Influence of individual beef cuts on net carcass value

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ABSTRACT

A least squares analysis of the weight of 15 individual export cuts from 808 carcasses of 20-month old steers identified significant effects of carcass weight, carcass fat measurement, carcass grade and sire breed on the weight of export cuts.

Increasing carcass weight had a positive effect on cut weight but increasing carcass fatness had a variable effect on weight of cut. The weight of a cut marketed with negligible subcutaneous fat (cube roll) decreased in weight by 7% as carcass fat depth increase from 4 to 12 mm. In contrast a cut which included subcutaneous fat increased in weight by 15% over the same fatness range. The data show that the most equitable pricing system (schedule) would take account of weight of individual cuts.

INTRODUCTION

An objective of the New Zealand Meat Producers Board carcass grading system is to provide a framework for rewarding farmers for the value of their product (NZMPB, 1979).

Approximately 22% of export beef is sold as individual cuts. These cuts vary in price/kg depending on anatomical location and weight. The composite value of these carcasses is the sum of the value of each cut (weight × price/kg). Any factor which influences the relative and/or absolute weight of an individual beef cut may alter carcass value.

The present schedule price of beef carcasses suitable for export as cuts does not incorporate price differentials/kg for cuts of differing weight (NZMPB, pers. comm). This study investigates carcass characteristics which influence the relative and absolute weight of beef cuts and considers the potential impact of these on the beef schedule.

MATERIALS AND METHODS

Analysis was made of data collected on carcasses of 808, 20-month old steers slaughtered and graded under commercial conditions. All steers were from Friesian cows and were progeny of 8 bull breeds. The weight of the trimmed saleable export cuts from each carcass was recorded along with carcass weight, grade and fat depth over the 13th rib. Details of the methods have been given in previous analyses of some of the data (Everitt *et al.*, 1977; 1980).

A least squares analysis using a mixed model with variable (carcass weight, fat thickness) and fixed (fat grade, breed) effects was used to evaluate factors affecting the weight of 15 individual export cuts.

A computer model was constructed from the output of the least square analysis to explore the effects of weight of individual cuts on carcass value. Only variables which showed a significant F test ($P<0.05$) or which satisfied an economic range test (ERT) were included in the prediction equation for each cut. ERT included variables if the value of a cut varied by >50 cents over the range the of the variable. Ninety-two percent of variables meeting the ERT were also significant at 5% level of probability. Incorporation of export prices for beef cuts and the costs of processing allowed the model to predict the schedule.

RESULTS

The significance of independent variables in predicting the weight of each export cut is shown in Table 1. Carcass weight showed a highly significant positive relationship with the weight of all cuts. The relative weight of cuts to total saleable meat varied between cuts. For example the striploin and inside increased more rapidly and the tenderloin and shank increased less rapidly than total saleable meat.

Increased depth of fat over the eye muscle at the 12th rib decreased the weight of 8 cuts (tenderloin, cube roll, inside, knuckle, flank steak, chuck, brisket-PE), had no significant effect on 4 (outside, sirloin, clod, chuck tender) and increased the weight of striploin, brisket-NE and trimmings. The decrease in cut weight as fat thickness decreased from 4 to 12 min (the P grade range), ranged from 8.8% for the cube roll to 4.0% for the chuck. The increase in weight of cut over the same fat thickness ranged from 17.0% for the striploin to 2.7% for trimmings.

The effect of fat grade on weight of cut was variable

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TABLE 1 Statistical significance of independent variables in least squares analysis of cut weight.

Dependent Variable Weight (kg) of	Independent Variables					RSD (kg)
	Carcass weight	[Carcass weight]^2	Fat depth	Fat grade	Sire breed	
Striploin	***	***	***	***	***	0.60
Tenderloin	***	***	***	***	***	0.25
Cube roll	***	NS	***	***	NS	0.45
Inside	***	NS	***	***	***	0.66
Outside	***	NS	NS	*	***	0.90
Knuckle	***	*	***	***	***	0.70
Sirloin	***	NS†	NS	***	***	1.00
Flank steak	***	**	***	***	***	0.17
Shank	***	NS	***	NS†	***	0.87
Clod	***	NS	NS	NS	***	0.51
Chuck	***	**	***	NS†	***	1.73
Brisket-point end	***	NS	***	NS	***	0.73
Brisket-navel end	NS	***	***	***	***	0.94
Chuck tender	***	NS†	NS	NS	NS	0.23
Trimmings	***	***	NS†	***	***	2.34

† significant on basis of ERT (see text for details).

but tended to enhance the fat depth effect for most cuts. The composite effect of fat grade on cut weight was to reduce yield of saleable meat by 0.1, 0.8 and 1.0 percentage units as grade changed from M to L, L to P and P to G respectively.

Conformation was significant for only 2 cuts and has not been included in Table 1.

Sire breed significantly affected the weight of 13 cuts. Ranking of sire breeds for weight of cut varied slightly between cuts, but on % total saleable meat, breeds ranged from Limousin (70.9%) through Blond Aquitane (70.3), Angus (69.5), Charolais (69.4), South Devon (69.3), Hereford (69.0), Red Devon (69.0) to Friesian (68.6).

Three export cuts (striploin, cube roll and tenderloin) are sold within weight ranges. The effect of carcass fat thickness and sire breed on the carcass weight (critical carcass weight) at which a change in weight range of these cuts occurs is shown in Table 2. The combined effects of fat thickness (within the P grade) and sire breed result in a range of 53 kg (203 to 137) in carcass weight above which a striploin >3 kg would be obtained. The combined effect is slightly less (34 kg) for the tenderloin.

DISCUSSION

Carcass Weight and Fat depth

Carcass weight is invariably the major determinant of yield of saleable meat (Everitt and Evans, 1970) and retail value (Harries *et al.*, 1975). The findings of this study are no exception.

The variable effect of increasing carcass fat depth on weight of cut is of interest. At 220 kg carcass weight, the weight of the cube roll decreased by 7% from 2.8 to 2.6 kg as carcass fatness increased from 4 to 12 mm (the P grade range). Under the same conditions the striploin increased in weight by 15% from 3.4 to 3.9 kg.

The cube roll is marketed stripped of all subcutaneous fat and might thus be expected to decrease

TABLE 2 Effect of carcass fat thickness and sire breed on the critical carcass weight (kg) of 3 beef cuts.

Sire breed	Fat depth (mm) 4mm	12mm
	Critical carcass weight†	
(a) Striploin >3 kg		
Limousin	167	137
Angus	178	147
Blond Aquitane	185	152
Hereford	189	155
Red Devon	196	162
South Devon	200	165
Charolais	201	165
Friesian	203	167
Average	190	156
(b) Tenderloin >1.5 kg		
Limousin	184	194
Charolais	186	196
Hereford	187	198
Blond Aquitane	190	201
Angus	190	201
South Devon	193	204
Friesian	196	207
Red Devon	206	218
Average	191	202
(c) Cube roll >2.5 kg		
No sire breed effect		
Average	196	210

† Carcass weight at which a change in weight range of a cut occurs.

in saleable weight with an increase in carcass fat depth which is taken over the striploin. In contrast, the striploin is sold with a covering of subcutaneous fat. The increasing weight of striploin with increasing fatness probably represents an increasing content of fat in the cut with increasing carcass fatness. A data set with a higher proportion of fatter carcasses might show a reduction in striploin weight as fat had to be trimmed off the cut.

The net effect of the variable influence of fat thickness on cut weight is that total weight of saleable meat declines more slowly with increasing carcass fatness than it would if all cuts were marketed to a consistent fat content. A decline in total weight of saleable meat of 0.22 to 1.31 kg/mm increase in carcass measurement C has been found by Everitt and Evans (1970) and Everitt *et al.* (1977). The comparable figure in this work is 0.14 kg/mm. However, the decrease in carcass yield with increasing fat grade (not included in Everitt's analysis) is equivalent to a further 0.19 kg/mm giving a total of 0.33 kg/mm.

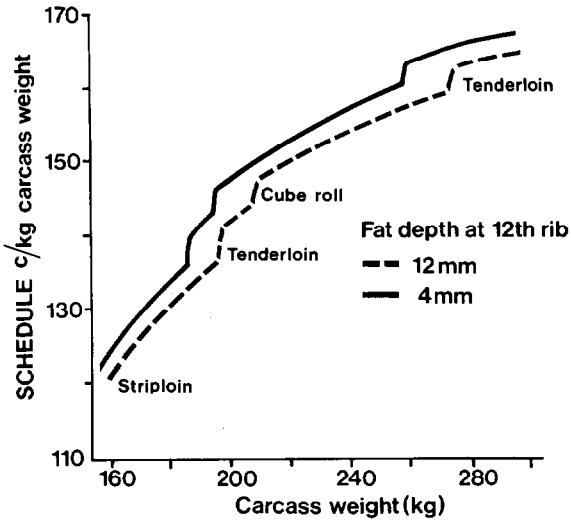

FIG. 1 Effect of critical carcass weight and variation in fat depth on computed beef carcass value (cents/kg).

Carcass Grade and Sire Breed

Subjectively assessed carcass grade was complementary to fat thickness in predicting cut weight. Other work has shown that a combination of visual assessment plus carcass measurement is better than either singly in predicting % carcass lean (Chadwick and Kempster, 1982). Some carcass grading systems make provision for subjective assessment of fatness to modify or complement a fatness measurement (Kempster *et al.*, 1982). Our results suggest that a combination of fat measurement and subjective assessment is desirable in the New Zealand export beef grading system. The contribution of subjective grade may be through an assessment of fat distribution.

The ranking of sire breed for effect on cut weight and thus carcass yield is very similar to that reported for other large sire breed comparisons on beef cows in New Zealand (Bass *et al.* 1976; 1981) and with earlier analyses of some of this data (Everitt *et al.*, 1977; 1980).

Cut Weight and Carcass Value

Factors affecting the weight of beef cuts are of more than academic interest if they separately or in combination influence the value of the carcass. Individual cuts in the beef carcass vary in their value/kg by up to 300% and tenfold in their individual contribution to total carcass value. The weight of an individual cut can also change the value/kg by a factor of 2.35 particularly if sold chilled. By adopting appropriate prices for individual cuts, the impact of carcass weight, fat thickness within a grade, critical carcass weight and sire breed on computed schedule value can be demonstrated (Figs. 1 and 2).

The computed schedule rises continuously (and steeply at low carcass weight) as a function of carcass weight. Adoption of continuously changing schedule has been suggested (Nicol, 1976; Everitt *et al.*, 1977). The present schedule employs constant price/kg over 25 kg carcass weight ranges.

A change in weight range of a particular cut with the associated change in value causes sudden increases in schedule price of up to 4 cents/kg or $8 per 200 kg carcass. The importance of these changes in value of a specific cut on the schedule has not previously been recognised. The predicted schedule for the lean

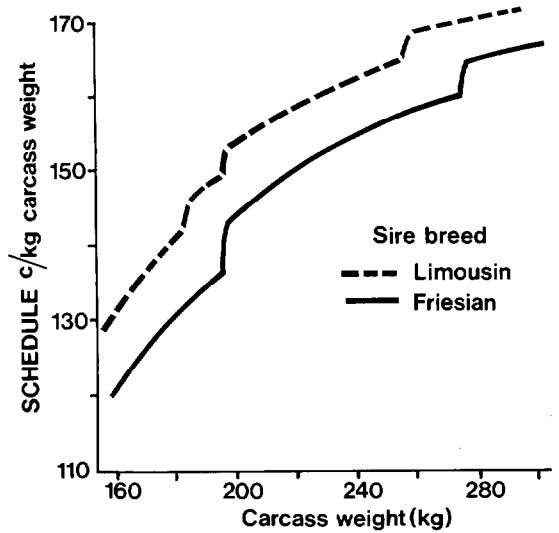

FIG. 2 Influence of extremes of sire breed variation on computed carcass value (cents/kg).

carcass is 4 cents/kg on average, higher than for the fatter carcass (Fig.1). The difference is greater (6 cents/kg) where a change critical carcass weight has occurred for the 4 mm carcass but not for the 12 mm carcass. In the present grading system there is no differential payment for varying fat thickness within a fatness grade.

The extremes of the sire breed ranking for yield of saleable meat (Limousin and Friesian) results in a 7 to 10 cents/kg difference in the computed schedule (Fig. 2). This difference is equivalent to $14 to $20 on a 200 kg carcass or a difference of 6% in value. The sire breed effect on critical carcass weight is also clearly reflected in the schedule. The large increase in schedule for the Friesian at around 196 kg is the result of a critical carcass weight of between 196 and 203 kg for all 3 weight-ranged cuts.

Implications for the Beef Schedule

The prediction of schedule value from the sum of the value of individual cuts has identified critical carcass weight as an additional component of the schedule price. Variable critical carcass weights cannot readily be incorporated into the present pricing system. The range in fat thickness within the present P grade results in lean carcasses subsidising fatter carcasses by up to $5 per carcass.

A continuous schedule based on carcass weight and fat thickness, while incorporating carcass weight and fat measurement effects on cut weight, would not accommodate critical carcass weight without including some significant steps (Fig. 1). Our recommendation is that a continuous stepwise schedule rather than a continuous schedule as suggested by Nicol (1976) and Everitt *et al.* (1977) replace the present stepwise schedule.

Although sire breed has an effect on schedule price it is impractical to include breed as a carcass grading criterion. However, this evidence should assist farmers supplying cattle of breeds with superior carcass yield and lower critical carcass weights in negotiating above average schedule payments.

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