supported by Clawson (1959, p. 17) who observes that 'if some form of trip cost allocation to different objectives were made, . . . this might well change the nature of the curve somewhat, to make it more elastic at the low volume-high price end'. Accordingly, travel costs were not weighted by other activities undertaken during the course of the saleyard visit.

The total number of visits was calculated by examining the frequency of buying and selling in saleyards and weighting these frequencies according to respondents' own assessments of their personal attendance at the saleyard. Those who stated that they 'sometimes attended' a sale if they were buying or selling were given a weighting of 0.5. For example, a respondent claiming to have sold livestock 4 times in the last twelve months and 'sometimes attended' was assumed to have visited the saleyard twice. The frequency of attendance during buying and selling visits was then summed with respondents' estimates of other visits not directly associated with the sale or purchase of livestock. There may be some conjecture about this method of calculating saleyard visits. It could be argued that only visits not directly associated with a sale or purchase represent the gathering of market intelligence by producers. However, apart from information on comparative quality or suitability of stock, producers also learn at what point in the sale livestock were sold. Anecdotally, this factor, too, has a bearing on the ultimate prices achieved. Thus, any visit to the saleyard was assumed to yield market information which could not otherwise be obtained.

Respondents were also asked to rank the value of saleyard visits as a source of information between 'very important' and 'irrelevant'. A four-point Likert scale was provided for this purpose. Care was taken to distinguish saleyard visits from livestock reports published in the media. The question was divided into two parts requiring a separate ranking for selling and for buying livestock. Saleyard visits were ranked as a 'very important' source of information when selling livestock by 40.6 per cent of respondents. A further 31.1 per cent regarded saleyard visits as 'important' when selling. Saleyard visits would appear to be less influential as a source of information when buying livestock. The proportion of respondents stating that saleyard visits were 'very important' and 'important' when buying livestock was 36 per cent and 10 per cent, respectively. Some studies have used such subjective rankings to further weight travel costs (see, for example, Bennett 1996, p. 8). This procedure was not adopted in this case since use of the individual TCM allows for the inclusion of these rankings as a separate explanatory variable, which was included in the analysis with 0.25 = irrelevant, 0.50 = of little use, 0.75 = important, 1.0 = very important.

Data on travel costs are usually collected at the site of the subject of the valuation. Thus, only those that have already undertaken some travel expenditure are included in the data set. In this case, not all respondents had undertaken travel expenditure, with 50.9 per cent indicating that they never attend the saleyard when selling livestock and 76.4 per cent indicating that they never attend when buying livestock. Moreover, 54 per cent of respondents indicated that they never visit the saleyard for 'other' purposes. Inclusion of these respondents in the analysis of travel cost would distort results, producing a downward bias on estimates. Those respondents not visiting the saleyard site were therefore excluded from further statistical estimation which reduced the total of usable responses to 63.

The size of the livestock enterprise was assumed to have some influence over respondents' visitation frequencies. Since comprehensive details of livestock numbers were also provided by respondents, it became necessary to subsume this information into a single index for inclusion as a variable in regression estimates. Livestock were weighted according to their dry sheep equivalents to produce a total index of the livestock holding of each respondent.

The individual TCM was chosen since it permits examination of other explanatory variables such as the size of livestock enterprises and avoids the subjective weighting of saleyard visits in line with respondents' expressions of the relative importance of those visits. Various functional forms were considered including linear, quadratic, semi-log and double-log forms. The estimated individual travel cost models are presented in table 2.

Table 2 Models of individual travel costs

	Estimated coefficients					
Model	Constant	Travel cost (TC)	Stock index	Importance of saleyard	$(TC)^2$	Adjusted R^2
Linear	−6.906 (−1.060)	−0.075 (−2.943)	0.002 (2.895)	27.088 (3.287)		0.24
Quadratic	−4.109 (−0.536)	−0.122 (−1.692)	0.0020 (2.964)	26.259 (3.141)	0.0001 (0.703)	0.24
Log:Linear	0.561 (1.248)	−0.0059 (−3.388)	0.0002 (3.281)	1.837 (3.231)		0.27
Log:Log	1.712 (1.921)	−0.546 (−3.148)	0.391 (3.798)	1.272 (3.296)		0.27

Note: t values in parentheses.

Regardless of functional form, all variables have signs which are consistent with *a priori* expectations and are significant at the 5 per cent level. The visitation rate declines with increased travel costs, larger stock producers visit saleyards more frequently and producers who place greater value on information gleaned from saleyards attend saleyards more often. Functional form has some influence over the explanatory capability of the models with the quadratic form explaining 24 per cent of the variation in the data and semi-log and double log-forms explaining 27 per cent of the variation in the data. Relatively, low adjusted R^2 values are not uncommon for TCM studies since visitor travel behaviour is often explained by other socioeconomic variables for which data are not always readily available (see, for example, Tobias and Mendelsohn 1991, p. 93).

Individual consumer surplus can be estimated by assuming that travel costs act as a proxy for the price of visiting saleyards for the purpose of collecting market information. While the double-log form has simple non-linearity and tends to describe spatial data well, the semi-log form has often found favour in recreational demand analysis. In part, this is due to the simplicity of the consumer surplus computations (Peterson and Styne 1986; Herath and Jackson 1994). More specifically, consumer surplus is determined from the inverse of the travel cost coefficient in the semi-log model. Since the semi-log model performs equally as well as other functional forms in this case, it is chosen to compute the consumer surplus accruing to producers.

The estimated individual consumer surplus is \$169.50. This represents the annual value of market information derived by a single producer directly visiting the saleyard venue. Given that this was derived from a sample of 106 producers and the total client list comprises approximately 7 000 individuals and firms, the total value of information to all saleyard clients is about \$700 000 per year.

6. Discussion

The results presented in section 5 point to significant values for market information derived from direct visits to saleyard venues. However, there are a number of other issues which arise from these results. First, there is some inconsistency between the calculated consumer surplus and other responses provided by saleyard users. The mean number of visits by respondents was 12 per year at an average cost of \$64.76. Thus, while the decision to visit saleyards may not be strongly influenced by travel costs, the frequency and expense of such visits suggest that some benefit must be derived by those individuals who undertake them. Moreover, the high ranking placed by a large number of respondents on saleyard visits as a source of market information points to the need for further investigation of this issue.

Second, there are operational limitations to the application of the TCM in the current context. We noted earlier that this methodology was likely to understate the value of market information gleaned from saleyards since livestock marketing reports provide summary information as a public good. This could also explain some of the inconsistencies in the data described above. More specifically, respondents may value market information from the saleyard, yet since some information can be acquired at zero cost there is no need to undertake travel expenditure to gain such information. While care was taken to distinguish saleyard visits from livestock marketing reports during the administration of the survey, it is possible that some respondents were unable to clearly make this distinction.

A further issue relates to alternative methods of livestock marketing and the potential for ‘free-riders’. The collected data revealed only a modest use of other livestock marketing methods. Almost 36 per cent of respondents reported using direct selling while 0.9 per cent reported using CALM, the computer-based livestock selling system where producers sell their livestock on farm. These results are consistent with data collected by the MRC (see, for example, AACM International 1995, p. 9). It is of interest to note that those respondents reporting use of these alternative marketing methods also indicated a high ranking for the value of information collected during saleyard visits. In fact 73 per cent of respondents who use other marketing methods ranked saleyard visits as either ‘very important’ or ‘important’ when selling livestock. These results support the view that producers acting outside the saleyard system rely on saleyards to provide market indicators in their dealings in other livestock markets.

7. Conclusion

This article has attempted to quantify the value of market information gained by saleyard users through direct visits to livestock selling complexes. The use of the TCM suggests that such information has value for livestock producers. However, other data collected during the course of this study suggest that there may be limitations in employing the TCM methodology in the current context. More specifically, while it would appear that many livestock producers have a preference for gathering market information first-hand, travel costs may not be the appropriate vehicle for assessing the betterment derived from that information.

These results point to cautious application of the TCM beyond its traditional field of research. While other techniques generally reserved for valuing environmental goods have been applied to alternative fields of study with relative success, this study raises some doubt about the flexibility of the TCM methodology.

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