THE ECONOMIC IMPACT OF DARK CUTTING BEEF IN AUSTRALIA

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Abstract - The cost of dark cutting beef to the Australian industry was estimated from Meat Standards Australia (MSA) 2013 data from 9 southern Australian plants (23.24% share of MSA slaughter). To accommodate continuously changing market prices, market options and saleable meat yield, this analysis put in place a number of assumptions so a cost estimate can be made. In this scenario, the 9 southern plants loss for 2013 stands at greater than $16 million (equal to $1.82/kg of saleable meat), of which the producers were penalized $7.58 million. In a further scenario, if markets that will accept AUSmeat colour score 4 are utilized, the industry could recoup somewhere up to $9.4 million. Thus the estimated cost of dark cutting beef for 9 southern Australian processors would lie between $6.68 million and $16 million. When these 2 scenarios are applied to all MSA carcasses graded using national averages for carcass attributes, the scope of the loss is estimated to be between $14.5 million and $44.49 million in 2013 and between $19.05 million and $55.75 in 2014.

Key Words – Meat Standards Australia; pH; Meat colour.

I. INTRODUCTION

Beef carcases that are characteristically dark in colour and high in pH are typically deemed dark cutting. Generally, dark cutting beef results in a product of vastly inferior quality, which is dryer in texture, variable in tenderness and more prone to bacterial spoilage [1,2]. Thus, consumers have been shown to reject these products due to poor palatability [3]. In 1996, the Australian beef industry implemented Meat Standards Australia (MSA), a quality grading system to predict the eating quality of individual beef cuts using critical control points along the supply chain [4]. MSA uses a set cut-off for pH at 5.7 as well as a meat colour threshold based on a colour scale to ensure that an MSA graded product is not dark cutting.

In Australia, 3.04 million carcases were graded for MSA during the 2013-2014 financial year. Of these, 5.63% of carcases were not graded due to unsatisfactory pH and/or meat colour [5]. This percentage of ungraded carcases represents a substantial economic loss based on the MSA premium payment system. MSA graded carcases demand a premium price while those carcases that do not reach the MSA grade are devalued, returning less to the processor with penalties passed on to producers. McGilchrist *et al* 2012 [6] estimated this penalty at $7.09 per carcase graded, equating to an estimated cost to producers throughout Australia of $17 million per year due to dark cutting. However, since the implementation of the MSA grade, no estimate of the cost to either the producer or processor has been made.

This Paper aims to determine the cost of dark cutting carcasses across 9 southern Australian plants during the 2013 calendar year. This will be determined by calculating carcass yield, and the value per kg of saleable meat, and will be presented as a mean carcass value, thus an overall cost to these processors. This will then be extrapolated to estimate a cost across the entire Australian beef industry.

II. MATERIALS AND METHODS

Access to data

The business activities of the processors that have contributed to this project are confidential, and thus the exact cost of ungraded carcases was not available. Furthermore, the only MSA data available in detail was limited to just the 9 processors in the southern regions of Australia. However averages of carcass weight and number of dark cutting carcases from the national MSA data during 2013 and 2014 were available. Therefore an estimate for a national cost has

been extrapolated based on the analysis of the southern plants.

Data description

The analysis was performed on all carcases that were excluded from grading within the MSA system ("ungraded") due to meat colour and/or pH across the 9 southern processors during 2013 (n=46,751). This exclusion was based upon AUSmeat colour score 4 or higher or pH greater than 5.7. This analysis was then extrapolated to calculate a national cost. Only the national average values for hot standard carcass weight (HSCW), eye muscle area and rib fat from 2013 and 2014 national data as well as total ungraded carcases due to pH and meat colour (2013 n=125,211 and 2014 n=158,807) were available.

Producer penalty rates

All 9 processors were contacted in relation to the grid payment information and the penalty rates which are applied to producers. All plants except one provided information so this plant was given a mean penalty rate based on the penalties applied by the other processors. The penalties ranged from 20c to 80c per kg of hot standard carcase weight (HSCW). Due to the large variation, the rate of penalty was calculated as a mean of all plants adjusted for the volume of carcases that were ungraded at that plant. This equated to 59c/kg of HSCW and was applied across all data individually to calculate the cost to producers.

Calculation of carcass values

Due to the commercially sensitive nature of processor pricing, the exact value of price differentials between cuts from MSA and non-MSA graded carcases were not available. Thus the degree a carcass is downgraded due to dark cutting was calculated using a number of assumptions. This included the following; There are only two price scales, MSA and non-MSA, and this price is the same for all plants; All ungraded carcasses were priced for a downgrade in the domestic market only; All ungraded primals other than the 4 highly utilized grilling cuts (striploin, cube roll, rump and tenderloin) are downgraded to mince price ($5/kg); Ungraded trim, no matter the chemical lean, is penalized $1/kg; Cost is to be the difference in price for an ungraded carcasses, if that carcass was graded MSA, based on carcass weight and saleable meat, and; all carcases had the same primal composition and thus the same percentage in saleable meat yield (SMY).

The value of the carcass was estimated based on current industry values and the percentage a primal contributes to the carcases saleable meat yield (Table 1). The calculated value of an MSA graded carcass was $6.49 per kg of saleable meat, while the value of an ungraded carcase was $4.67 per kg of saleable meat, thus the cost is equal to $1.82/kg of saleable meat. An additional value of 10c/kg for bone and fat was added to arrive at a total cost.

Calculation of saleable meat yield

To calculate the estimated saleable meat yield (SMY), it is first necessary to calculate the percentage lean. This was estimated using a yield prediction equation derived from CT scan data sets (R^2= 0.62, RMSE = 3.3). The equation was as follows:

Predicted % lean meat yield = 60.27083455 + ((Total HSCW /2) x -0.05431688) + (ribfat x -0.55631674) + (eye muscle area x 0.10919679).

The value of fat and bone was estimated by subtracting the predicted lean meat yield from the total HSCW. Saleable meat yield was predicted using the following linear equation:

% SMY = 45.5883 + (predicted lean meat yield x 0.4345)

Total saleable meat was calculated by multiplying the percentage SMY by total HSCW. This number was then multiplied by the carcass values calculated in table 1 with the addition of the fat component.

Calculation of estimated cost of Dark cutting

The cost of dark cutting was estimated by subtracting the value of the ungraded carcass from the proposed MSA value. This calculated the total cost to the processor and was calculated for every individual carcase in the southern plants data set. The cost to the producer was a component of the processor cost as the processors already pays less for the carcass. All values are expressed in Australian Dollars.

Table 1 The proportion each primal contributed to total saleable meat yield, as well as the wholesale cost of MSA and non-MSA graded primals ($/kg)

Primal	% SMY	MSA ($/kg)	Non-MSA ($/kg)
Striploin (3 rib)	5.0%	13	8
Cube roll	2.5%	19	10
D-Rump	2.6%	8.5	6.5
Tenderloin	1.9%	24	14
Oyster Blade	2.0%	7.5	5
Blade	2.0%	6.5	5
Chuck tender	1.2%	6.8	5
Chuck	5.3%	6	5
Brisket	7.1%	6	5
Foreshin	0.6%	6.5	5
Topside	4.6%	7.5	5
Knuckle	5.0%	7.7	5
Outside	3.1%	6	5
Eye round	1.6%	7.2	5
Hindshin	1.0%	6.5	5
Thin flank	0.6%	5	5
Trim (90CL)	26.6%	5.5	4.5
Trim (65CL)	27.4%	3.5	2.5
Fat + bone	-	0.1	0.1

III. RESULTS AND DISCUSSION

In 2013 the 9 southern processors graded 23.24% of all carcasses that were MSA graded nationally but contributed to 37.34% of the dark cutting beef in Australia in MSA graded carcasses. A total of 638,150 carcasses were graded across the 9 southern plants in 2013, compared to 2,745,452 nationally. Of these 125,211 failed to meet the requirements set by MSA for meat colour and/or pH, a rate of 4.56%, while 46,751 failed from the southern plants alone, a rate of 7.33%. In 2014 there were a total of 3,195,309 carcasses MSA graded nationally and 158,807 ungraded due to pH and meat colour, a rate of 4.97%. The number of carcasses graded for MSA nationally makes up about 60% of the total eligible cattle killed nationally. Southern plant data was not available for 2014.

Southern plant analysis

The cost to producers, penalized at the rate of 59c/kg of HSCW, was estimated to be on average per plant between $137.58 to $169.42 per non-compliant carcass due to not reaching MSA grades for meat colour and/or pH. This equated to a total cost to the producer from the 9 southern plants to be $7.58 million in 2013(Table 2). Due to the grid based structure of payments and discounts for dark cutting, this representation of cost is likely the most reliable and accurate due to this penalty being applied across actual HSCW data provided directly from processors.

Table 2 The estimated costs of dark cutting in Meat Standards Australia (MSA) graded carcasses separated by meat colour score in the southern region of Australia in 2013 and nationally in 2013 and 2014. Values in Australian dollars

Data	Meat colour 4	Meat colour >4	total
Cost to Producers (millions)			
Southern 2013	$ 4.48	$ 3.10	$ 7.58
National 2013	$ 13.84	$ 6.68	$ 20.53
National 2014	$ 16.91	$ 8.78	$ 25.69
Cost to Processors (millions)			
Southern 2013	$ 9.66	$ 6.68	$ 16.34
National 2013	$ 29.99	$ 14.50	$ 44.49
National 2014	$ 36.71	$ 19.05	$ 55.75

In this current scenario, the cost of dark cutting to the processors in the southern plants was estimated to be as high as $16.34 million in 2013 based on the analysis using saleable meat yield (Table 2). This value is approximately 115% greater than the cost to the producer and thus under this scenario the processor will be accepting over half the costs due to dark cutting. The processors stand to lose between $296.72 to $365.67 per carcass at wholesale (based on the range of mean HSCW per plant). Under these conditions one processor alone stands to lose $6.8 million (data not shown) due to dark cutting.

The current scenario assumes that all carcasses are bound for the domestic markets, and in this case it is feasible that the ungraded carcasses are penalized at such great rates. However, in 2014, 74% of Australian beef production was exported [7] and markets such as the European Union do not have an absolute requirement for an AUSmeat colour <3 and thus penalties for

carcasses with AUSmeat colour 4 will not be so harsh. Furthermore, this will also likely allow processors to offer producers a more favorable pricing grid for carcasses with AUSmeat colour 4. Thus in a scenario where only carcasses with a meat colour score of greater than 4 would be penalized, the cost to the 9 southern processors would still be $6.68 million in a calendar year (Table 2). However, it is unlikely that all carcasses with an AUSmeat colour score 4 would be sold to an international market thus the cost to the southern plants in 2013 would lie somewhere between $6.68 million and $16.34 million.

National cost of dark cutting

The unavailability of national data for all individual MSA graded carcasses has not allowed for a thorough analysis of the national impact of dark cutting. However an estimated cost could be made based on the analysis from the 9 southern plants. By using the national averages for HSCW, eye muscle area and rib fat for the ungraded carcasses a similar analysis can be applied to output the average national cost for MSA graded carcasses. These estimates can be seen in Table 2. Using the above scenarios the Australian beef industry lost between $14.5 million and $44.49 million in 2013 and between $19.05 million and $55.75 million in 2014 for MSA graded carcasses only. It must be noted that carcasses that are graded for MSA contribute to less than half of the national slaughter numbers, thus the total cost nationally is likely to be considerably higher. However, the penalties or cost incurred on those cattle that are not MSA graded is not known. In 1990, Voon and Edwards [8] estimated the cost of dark cutting to the Australian Beef industry to be close to $80 million per year. Although red meat production and export has increased significantly in the last 25 years, so has the understanding of managing dark cutting, yet dark cutting still has a large economic impact. Furthermore, a decrease in dark cutting by just 1% could result in a possible $10 million profit to the industry (data not shown) and thus highlights the need for continued research into decreasing rates of dark cutting.

IV. CONCLUSION

The rate of dark cutting in Australian beef is approximately 5%. However, when the economic cost of this incidence of dark cutting is costed, the magnitude is more impactful. A loss to the Australian beef industry of up to $55 million is feasible at a rate of 5%, creating a large financial burden. Thus further research into decreasing the incidence of dark cutting in Australia is warranted.

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