AN OBJECTIVE BRUISE SCORING AND PENALTY SYSTEM FOR THE AUSTRALIAN BEEF CATTLE INDUSTRY

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SUMMARY

Bruising has been widely recognised as a costly problem for the Australian beef industry. Better husbandry can reduce the size of the problem but some economic incentive is required to incite desirable changes. Where cattle are sold directly to an abattoir with price based upon objective specification, it is possible to score bruises on the carcass and give them a market value. A bruise scoring and penalty system is presented which would reward producers who mitigate against bruising and concomitantly reduce the incidence of bruising.

INTRODUCTION

The problem of losses due to bruising of beef cattle prior to slaughter has not been ignored by Australian researchers. The Australian Meat Board (1954) reported upon its importance 30-odd years ago and noted at the time that 10 per cent of carcasses were downgraded due to bruising. Some impressive surveys have since been conducted. Frapple and Bond (cited in Wythes and Shorthose, 1984) surveyed 250,000 carcasses in north-western Australia and found that 30 per cent of them were bruised. Beasley and Hasker (1985) surveyed over 19,000 carcasses in central Queensland abattoirs and reported an average trimming loss due to bruising of 1.3 kg per carcass. Wythes et al (1985) surveyed 35,000 carcasses in a southern Queensland abattoir and reported a similar trimming loss of 1.1 kg per carcass.

Several attempts have been made to estimate the cost of bruising. In 1975 Meischke put the national cost due to bruising at $26.7m whilst in 1982 Shorthose and Wythes put the figure at $36m. These estimates were based upon losses due to trimming, downgrading of cuts and carcasses and reduced abattoir productivity.

In addition to the incidence and cost of bruising, the literature has considered its actual causes. Wythes and Shorthose (1984) reviewed the literature on the causes of bruising and grouped these into characteristics associated with the animal itself and features of the handling methods to which the animal is subjected. Horns, sex and age are examples of animal characteristics which affect the incidence of bruising. On the other hand, the chosen method of sale or method of transport are examples of variations in handling which can affect its incidence.

Given the considerable investigative effort which has gone into the bruising problem, it is inviting to ask what benefits have been brought about. We are inclined to answer 'very few'. It is our contention that the studies to date, concerned with establishing the causes, incidence and cost of bruising have done virtually nothing to bring about desirable change. Despite producers and processors now having an adequate knowledge of how to combat bruising, they are unlikely to act positively until they perceive an economic incentive which will make the concomitant effort worthwhile.

Without an incentive system in place, it is rational for the individual producer and processor to simply free-ride (ie., choose to leave the problem to someone else). We contend that at present, the vast bulk of producers act like free-riders and that this behaviour causes the bruising problem to be more wasteful than it needs to be. Unfortunately, however, the current system also results in the actual cost of bruising being shared among all producers, regardless of whether the individual's cattle are bruised or not. Only when bruising is scored and valued on the individual carcass and the producer's return adjusted accordingly, will there exist an economic incentive to confront and act upon the bruising problem. In this paper, a system is developed which will :

- identify or score bruising on primal cuts of the carcass;
- relate bruising on cuts to penalties which reflect market considerations; and
- demonstrate how returns payable to the producer can be adjusted in the event of bruising.

The system will be objective in the sense that the bruise identification will be based upon bruise trim that causes economic downgrading of particular cuts and the associated penalties will be based upon market realities. Obviously, however, a procedure for scoring and valuing bruises can only apply where cattle are sold direct to an abattoir with price based upon carcass attributes.

METHOD

Two methods of carcass sale exist:

- an average cents per kilogram price for the total carcass weight in the lot; and

- a cents per kilogram price for each carcass depending upon its particular quality attributes. (Australia has a national computerised selling service (CALM) which offers both these selling methods. The CALM selling method based upon average cents per kg is the C sale and the method based upon individual carcass attributes is the G sale).

Pricing on an individual carcass basis is most applicable where the cattle are intended for a 'quality' market eg., 'local trade steer' or 'Japanese'. Bruising on these cattle can result in substantial losses due to downgrading of the bruised cuts from a high to a low quality market. By contrast, cattle intended for a low quality market eg., 'US manufacturing', are likely to be sold on the basis of an average price (cents per kilogram carcass weight) for the lot. Losses due to bruising of low quality cattle will be relatively minor because the potential for downgrading of cuts is limited.

The development of AUS-MEAT has provided the Australian beef industry with an opportunity to reduce losses due to bruising. This opportunity arises because of the emphasis given by AUS-MEAT to objective description and to carcass trading (AUS-MEAT is an all-embracing concept and includes : a) A uniform language to objectively describe/relate livestock, carcasses and meat for cattle, sheep and pigs; b) A monitoring system for recording carcass attributes and quality standards

and providing assurances of quality; c) A basis for promoting efficient trading systems and the popularity of Australian meat.

Objective description refers to the practice of measuring key attributes of a carcass. The trading of carcasses on the basis of objective description allows the maximum possible scope for accurate pricing in terms of end-use-value (ie., as meat).

In practice, a bruise might be found anywhere on the carcass. In designing a workable system, however, it is necessary to limit the area that can qualify for a bruise. Such limits can be set in terms of :

- particular primal cuts recognised and used by the meat trade; and
- the economic importance of particular cuts as given by their size relative to the whole carcass, their loss in value once bruised and the frequency with which particular cuts suffer bruising.

Beasley and Hasker (1985) considered all these factors and reported that four cuts need to be included in a bruise scoring system. These are the silverside, the full rump, the striploin and the blade. These cuts are coded as C2020, B1570, B1560 and C2300 respectively in the Handbook of Australian Meat (1986). Other cuts on the carcass eg., tenderloin, knuckle, etc., are either relatively unimportant (in terms of being a low proportion of the total carcass or suffering little loss in value once bruised) or incur a low incidence of bruising in practice (Beasley and Hasker 1985).

Having specified the carcass area upon which a bruise can be scored, it is necessary to define what level of damage constitutes a bruise. This definition needs to recognise that in some circumstances a bruise will not be big enough to cause the particular cut to be downgraded (ie., sold for less cents per kilogram). In these circumstances, the processor has not lost because the weight associated with the bruise has been trimmed off before the scales.

A bruise is defined here as follows :

A bruise will be 'scored' if it causes trimming down to the muscle tissue (of a designated cut) of an area greater than 100mm in diameter.

Scoring over the cutting line must be done with care since the definition requires the minimum area to fall completely within the boundaries of the cut. Thus in the event of a bruise straddling two cuts (eg., rump and loin) it would need to be exceptionally large to receive a score.

Given the bruise definition, scoring can be done on the slaughter floor as follows :

Primal Cut Bruised	Score
None	n
Silverside	s
Rump	r
Striploin	l
Blade	b
All cuts bruised	e

The abattoir grader inspects each carcass side then keys in the appropriate bruise score. Three data fields are required to accommodate every possible combination eg., s r l, if the silverside, rump and loin are all bruised. The alpha code/score serves three purposes : 1.it assists the grader to make the connection between particular primal cuts and the keyboard; 2.it provides a basis for feedback to the producer; and 3. it allows each score to be related (by the computer) to a penalty factor.

Thus, operation of the system at the slaughter floor stage is very simple. The more complex task of relating the score to a penalty and adjusting gross return accordingly is a 'black box' function performed by the computer.

DOWNGRADING OF BRUISED CUTS

Abattoirs throughout Queensland were questioned about the consequences of bruising on market destination, and hence pricing, for particular cuts. It was found in those situations where market downgrading occurs, the price differential remains relatively constant, regardless of movements in the general price level. Constant price differentials, together with weight relationships are used in Table 1 to derive bruise loss and penalty factors for each cut. The penalties are designed to apply to the whole carcass weight. With a silverside for example, the loss of 58 cents per kg is equivalent to a loss of 2 cents per kg for the whole carcass.

Table 1. Derivation of bruise penalties

Primal cut		Proportion of carcass (a)	Cost of bruising * (b)	Bruise loss factor (a x b)
		%	¢/kg	¢/kg
Silverside	s	3.5	58	2.0
Rump	r	1.9	113	2.1
Loin	l	1.8	164	3.0
Blade	b	2.9	43	1.2

* These costs are based on market downgrading due to bruising. The unbruised values used for the silverside rump, loin and blade were 360, 393, 426 and 310 cents per kg respectively, and the bruised values used were 302, 280, 264 and 265 cents per kg respectively. Thus, the cost of bruising a silverside (58 cents per kg) is given by 360-302.

With the possibility of no bruising or a combination of four bruises, there exists 16 possible combinations of scores, each of which must have a unique penalty factor. These penalty factors must be added for each side and multiplied by the carcass weight to give the amount ($) by which the gross return must be adjusted to give a net return after bruising. Thus, in the case of no bruising (ie., a score n) the penalty factor is zero. A complete list of the penalty factors, expressed in dollars per kilogram, is given in Table 2.

Table 2. Combination of bruise scores and corresponding penalties

Bruise score combinations	Penalty factor (carcass basis) $/kg
No score n	0.000
s	0.020
l	0.030
r	0.021
b	0.012
sl	0.050
sr	0.041
sb	0.032
rl	0.051
rb	0.033
bl	0.042
srl	0.071
slb	0.062
srb	0.053
brl	0.063
e	0.083

The magnitude of the penalty factors take into account many influences including :

- The opportunity loss caused by bruising; this will range upwards from zero, depending upon the difference between intended or potential market and the actual market for the cut once it is bruised.
- The point at which the bruising is valued - namely, at the scales. At this point, the cost of any bruising will not be quite as large as in the boning room or butcher shop where valued adding processes take place.
- The fact that bruising can be caused by either the producer or the processor and therefore its cost might be somehow shared.

As already explained, the potential for down-grading due to bruising varies between carcasses depending upon market destination before and after bruising. In general terms, the potential for bruise related losses is greater in cattle destined for 'quality' markets. Despite this, it is proposed that a single set of penalties will be applied to all carcass descriptions, regardless of market destination. Accordingly, the penalties shown in Table 2 reflect the opportunity losses from bruising applicable to the full range of slaughter cattle likely to enter a large-scale abattoir. The penalties were 'generalised' in this way for several reasons:

- regardless of market destinations, bruising causes losses (eg., productivity losses on the slaughter floor) and therefore should be confronted by an economic disincentive; and
- a bruise scoring and penalty system must be kept simple if it is to have any practical value.

Operation of the system

To this point, the paper has covered identification and scoring of bruises on the slaughter floor and the determination of penalties for particular bruise score combinations. The computer functions required by the system will now be explained with the aid of examples.

Once the side bruise scores are registered, the computer then relates these to particular penalty factors. The penalty factors are then added and multiplied by the relevant carcass weight to determine the cost of the bruising and subsequently the net carcass return.

The calculation involved is thus :

$$NCR(\$) = [(ws_1 + ws_2)\ P_g] - [(bs_1 + bs_2)\ w_{sl + s2}]$$

Where : NCR = net carcass return; w = weight; s_1 = side one; s_2 = side two; P_g = price for a particular grade ($); b = bruise penalty

Example 1

The procedures to calculate the net return for a domestic trade carcass with side weights of 109kg and 111kg returning $1.90/kg and with bruise scores of s and sl are as follows :

NCR($) = [(109 + 111) 1.90] - [(0.02 + 0.05) 220]
= 418.00 - 15.40
= 402.60

In this case, bruising would cost the producer 3.7 per cent of his potential return.

Example 2

For the case of a 'Jap ox' carcass with side weights of 150kg and 151kg, priced at $2.20/kg and with bruise scores of n and r, the calculation would be as follows :

NCR($) = [(150 + 151) 2.20] - [(0.0 + 0.021) 301]
= 662.20 - 6.32
= 655.88

The opportunity loss in this case would be less than one per cent.

Example 3

For the case of carcass destined for the US manufacturing market with side weights of 120kg and 124kg priced at $1.70/kg and with bruise scores of rb and srb, the calculation would be as follows :

NCR($) = [(120 + 124) 1.70] - [(0.033 + 0.053)244]
= 414.80 - 20.98
= 393.82

The opportunity loss in this case would be 5%.

Several of the computations shown in the above examples are 'black box' functions and are not revealed to the producer on their feedback sheet. A direct sale feedback sheet should give the producer individual carcass data which relate objective measurements to price received. An example of a producer feedback sheet based upon the three examples given above is provided in Table 3.

Table 3. Aspects of the bruise scoring system that would appear on the producer feedback sheet

Carcass wt kg	Price ¢/kg	Bruise Score	Bruise adj. $	Net return $
220	190	s sl	15.40	402.60
301	220	n r	6.32	655.88
244	170	rb srb	20.98	393.82

CONCLUDING COMMENTS

This paper developed a bruise scoring system for cattle sold by specification direct to an abattoir and demonstrated how this system would work in practice. The authors consider the system to be as objective as current knowledge and abattoir technology will permit. Furthermore, the system is regarded as compatible with the AUS-MEAT language and specification selling. The system will allow processors to effectively pay a premium price for unbruised cattle and thereby encourage producers to pursue husbandry practices that mitigate against bruising.

The corollary is that producers who either fear the imposition of an explicit bruise penalty or who cannot implement practices to reduce bruising will be disinclined to sell on a carcass quality basis. To the extent this applies, marketing efficiency will be impaired. Progressive producers, however, will view a bruise scoring system as a means by which the market place can more fully and fairly reward their attempts at excellence.

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