TRADING LIVESTOCK ACCORDING TO ESTIMATED LEAN MEAT YIELD

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SUMMARY: Detailed carcass dissection has established the functional relationship between simple carcass measurements and the yield of lean meat. This relationship can be used commercially as a basis for exchange between the livestock producer and the meat processor. One advantage of using this (new) basis is that the buyer does not have to adjust his unit price to reflect his own subjective estimate of carcass meat yield. Unit price will therefore refer exclusively to the meat quality dimension of the carcass and consequently variations in price will provide a better guide to the producer regarding adjustments he should make to satisfy consumer preferences.

INTRODUCTION: The task of giving livestock a money value which accurately reflects their meat quality and yield of lean meat is difficult. This is because quality of meat cannot be predicted easily and because there are several, not particularly well integrated stages, which separate livestock production from actual meat consumption. Initiatives are underway in Australia which attempt to address both these problems.

The problem of predicting the eating quality of meat is being addressed through the technology of carcass specification. This technology objectively measures criteria of individual carcasses which are linked with the inherent appeal of the meat. Thus tenderness, taste and size of cut can be indicated by specifications such as age, marbling and weight respectively. The eye appeal of sliced meat can be indicated by depth of the fat cover and the colour of the fat and meat itself. The data applicable to each carcass are physically linked to the carcass (via a secure ticket) so that they can be transmitted backwards or forwards to the supplier or user respectively. The carcass user (a boning room or butcher) can satisfy minimum market requirements by direct reference to the specifications on each carcass.

The second problem of a long market 'pipeline' separating livestock production from meat consumption is being addressed by fostering marketing systems which will legally recognise producer ownership extended to and terminating at the slaughter floor scales. Thus the product being assessed for exchange is not a group of live animals (as in the saleyard situation) but a single carcass. The objectivity and accuracy which can be employed in assessing the quality and quantity dimensions of a carcass far exceeds that which can be applied to live animals.

The existing means by which carcasses are valued can be summarized into two stages. In the first stage a unit price ($/kg of carcass weight) is established by reference to three critical factors:

1. the relationship prevailing between supply and demand at the particular time and place;

2. the palatability and eye appeal (ie., quality) of the carcass meat as implied by the objective specifications; and

3. the yield of meat obtainable from the carcass.

The second stage of valuing a carcass is simply a matter of multiplying the unit price by the hot carcass weight (ie., total value = unit price x hot carcass weight).

It will be apparent that unit price is presently being required to perform a difficult task. It must embody at one time the often converse influences of meat quality and carcass yield. If both influences are incorporated into unit price simultaneously, its signalling power to producers can be diminished. The corollary is that pricing accuracy will be enhanced if the meat quality and carcass yield dimensions are made demonstrably independent. This can be achieved by confining the function of unit price strictly to reflecting the value of the meat as implied by the carcass specifications and using yield estimation strictly as a method of paying for the carcass.

METHOD: From the supply side, there are three fundamental determinants of meat production profitability : the resources needed to achieve liveweight, the yield of meat from carcasses and the quality of the meat. All three are important but the emphasis on this occasion is confined to carcass lean meat yield. Australia can be justifiably proud of the research it has done in this area. Findings to come out of this work include:

* the relationship between carcass weight and yield of muscle, fat and bone from carcasses destined for different markets;
* the muscle, fat and bone components of primal cuts and manufacturing meat destined for different markets;
* the above relationships according to different genotypes;
* relationships between lean meat yield and simple measurements on the live animal (eg., anal fold) and the carcass.

The ultimate benefit from this research will be a new system of payment for livestock, a system that is more objective, more equitable and more rational. Projects recently completed by the research division of the Livestock and Meat Authority of Queensland have produced equations which can be used to predict the lean meat content of pig and beef carcasses on the slaughter floor. The equations were derived from yield data designed to represent variations in the livestock populations due to genotype, age, weight, fatness and shape. The general form of each equation is presented below.

Lean meat yield for pigs = a - b (fat depth at P2)
+ c (muscle depth at 3/4 last rib)
- d (fat depth at 3/4 last rib)

Lean meat yield for cattle = a - b (fat depth at P8)
+ c (eye muscle area)
- d (hot standard carcass weight)

P2, P8 and 3/4 last rib all refer to specific measurement sites on the carcass. The coefficients generated have not been presented in this paper because the equations have not yet been released to industry.

To make use of the estimation equations it must be possible for the abattoir to take the carcass measurements (fat depth and carcass weight) and then operationalize the equations. Clearly, some electronics are desirable. As it turns out, most large abattoirs have the technology which allows the estimation procedure to be conducted with minimum effort. The Hennessy Grading Probe, for example, can measure fat depth directly and from this compute a meat yield estimate - both can be electronically transmitted to a central computer where a 'black-box function' will calculate gross carcass return based on the estimated yield (in kilograms) of lean meat and unit price (in $/kg of lean meat). However, some abattoirs may be too small to justify the fixed costs associated with sophisticated electronics and where this is the case it would be possible to achieve the same end result without the same technology. It is a simple task to construct weight/fat matrices which allow yield estimates to be quickly derived from manual fat depth recordings.

DISCUSSION: The new basis for exchange of livestock can be stated simply. The lean meat yield in the carcass must be objectively estimated so that the buyer will no longer have to adjust unit price to reflect his own subjective estimate of yield (lean or saleable). With carcass yield expressed in terms of kilograms of estimated lean meat, unit price must, correspondingly, be expressed as $/kg of estimated lean meat (rather than $/kg of carcass weight). This will have the immediate effect of making the relationship between unit price and the objective specifications that indicate meat quality, more consistent and more meaningful. The remainder of the paper will be devoted to explaining why this approach will enhance the marketing function and how it can be brought into commercial practice.

A carcass is made-up of muscle, fat and bone. Whilst all of these components have a value, the most valuable by far is muscle. Most consumers still prefer to buy meat cuts with some selvage of fat but this selvage essentially acts as packaging because typically, only the lean portion is ingested. In practice, many carcasses have more fat cover than preferred by final customers (so have to be trimmed) and none or very little of the bone component can be sold to consumers. Saleable meat yield as a proportion of carcass weight ranges from about 65 to 74 per cent. Clearly, therefore, carcass weight is a rather poor guide to saleable meat yield and pursuit of the ideal of an accurate payment system requires that some better parameter (than carcass weight) be found.

The obvious question to confront at this stage is: why not saleable meat yield? ie., the proportion of the carcass that is actually packed in a carton by the exporter or sold across the shop counter by the butcher. As a basis for pricing carcasses, saleable meat yield has several shortcomings. Firstly, it cannot be predicted with acceptable accuracy because the amount of fat it contains in excess of the minimum required varies substantially between carcasses - even when the subcutaneous fat is trimmed to the same thickness.

Secondly, because the minimum fat cover requirements vary between markets, saleable meat yield will vary among carcasses independently of fatness. In other words, saleable meat yield is not, by definition, a common standard which can be used to compare performance among carcasses destined for different markets.

A third problem with payment according to saleable meat yield is that it perpetuates the age-old problem of price averaging. When the processor pays the same amount for two carcasses of the same saleable meat yield but different lean meat yield, he is forcing the superior lean meat yielding carcass to cross-subsidise the lower lean meat yielding carcass. The point can be demonstrated using actual data from two export carcasses. Both carcasses weigh 330 kg: the first has 14mm of fat cover and an estimated lean meat yield of 195 kg whilst the second has 10 mm of fat and an estimated lean meat yield of 207 kg. Under the existing exchange system the producer would receive exactly the same return from both carcasses since the fat cover on both is regarded as acceptable for the export market and they would yield roughly the same quantity of saleable meat. Under an exchange system based on lean meat yield, the unit price applying to both carcasses would be the same but due to the 12 kg difference in lean meat yield, the first carcass would return about $20 less and the second carcass about $20 more at 1990 prices. Thus, under the existing system of exchange, incorrect price signals with respect to true yield are sent back to the producer and the problem of cattle being delivered with fat cover well in excess of the minimum required is perpetuated.

There is also a more general point that should be made about payment systems. It is not necessary that they are seen to pay literally for every part of the animal. The feature they should exhibit however is accuracy in terms of the principal product produced - lean meat in the case of cattle or pigs. Even though the unit price of a yield based payment system would only apply to the lean meat portion of the carcass, it would implicitly reward the producer for all saleable products derived from the animal. Competition among processors for livestock would ensure, in practice, that the unit price reflects the full value of the animal.

Before moving on to examples, the purpose of yield estimation will be reiterated. Practically the only purpose to which a carcass lean yield estimate can be put is calculation of gross carcass value. There are two stages in the marketing 'pipeline' where just such a need arises:

* exchange between the producer and the processor;
* exchange between the wholesaler and retail butcher.

In Australia trading between producers and processors is well developed in some areas, but particularly in Queensland, and is common throughout Australia between wholesalers and retail butchers.

The mechanics of lean yield payment can be demonstrated for carcasses suited to particular markets. From the perspective of the meat processor, consumer preferences with respect to beef vary widely. This perception stems from the fact that specifications applying to export markets are substantially different from those applying to the domestic market. For example, beef supplied to the Japanese grain fed market has to be marbled in order to attract premium prices. Domestic market consumers are primarily interested in tenderness (largely a function of age) and actively select against fat. Even within the domestic market there are identifiably separate markets.

Once known, the preferences of particular markets can be satisfied by selecting carcasses with the 'right' specifications - they will then meet some minimum level of acceptability. The quality implied will correspond with a particular unit price which can be expressed as dollars per kilogram of estimated lean meat in the carcass. Below is a table which shows how a lean meat yield payment system would reward carcasses relative to existing payment systems. Table 1 refers to product aimed at the Australian domestic market - essentially less than 250 kg carcass weight. It will be noted that carcasses with less than 4 mm of fat are paid a lower unit price under both payment systems. This reflects the fact that below 4 mm the carcass quality is regarded as unacceptable and therefore falls into another market. The prices applying to acceptable carcasses of $2.45/kg of hot carcass weight and $3.87/kg of estimated lean meat yield are equivalent ie., they return the same total pay-out for the example carcasses 12 to 33. If a lean meat payment system was to be adopted, competition between processors would continue, based on the new equivalent ($ per kg of estimated lean meat). In due course this equivalence may break down in favour of higher prices for lean meat. This would come about because of the greater efficiency and profitability that would be induced by a lean meat payment system.

Irrespective of price effects, yield based payment could bring about savings. Since the producer is paid nothing for fat, he will use the lean meat sale option for livestock that reach, but barely exceed, the minimum specifications. Equipped with a very clear idea of the minimum requirements of the market the producer will be able to make large savings in feed costs. When exchange price is based on gross liveweight or carcass weight it is often profitable for the producer to add weight as fat (ie, fatten beyond maturity) even though this fat will be trimmed in the abattoir. The potential savings are significant when it is considered that fat deposition in cattle uses up three times more feed energy than lean meat.

Less trimming will also mean savings for the processor. If carcasses do not have to be trimmed to meet market specifications, worker productivity on the slaughter floor and in the boning room will rise substantially.

CONCLUSIONS: The benefits of yield based payment stem from the fact that it allows payment for the raw material (ie., a carcass) to closely parallel the finished article required by the consumer (ie., lean meat). By treating each carcass as a separate entity and estimating its yield of lean meat on the slaughter floor, it is possible to reward producers with highly accurate prices. Accurate prices are those that closely reflect consumer preferences. Since consumer preferences are orientated around lean meat, pricing accuracy will be maximised if the producer/processor exchange prices are based on estimated lean meat.

More accurate prices will benefit the whole industry. If market preferences are answered by positive and rapid changes from the production sector then, through time, market share should increase relative to competing goods that are slow to react to consumer wants.

In the short term, it is possible that some producers will be made worse-off by a more accurate payment system. If their product is not that preferred by the market, and they fail to respond positively, their profitability will suffer. As shown in Table 1, the effect of yield based payment at a point in time is to

redistribute rewards away from 'inferior' product in favour of 'superior' product. The redistribution process is always accompanied by winners and losers - at least in the short-term. In the longer term however, the whole industry will be ahead because it will have the capacity to respond to market preferences.

All of the benefits associated with yield based payment stem from its capacity to deliver more accurate pricing. From the processors' point of view, accurate pricing can be translated to mean:

* a far simpler price grid and hence lower procurement costs,

* by corollary, greater scope to concentrate on the significance of meat quality to the end user,

* ultimately fewer inferior carcasses leading to less waste and greater market penetration.

From the producers' point of view, accurate prices will have a very immediate benefit. Prices will provide them with a clear message regarding the quality of beef required by the consumer. The use of sophisticated breeding and feeding technology aimed at enhancing yield will take-on a new relevance. The corollary is that the switched-on producer will be fully rewarded for taking the effort to 'meet the market'.

Further Reading

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Table 1 : A comparison of returns from 33 domestic weight beef carcasses under two payment systems (i)$/kg HSCW x HSCW & (ii) $/kg LM x ELMY

Animal No.	Fat Depth (P8)	HSCW	Unit Price ($/kg HSCW)	Carcass Return (a)($)	ELMY (%)	Lean Meat (kg/Carc)	Unit price ($/kg L.Meat)	Carcass Return (b)($)	Redistribution (b) - (a) ($)
1	1	93.77	2.20	206.29	68.43	64.16	3.29	211.15	4.86
2	1	124.93	2.20	274.84	67.71	84.59	3.29	278.38	3.53
3	1	119.82	2.20	263.60	67.83	81.27	3.29	267.45	3.85
4	1	168.13	2.20	369.88	66.72	112.18	3.29	369.14	-0.74
5	1	150.14	2.20	330.30	67.13	100.79	3.29	331.69	1.38
6	2	111.62	2.20	245.56	67.54	75.39	3.29	248.08	2.51
7	2	127.09	2.20	279.59	67.18	85.38	3.29	280.97	1.38
8	2	172.30	2.20	379.06	66.14	113.97	3.29	375.03	-4.02
9	3	148.83	2.20	327.42	66.20	98.53	3.29	324.24	-3.18
10	3	159.54	2.20	350.98	65.96	105.23	3.29	346.28	-4.70
11	3	160.65	2.20	353.43	65.93	105.92	3.29	348.55	-4.87
12	4	149.57	2.45	366.44	65.70	98.28	3.87	380.63	14.18
13	4	153.23	2.45	375.41	65.62	100.55	3.87	389.44	14.03
14	4	162.55	2.45	398.24	65.41	106.32	3.87	411.78	13.53
15	4	219.24	2.45	537.13	64.10	140.54	3.87	544.32	7.18
16	4	218.46	2.45	535.22	64.12	140.08	3.87	542.54	7.31
17	4	215.77	2.45	528.63	64.18	138.49	3.87	536.37	7.74
18	5	114.48	2.45	280.47	66.03	75.59	3.87	292.78	12.30
19	5	166.46	2.45	407.82	64.84	107.93	3.87	418.01	10.18
20	5	222.16	2.45	544.29	63.55	141.20	3.87	546.86	2.57
21	5	160.03	2.45	392.07	64.98	104.00	3.87	402.78	10.71
22	5	209.34	2.45	512.88	63.85	133.67	3.87	517.70	4.81
23	6	231.08	2.45	566.14	62.87	145.29	3.87	562.69	-3.45
24	6	216.02	2.45	529.24	63.22	136.56	3.87	528.91	-0.33
25	7	215.01	2.45	526.77	62.76	134.94	3.87	522.64	-4.13
26	7	213.89	2.45	524.03	62.79	134.30	3.87	520.13	-3.89
27	7	248.01	2.45	607.62	62.00	153.77	3.87	595.56	-12.05
28	8	230.64	2.45	565.06	61.92	142.82	3.87	553.13	-11.93
29	8	224.21	2.45	549.31	62.07	139.17	3.87	539.00	-10.31
30	8	208.81	2.45	511.58	62.42	130.35	3.87	504.84	-6.74
31	9	215.33	2.45	527.55	61.79	133.06	3.87	515.35	-12.20
32	9	245.25	2.45	600.86	61.10	149.86	3.87	580.42	-20.43
33	10	225.79	2.45	553.18	61.07	137.90	3.87	534.08	-19.10
				14,321.06		3,852.22		14,321.06	Zero Sum