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THE ECONOMIC SIGNIFICANCE OF
CHILLER ASSESSMENT CHARACTERISTICS
FOR QUEENSLAND BEEF PRODUCTION

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1. Introduction

The description and assurance of quality characteristics of meat have become increasingly important for the meat export trade to Japan. The introduction by the Australian Meat and Livestock Corporation (AMLC) of the Chiller Assessment trading language in March 1991 explicitly recognises the importance of meat quality. All export meat processors in Queensland now use chiller assessment to some extent in assessing the quality characteristics of meat bound for Japan.

Meat is a heterogeneous commodity, where a varying range of quality characteristics broadly equates to the range in prices. In Japan this range of meat quality and prices is more marked than Australia, with the market paying the highest premiums for domestically produced Wagyu beef, and the lowest for imported frozen manufacturing beef. However specific price signals from the Japanese market for the quality characteristics measured under Chiller Assessment are not strong. Weak price incentives and information flows back along the marketing chain to beef processors and producers may not stimulate the industry to target production to specific demands from the Japanese market. This has implications for the cost efficiency and competitiveness of Australian exports to Japan.

This paper examines the role played by Chiller Assessment in transmitting price signals and information flows between the Japanese demand for beef and cattle production in Queensland. It looks at what measures the Japanese currently use to select meat quality, and examines whether a move towards more descriptive quality characteristics will be a benefit to the meat industry.

2. Data

Information was collected from the majority of meat processors in Queensland, as well as feedlotters and other exporters. Processors were surveyed about chiller assessment and then visited in person in November and December of 1993. Some of the information sought was confidential and there were varied responses to requests for information. The lack of consistent data made it impossible to calculate shadow prices for quality characteristics as was originally intended. However enough detailed information was collected to summarise important aspects of trade with Japan.

3. Methodology

Defining meat as a heterogeneous commodity means that it has a range of individual characteristics that differentiate meat products from each other. Lancaster (1971) suggested that different prices for goods reflected the unique bundle of characteristics that each good possessed. Each characteristic has an implicit price which contributes to the price of the good, and thus, through techniques such as hedonic pricing, it is possible to estimate those implicit values of characteristics.

In the perfectly competitive model of economics, price acts as a stimulus and information flow between demand and supply conditions. Changed market conditions are signalled to both consumers and suppliers through price variations. Producers are encouraged to increase or decrease production in response to price signals, and the supply of goods will vary in response to changed demand signals. These same market forces will bear on characteristics that send clear market signals, despite that fact that they may be implicit in overall prices. People selling houses that possess the characteristic of beautiful beach front vistas expect a premium, and each sale informs the market that such characteristics are in demand. In the same way the sale of a heterogeneous commodity such as meat will send market signals about the importance or otherwise of the characteristics that add value to that commodity.

In the real world of course, market signals are not always clear. Imperfect knowledge by consumers may lead to price differences for the same article. In many cases the elaborate transformation of goods through manufacturing and distribution stages means that price signals become overwhelmed or uneconomic to transmit. Transaction costs for price signals are more likely to rise as the number of transmission stages increase and geographical and cultural differences become involved. Time lags occur when markets adjust and when structural and institutional changes occur.

Essentially this means that while price signals provide a benefit in terms of accurate information flows, their transmission is not costless and will become more expensive as transactions increase. Ultimately high transaction costs allow only price information on the most important characteristics to be transmitted. Artificially high transaction costs reduce market signals. Poor market signals reduce the responsiveness of suppliers and ultimately the growth of the market.

In the case of meat exports to Japan, the application of this economic model would suggest that important meat characteristics demanded by Japanese consumers should be transmitted through the price mechanism to provide a signal to suppliers. Some of the factors of meat quality include appearance, eating quality (tenderness, juiciness, flavour), food safety, storage life and retail display life. Appearance is important to the Japanese, and they look for meat with a cherry red colour, white fat, some marbling and a consistent size and shape. Food safety is also important and perhaps explains the Japanese preference for domestic beef.

Few price signals on this information trickle back to Australian beef producers. There is substantial price averaging in the industry, both in terms of meat quality and quantity (yield of meat from each carcass) (Cameron, 1993). As a result, there is little genetic testing or selection on the basis of yield or quality characteristics. This contrasts

to other primary industries in Australia, where sales are made on the basis of objective characteristics to determine the product's real value¹. The failure of the beef industry to incorporate information in the form of price signals is one reason why beef consumption has dropped in Australia and market share has been lost to the pork and poultry industries (Cameron, 1993).

4. Chiller Assessment

Chiller assessment is a trading language principally designed to measure beef quality. It was introduced by AUS-MEAT in March 1991 as an extension of Australia's meat description system. Chiller assessment provides a means for measuring four quality characteristics - marbling, fat colour, meat colour, and meat texture/firmness, as well as an estimate of lean meat yield which is derived from carcass weight, fat depth and measurement of the rib eye muscle area (Ball, 1991). Carcass weight and fat depth are among the standard carcass measurements included in the AUS-MEAT slaughter language².

Chiller Assessment usually occurs the day after slaughter but prior to boning when carcasses have been chilled to about 12-14 degrees. The carcass is portioned or quartered to expose the rib eye muscle. Marbling (MB) is assessed by comparison with numbered photographs ranging from 1 (least marbled) to 12 (most marbled). Fat colour (FC) is assessed with colour chips ranging from 0 to 9 (white to yellow). Colour chips are also used to assess meat colour (MC), which ranges from 1 to 9 (cherry red to brown red). Where a carcass trait falls between two scores, the lower score is awarded. Meat texture (MT) is rated on a score of 1 to 3 (coarse to fine), but is rarely used in Queensland. The rib eye muscle area can be measured electronically or estimated manually by the use of a grid placed over the eye muscle area.

These scores can be used as criteria for specifying meat orders, describing meat products, and maintaining quality standards. Scores may be grouped, used as single scores, or used to set a minimum standard. Ball (1991) gives an example of scores on beef carton label as -:

MB: 2-4 MC: 1-5 FC: 0-3.

¹ For example wool is sold on the basis of fibre length, tensile strength, fibre diameter and yield. The dairy industry sells milk on individual components of content and value. Pork is sold over a grid that reflects fat measurement, weight and yield. Wheat payments are based on weight, protein content and milling qualities (Cameron, 1993).

² The AUS-MEAT slaughter language also includes sex, dentition (as an indicator of age), butt profile (as an indicator of muscling) and bruising. Many processors do not use butt profile because there is a poor correlation between it and the actual profile of meat cuts.

The initial focus of the chiller assessment scheme was improved access to the Japanese market following its liberalisation in 1991 (AMLC, 1992). The Chiller Assessment language shows most similarities to the Japanese grading system (Ball, 1991), and its greatest use to date has been in the high value exports to the Japanese market (ACiL, 1993). Its use has also been stimulated by the growth in the lot feed industry, the mandatory minimum requirements for export grainfed beef³, and increased use in the domestic market⁴. Approximately 21 per cent of Australian beef production is chiller assessed (ACIL, 1993)⁵. There are some markets where chiller assessment is not appropriate (manufacturing beef for the United States), or has met slow acceptance (retail butchers in the domestic market). ACIL (1993) estimates that 100 per cent of grainfed beef and 25 per cent of grassfed beef exports to Japan have been chiller assessed.

5. The Japanese Market

The Japanese beef market has progressively liberalised since the Japanese Beef Market Access Agreement was signed in 1988 between Australia, Japan and the United States. Under this agreement, Japan has replaced its quota system and the involvement of the Livestock Industry Promotion Corporation (LIPC) with a system of higher tariffs⁶.

Production of beef in Japan is based on two main sources, Wagyu cattle and the dairy herd. Wagyu cattle are the traditional beef breed, and they are fattened in specialist feedlot conditions for about 19 months. When Wagyu calves are purchased from specialist breeders, records for each animal are provided for three generations (Reithmuller and Kobayashi 1993). This means the feedlotter has accurate expectations about each beasts' performance. The dairy herd provides calves for feedlotting, and culled females for manufacturing beef. Dairy calves are grown out for about 6 months and then

³ For grain fed beef (threshold of 100 days on grain) the minimum export specifications are MC 1 - 5 and FC 0 - 5. For younger grain fed cattle (threshold of 50 days on feed), the minimum specifications are MC 1 - 3 and FC 0 - 3. Most grain fed carcasses would easily meet these specifications.

⁴ The Meat Industry Authority in New South Wales has required since September 1992 that all colour branded carcasses (gold and purple) be Chiller Assessed. The major supermarket chains, Coles and Woolworths, already require the majority of their product to be chiller assessed.

⁵ This proportion would be higher in Queensland where the focus of meat production is on export markets.

⁶ The 70% tariff set when the market was liberalised in April 1991 was reduced by 10% in 1992 and a further 10% in 1993. Under the GATT agreement made in December 1993, the current 50% import tariff will be reduced by 2% a year for six years, beginning in April 1995.

feedlotted for a further 14 months before slaughter.

Longworth (1983) and Mori, Lin and Uri (1992) describe the Japanese beef market as being typically divided into three segments. At the upper end of the market is the highly marbled "Kobe" beef which is derived from the best quality (usually black) Wagyu cattle. At the lower end of the market is the manufacturing sector which draws supplies from low quality domestic carcasses and the inferior cuts from better quality beasts, as well as imported frozen grass fed beef from Australia and New Zealand. Mori, Lin and Uri (1992) estimate the remaining middle market at about 65 to 70 % of beef consumed, and for convenience, subdivide it into high quality and low quality sectors. The high quality market consists of Wagyu beef that is not classified into the upper end of the market, high quality dairy beef, and imported high quality grain beef. The lower quality market consists of the majority of domestic dairy beef and imported chilled grass and grain fed beef.

Mori, Lin and Uri (1992) argue that the upper high quality beef market in Japan is separate to the high quality section of the middle market, and there is limited opportunity for imported grain fed product to be substituted into that market⁷. McKinseys (1990) identified the middle market segment as having the greatest potential for Australian exports. The user requirements in this segment were characterised by broader tastes, and budget and quality consciousness.

The distribution and retailing system for food in Japan is a multi-layered and complex one. Beef imports to Japan typically go through a chain of importers, wholesalers, distributors and retailers, being further segregated and broken up at each level. The retail level is characterised by a large number of small outlets, with a current trend towards more supermarkets and specialist retail centres. This trend is accelerating due to changes in the regulatory structure in Japan, and the abolition of resale price maintenance. Increased competition between supermarket chains is placing pressure on the distribution channels and the ways in which supermarkets purchase and present food lines (Reithmuller, 1994)⁸. Food quality, freshness and safety are all important issues for Japanese consumers (Anderson and Riethmuller, 1992). The SMART report (1993) identifies freshness as the single most important contributor to consumer intent to

⁷ This is supported by price trends since liberalisation. The prices of black wagyu cattle have been largely unaffected, while prices for other wagyu cattle and for dairy beef have fallen significantly (Reithmuller and Kobayashi, 1993).

⁸ Consumer cooperatives are also important retailers of food in Japan, particularly as their members tend to have higher levels of income and education.

repurchase⁹.

White (1993) and McKinseys (1990) distinguish two uses for meat in the middle market - home use and eating out. Different attributes were important to customers in each area. White (1993) identifies the qualities of freshness, country of origin, price as a measure of quality and slight, but not strong marbling as important attributes for home use. For eating out the most important qualities are taste, smell, tenderness and leanness. For Japanese, imported beef is seen as inferior to the local product, and American beef is seen as superior to Australian beef. As well, the US beef is seen as better in terms of marbling, taste, smell and tenderness, and the lower price of the Australian product creates the impression of lower quality.

The SMART report (1993) uses an extensive survey of Japanese consumers to identify meat characteristics and pricing information that was important. The report showed that consumers were able to distinguish between various ranges of product, and that most Australian product falls into the moderately liking and low liking groups. Price as a reflection of value for money was found to be the single most important consideration for meat purchases (See Table 1).

Table 1
Contribution of factors to Japanese Consumer's decision to purchase meat (SMART Report).

	<u>Sliced Meat</u> (%)	<u>Steak</u> (%)
Price	45	52
Taste	39	39
Cooking Aroma	10	5
Appearance of raw meat	5	3
Unexplained	1	1

Preferences for the appearance of raw meat were related to the meat colour (33%), texture (26%), marbling (22%), the lack of fat (13%), and fat colour (5%)¹⁰. The Japanese preference is for lack of fat and for white fat. Sliced meat has all fat removed, and meat steaks have fat trimmed to 5mm. Acceptable appearance attributes would translate into chiller assessment

⁹ Pack date accounted for about 60% of re-purchase intent, dominating other considerations of country of origin, description, thickness, weight and cut.

¹⁰ The percentages in brackets give the relative contributions of each characteristic to preference for raw steaks. The contributions to preferences for raw sliced meat was slightly different.

scores of MC 2-4, MT 3, MB 2-4, FC 1-4.

The SMART report showed that preferences for eating qualities were most strongly related to tenderness (78% for steak), with juiciness (12%) and familiar taste (10%) being important. Familiarity of smell when cooking is also important. Based on product characteristics (raw appearance, cooking odour, eating quality and overall liking) the report distinguished three groups of products in the Japanese market:-

Premium	Wagyu, grainfed, high quality pasture, and yearling
Superfresh	grainfed yearling and high quality pasture
Economy	pasture and manufacturing

Queensland meat processors indicated most potential growth in the Japanese market in three main areas. These were in grain fed beef, short fed beef¹¹, and the better quality grass fed beef. The market for lower quality grass fed beef was seen as limited¹², and the high quality market is seen as difficult to penetrate, uncertain, and of limited growth.

6. Beef Exports from Queensland

Before market liberalisation, beef exports to Japan were controlled or organised by the LIPC. Beef was demanded on a categorical basis with respect to sex, weight, age, fat cover and bruising. A large sector of the beef industry in Queensland became geared to the production of "Jap Ox", a bullock that would dress between 300 and 420 kilos. Three or twelve cuts would be boned from each side of the carcass, and the remainder sold into other markets.

Meat exports from Queensland to Japan have increased significantly since liberalisation (Table 2). Most of the increase has come in the form of bone-out, chilled beef, particularly grain fed beef¹³. There is ongoing significant investment in the processing industry and most investment has been directed to providing increased supplies to the Japanese market. There has been substantial vertical integration in the industry between feedlots, processors and Japanese interests. About 25% of cattle in feedlots in Queensland are

¹¹ Short fed cattle are cattle grain fed for up to 100 days. The meat from short fed cattle is classified as grass fed beef.

¹² The manufacturing meat market in Japan is not nearly as profitable, partly because of the overhang of frozen stocks in Japan, and because of the oversupply of low quality meat in Australia.

¹³ Grainfed exports to Japan have increased from 621 tonnes in 1984 to 66,000 tonnes in 1992 and 86,014 tonnes at the end of November 1993. As well, there has been a marked increase in the amount of short fed beef exported.

being "custom fed" to specifications for Japanese or processor interests.

Table 2

Foreign Exports of Beef from Queensland

Period	Bone-in (tonnes)	Bone-out (tonnes)	Japan (tonnes)	Japan \$'000
1990 - 91	37,950	339,925	137,343	675,591
1991 - 92	40,770	363,251	133,175	647,347
1992 - 93	33,514	400,570	167,985	820,256

source:ABS 7204.3

Feedlot capacity in Australia has increased from 365,550 head in 1990 to 491,631 in November 1993. Utilisation over the same period has risen from 69% to 84%, and the proportion of cattle fed for export has risen from 59% to 76%. Queensland has the largest feedlot capacity of all States (Table 3). Nationally, about 60% of feedlot cattle are bound for the Japanese market. This proportion is likely to be higher in Queensland. The average length of feeding in the industry is between 150 and 200 days.

Table 3

Summary of Feedlot Activity

Quarters	Nov92	Feb93	May93	Aug93	Nov93	Nov96 (F'cast)
	('000s of cattle)					
Feedlot Capacity Australia	452	459	477	510	516	679
Feedlot Capacity Queensland			203	240	243	301
Cattle on Feed Australia	288	335	515	414	401	
Cattle on Feed Queensland	147	164	196	235	237	
Cattle turned off Australia	160	160	209	223	221	

Source:AMLC/ALFA National Feedlot Survey

Associated with the rise in beef exports to Japan has been an improvement in quality. This has occurred through improvements in quality control, hygiene, presentation, and the quality of the meat itself. Meat cartons are inspected much more frequently and rigorously now to check on contents

and labelling. Hygiene has been targeted in a number of ways - new stainless steel facilities, improved chiller and transport operations¹⁴, more rigorous chemical residue testing, and improved kill floor and chain designs. Presentation has improved through specific meat trimming¹⁵, crivac packaging¹⁶, and boxing¹⁷. Meat quality has generally been targeted through the purchase of grain fed cattle.

The focus of the Japanese market has not only been on the narrow target of meat quality, but on broader quality issues of consistency and food safety. Most meat processors reported that feedlot ownership or integration was essential to satisfy consistency requirements rather than to simply to upgrade meat quality. Food safety was seen as a continuing area of quality control, with future emphasis likely to be on increased chemical residue testing and maximum allowable bacteria counts.

7. Chiller Assessment and Japanese Orders.

Chiller assessment is generally used as a filter for supplying meat to the Japanese market. Processors use chiller assessment as an inhouse means of targeting meat quality to Japanese orders. Table 4 gives a sample of the specification ranges used by exporters from Queensland. Varying estimates exist about the level of understanding in the Japanese market of the chiller assessment language. ACIL (1993) present a range of estimates of between 20 % and 84 % of the Japanese beef marketing channel being aware of the chiller assessment system. Most chiller assessment specifications for a market have been developed from the processor's understanding of Japanese customer requirements, and do not form a trading language in its own right.

There are two main reasons why Japanese customers do not rely on chiller assessment specifications for trade negotiations. The first is that chiller assessment does not fully describe meat quality. The second is that the Japanese rely on other means of targeting beef quality which include brand names, days of grainfeeding, and trust/relationship.

¹⁴ Inadequate chilling is a cause of meat drip and bone taint.

¹⁵ Most abattoirs trim according to the needs of the customer, and will change for different orders. For example, Stockyard Meat Packers prepares meat with five different trim specifications for just one of its Japanese clients, the Japanese Consumers Cooperative Union.

¹⁶ To stop meat drip, one abattoir wraps its meat in a special cloth before crivac packaging. The cloths were designed and supplied by the Japanese meat importer.

¹⁷ Processors are careful to pack similar size cuts in each carton, and in some cases to standardise carton packing per container load.

Table 4
Sample of Meat Specification Ranges used by Meat Exporters in Queensland

Order	Feed Type	Fat Colour	Meat Colour	Marbling
1	grass	0 - 7	1 - 6	
2	grass	0 - 6	1 - 5	+1 and up
3	grass	0 - 5	1 - 5	
4	short fed	0 - 5	1 - 5	+1 and up
5	100 grain	0 - 5	1 - 4	+1 and up
6	120 grain	0 - 4	1 - 2	
7	120 grain	0 - 5	1 - 4	+1
8	150 grain	0 - 4	1 - 4	2 and up
9	150 grain	0 - 3	1 - 2	+1 - 2
10	150 grain	0 - 3	1 - 2	3 - 4
11	150 grain	0 - 3	1 - 2	5 and up
12	150 grain	0 - 2	1 - 2	2 - 5
13	180 grain	0 - 2	1 - 2	1 - 6
14	200 grain	0 - 5	1 - 4	2 - +3
15	200 grain	0 - 2	1 - 2	3 - 8
16	100-200 grain	0 - 3	1 - 3	2 and up

7.1 Appropriateness of Chiller Assessment.

The chiller assessment language is similar to the Japanese grading system¹⁸. Dunlop and Dunlop (1993) suggest that there are discrepancies in comparing marbling scores, and that fat quality (softness and lustre), meat texture, meat tightness and muscle water content were important characteristics that buyers looked for but were not adequately described by the grading system. Fat odour and meat taste are also commonly reported as being important to the Japanese and a major reason for the demand for grain fed cattle¹⁹. Meat processors in Queensland indicated that there were some difficulties in describing meat quality objectively for the Japanese market, but that chiller assessment generally worked well²⁰.

Marbling tends to be underestimated in Australia because it is assessed at a higher temperature (10 - 15 degrees) than in Japan (0 - 4 degrees) (Dunlop and Dunlop, 1993). This is

¹⁸ Longworth (1983) and Lin and Mori (1991) give overviews of the Japanese grading system.

¹⁹ Grain feeding reduces "grassy smell". Seirer, Gaunt and Thatcher (1992) found that after 55 days of grain feeding, beef with any fat colour up to score 6 produced an acceptable cooking odour for Japanese.

²⁰ One abattoir reported a 96% confirmation rate of chiller assessment marbling scores by Japanese graders.

counterbalanced by the perception that Japanese grade more harshly. High marbling scores in Japan depend to some extent on associated fat and meat colours, while marbling is assessed in Australia independently of other factors. Some processors indicated problems with meat colour scores, suggesting that the scores varied between Australia and Japan because of the different light source used. Processors suggested that at the top end of their market in Japan, marbling was the most important criteria. Cattle for this market were generally grain fed for between 120 and 300 days, which meant that fat colour and meat colour scores would be low and acceptable, and few problems with fat odour or meat taste should exist.

Quality criteria for the lower end of the market was different. Provided a minimum standard of marbling was met²¹, meat texture/firmness and meat tenderness were considered the most important attributes to consumers. Meat colour and fat colour are also important to a lesser degree. A slight degree of marbling seems to be essential to prevent meat being too sloppy. Processors indicated that meat texture/firmness was currently graded on a subjective basis.

Market demands from Japan are not consistent across the range of processors. At the upper end of the market, marbling is the most important attribute, providing product supply and quality control is consistent. However processors reported large variations in the range of marbling scores demanded by their various clients. At the lower end of the market, demands showed more variation, and processors generally expected the tendency for specific market orders to increase in the future. Processors dealing with importers in Japan reported that marbling was still important at the lower end of the market, and that they exported the traditional three or twelve cut orders. In contrast, processors dealing directly with retailers or cooperatives reported more specialised trim requirements, a varied number of meat cuts per order (ranging from 29 down to single cut orders), and a greater emphasis on other meat quality factors than marbling. In some cases processors supplied both groups and noted the different requirements.

All processors agreed that meat profile was important, and rejected meat that was either too flat or too small in profile (one processor used a minimum rib eye muscle area of 58 square centimetres). There was little problem reported with fat odour and meat taste.

The response by processors to specific demands for meat quality or dissatisfaction with grading standards has been generally uniform - a tightening of in house chiller assessment specifications. In some cases the cutoff levels

²¹ Most processors indicated that the minimum marbling score was a high 1. Meat with a lower marbling score would be directed to the manufacturing market in Japan or to other markets.

are established within scores²². Processors all rated the chiller assessment language as very important for trade with Japan.

This suggests that the chiller assessment language provides an adequate base for meat trade with Japan, although there are some areas of potential improvement. Most important is the development of indicators for eating quality (tenderness, juiciness, flavour). This will also be of benefit to the domestic market where tenderness is the most important characteristic to consumers. Current developments in video image analysis (VIA) and tenderness metres are close to application²³. Seirer, Gaunt and Thatcher (1992) suggest the development of rapid fatty acid analysis may be a suitable way of ensuring acceptable taste and odour conditions are met. The availability of a more specific language than the numeric scale would be of benefit to some industry participants (ACIL, 1993).

7.2 Japanese methods of targeting quality.

In the Queensland beef industry, the preferred Japanese approach to targeting meat quality has been to select cattle according to the number of days they have been grain fed for. Where processors have responded to demands for higher meat quality by tightening chiller assessment specifications, the Japanese response has generally been to increase the length of grainfeeding. This is particularly the case where Japanese companies own feedlots or contract cattle going through feedlots.

Length of feedlotting has a number of positive correlations with meat quality factors, including marbling, meat colour, fat colour and odour and taste. As the length of feeding increases for cattle in a feedlot, variations in fat colour, meat colour and carcass weight become much smaller, allowing a more consistent product to be produced. Marbling, taste and odour generally improve. Thus the number of days on feed is a convenient indicator of meat quality for Japanese buyers. However the use of days on feed as a surrogate measure of quality causes inefficiencies in the Australian mechanism, an issue which is explored below.

Product identification in the form of brand names is a critical tool that the Japanese use to identify quality. All chilled beef exported to Japan from Queensland is exported under a brand name. In many cases firms use several brand

²² Many firms reported that marbling scores of high 1s were acceptable, while low 1s were not. One processor lowered its specifications for meat colour for an order from 4 and below to mid-4 and below to satisfy its customer.

²³ These developments are covered under the Trading Systems Key Program of the Meat Research Corporation.

names to differentiate their product. Some brand names carry through to the retailer and consumer. Others only last through to the importer or distributor level, where meat is split up and relabelled. Nearly all brand names in Queensland are specified by chiller assessment characteristics.

Most brand names that consumers recognise are developed from the retail end in Japan so that retailers have the flexibility to source product from different companies¹⁴. However, brand names are also important at the importer and distributor level. The use of brand names carries information about consistency of product, quality and food safety. Whereas meat into the US market can be easily sold on the open market according to its attributes, sales into Japan are usually part of an ongoing relationship where consistency is of major importance. This means that while brand names are of primary importance, they are underpinned by the ability of the exporter to provide meat quality, and the use of inhouse quality filters such as chiller assessment is fundamental to the success of the brand.

Meat exporters in Queensland indicated that they had clearly defined chiller assessment criteria for their brand names, and that the trend within the industry was towards more objective quality measurements as the basis for export sales.

8. Market Inefficiencies

There are two major sources of price inefficiency for meat quality signals in the meat distribution process. The first is the use by the Japanese of surrogate indicators such as days on feed for meat quality. The second is the poor transmission of price signals, particularly from the processor back to the producer (ACIL, 1993). To a large extent the two problems are interrelated, and a change towards the use of chiller assessment as a direct trading language is likely to improve the flow of market signals and information.

8.1 Inefficiency of a Days on Feed Standard

The number of days on feed is an inefficient means of indicating quality. This is because the correlations between days on feed and quality characteristics is not strong compared to the cost of grain feeding. Meat quality characteristics are influenced by other factors including age, temperament, genetic background and prefeedlot rations. The

¹⁴ An example of a brand developed in Australia to target the retail market in Japan is "Your Choice" from Australia Meat Holdings. The word "Choice" creates an association with the US grading standard of the same name. A more typical pattern is for the Japanese retailer to develop the required range of specifications. For example the "Queensland Bimi Kuroushi" brand from Stockyard Meat Packers was developed by Fuji Citio, a supermarket chain in Japan that surveyed retailers and developed specific cut specifications.

following research indicates that grain feeding has a low effect on meat quality, or at least that the effect diminishes after the first 55 to 100 days of grain feeding.

Seirer et al (1992) find grain feeding has a significant effect on fat colour for intermuscular fat after 55 days of grain feeding. Subsequent feeding to 97 days showed no subjective change in fat colour, although Chroma C results indicate a further fall. Their review of other research indicates that intermuscular fat colour will fall significantly in the first 55 days of grain feeding, and may continue to fall with extended grain feeding. External fat colour is much slower to change than internal fat layers, but as meat cuts in Japan are trimmed of subcutaneous fat prior to sale, the colour of external fat layers may not be a serious commercial problem. Baud et al (1992) estimate that extending time on feed from 200 to 300 days whitens fat by up to 1 score. However, 150 days of grain feeding is sufficient to make fat colour acceptable to the Japanese market (Baud et al 1993).

Meat colour is found by Seirer et al (1992) not to increase in visual appearance with 97 days of grain feeding. They quote Dundon (1990) as linking longer periods of grain feeding with improvements in meat colour. Baud et al (1993) find that meat colour after 150 days of grain feeding is highly acceptable to the Japanese market.

Seirer et al (1992) show that a number of combinations of fat colour and days on grain produce acceptable smell for the Japanese. After 55 days of grain feeding, beef with any fat colour score up to 6 produced an acceptable cooking odour. Changes in odour and smell are due to changing ratios of fatty acid profiles²⁵.

Dunlop and Dunlop (1993) report that marbling is correlated positively with body weight and days on feed. An additional 100 days on feed will improve marbling by two thirds of a score. Only a small correlation exists between marbling and feed ingredients. These results are supported by Baud et al (1992), who find that extending time on feed from 200 to 300 days improves carcass marbling by around 0.3 of a score. The effects of ration type on meat quality were small²⁶.

Trials by CSIRO²⁷ suggest that grainfeeding has no direct effect on meat tenderness. Tenderness is more closely

²⁵ Dunlop and Dunlop (1993) also link changes in fatty acid profiles with taste and odour.

²⁶ Current CSIRO trials at Moree in NSW are having some success with canola seed and cottonseed supplements improving marbling scores.

²⁷ Tropical Beef Centre, Rockhampton. The trials have been based on 1250 bos indicus cross steers from northern and central Queensland.

related to age than feed, and it is the ability of grainfeeding to turn off cattle up to twelve months younger that delivers a more tender product. Marbling has little effect on tenderness, but is a major contribution to taste.

Queensland processors report that meat colour and fat colour are generally acceptable for longer fed cattle. While targets vary in the industry, a fat colour range of 0 - 3 and meat colour range of 1 - 2 is typical of meat fed for over 150 days. For 120 days on feed, a typical target would be a fat colour range of 0 - 4 and meat colour 1 - 2. A small proportion of cattle are unsuitable because of dark meat colour²⁸.

For many grain fed cattle, sales are made on a categorical basis and threshold levels of fat colour, meat colour and marbling may apply. The high cost of feeding cattle means feedlotter have a large financial incentive to improve chiller assessment results. Processors report a marked improvement in the quality of grainfed cattle since chiller assessment has provided feedback²⁹. Processors also report large variations in the quality of cattle from different feedlots. This information suggests that the number of days on feed is not an accurate reflection of quality, both across time and within the industry.

The emphasis on the number of days on feed is a major source of inefficiency in the industry. Instead of trying to achieve required meat quality characteristics in the minimum number of days on feed and at minimum cost, the industry operates on a fixed number of days on feed and a fixed cost and tries to maximise conformity and meat yield. The market is not receiving explicit signals to select cattle that will satisfy meat quality signals in a shorter time frame³⁰.

²⁸ "Dark cutters", as they are known in the industry, are the result of high Ph levels, and are the product of age and pre-slaughter stress. Careful selection of cattle entering feedlots have reduced the incidence of dark cutters.

²⁹ Most improvement has been in fat colour scores and a reduction in the incidence of dark cutters. Industry estimates suggest that where 80% of feedlot cattle passed chiller assessment criteria in 1991, the successful percentage has improved to at least 95% in 1993. Because of varied chiller assessment targets, these are only rough estimates.

³⁰ There are distinct preferences for breed in the feedlotting industry. Leading are Angus and Murray Grey, followed by various British breeds. Two problems have developed from this broad market signal. The first is that large variations exist within breeds (Baud et al, 1992), and thus breed preference is not a particularly efficient means of selecting cattle. The second is that many suitable cattle from the less preferred breeds have been ignored, particularly Brahman cross cattle from Queensland (Baud et al, 1993).

If cattle could be targeted to meet meat quality specifications more quickly, major cost savings would result to the Queensland cattle industry. If 270,000 cattle bound for the Japanese market could be fed for 10 days less on average, the cost saving would be about \$8.1 million. If they could be fed for 30 days less, the saving would be about \$24.3 million³¹, or about 20% of costs.

8.2 Poor Transmission of Price Signals.

The Queensland beef industry is characterised by poor price signals and price averaging for both meat yield and meat quality. There is little evidence of direct price signals between processors and producers for meat quality characteristics. The relationship between meat quality and price between processors and the Japanese market is rarely explicit but is usually implicit in the use of brand names and the importance of consistency.

Many processors impose categorical limits on grain fed cattle for chiller assessment characteristics, particularly meat colour and fat colour. Some processors sort grain fed meat according to marbling score, either for the convenience of Japanese importers, or to place in different brand lines³². There is a strong information flow back to the feedlot industry in the form of chiller assessment feedback, and this has resulted in a much larger proportion of cattle meeting categorical limits over the last two years. However once categorical limits have been reached, there is little market incentive to further improve chiller assessment results, except where feedlots are closely integrated with the Japanese market.

Market signals are even weaker in the case of grass fed cattle. Most abattoirs do not provide chiller assessment feedback to producers³³. Cattle are rarely priced or bought on the basis of meat quality, although there has been some experimentation with price grids. The evidence shows that price averaging is a more substantial problem with grass fed cattle than with grain fed cattle.

The bulk of grain fed cattle meet a tight band of chiller

³¹ Cattle on grain consume 2.4% of bodyweight per day. Assuming an average weight of 550 kilos and a grain price of \$170/tonne, daily feed costs come to \$2.24. This has been rounded up to \$3.00 to allow for feed additives, hay, transport, management, capital and veterinary costs.

³² Some processors are unable to do this because they can not redirect meat after chiller assessment. One abattoir though can grade grain fed carcasses into eight different lines for boning on the basis of chiller assessment.

³³ Producers rarely ask for it. Many firms will supply on request, or AUS-MEAT will provide assessment for a fee.

assessment specifications. ACiL (1993) suggest the rejection rate for grain fed cattle under chiller assessment is 5 %, the same as for grass fed. Processors surveyed for this project indicated that the rejection rate for grain fed cattle is lower than 5 % (0.5 % for one abattoir), while the rate is higher for grass fed cattle³⁶. The different results to the ACiL report are largely the product of time since that report was prepared. Since then feedlots have improved in supplying grain fed cattle, and many works have tightened chiller assessment cutoffs for grass fed beef.

Most processors report problems with yellow fat colour in grass fed beef, and cite yellow fat as a more important area for improvement than marbling. For many processors the upper fat colour score for supply into the Japanese market is 6 or 7. For better quality grass fed beef, (often short fed on grain for up to 100 days), the permissible score drops to between 3 and 5. Wide variations in fat colour scores in particular are reported for grass fed beef³⁷. As well there are problems reported with meat colour, meat texture and meat firmness.

While there are no direct price signals on meat quality to producers, there are two important indirect signals. A recent trend towards premiums for 4 tooth Jap Ox in Queensland reflects a desire to improve meat quality. There is no premium from the Japanese market for 4 tooth Jap Ox compared to 6 tooth. Instead, 4 teeth cattle are younger and have generally better meat tenderness and fat colour than older cattle of the same age. However the number of teeth is not a fully accurate indication of age and the premium reflects an inefficient (although simple) means of targeting meat quality.

The second and most important trend is the use of chiller assessment data by processors when purchasing cattle (ACiL 1993). Almost all processors use previous chiller assessment records when competing for cattle from producers and feedlots. Many feedlots also use chiller assessment data to target feeder cattle. Thus chiller assessment records are being used extensively in the industry to set premiums and discounts, but producers are not made aware of the linkages between prices

³⁶ Annual data from one abattoir in Central Queensland revealed that 43 % of grass fed Jap ox had a fat colour score greater than 6. 40 % of short fed ox had a fat colour score greater than 6. Comparisons with NSW suggest the rates should be lower. A survey of 15,000 carcasses (89 % grass fed) across 43 abattoirs showed that 0.1 % had fat colour greater than 6 (AACM-Macquarie, 1993).

³⁷ Many abattoirs have become more careful about fat colour on the kill floor where carcasses can be downgraded for excessive surface yellow fat. Particularly for short fed cattle though, external fat colour may not be a good indication of inter muscular fat colour (Browne and Beasley, 1991, Seirer et al, 1992).

and chiller assessment performance³⁵.

9. Potential Effects of Meat Specification Orders.

Several direct effects could result from chiller assessment characteristics being used as the basis for a trading language with the Japanese market. It could accelerate the trend towards more specialised orders (Mori et al 1992). It would lead to more explicit price signals for quality characteristics and pressure meat exporters to target the supply of cattle more carefully. Price signals back to producers would improve. Information about the importance of quality characteristics would lead to an improvement in the genetic base of the cattle herd³⁷. Breedplan now has four carcass Estimated Breeding Values (EBVs), being fat depth, eye muscle area, estimated total meat yield (kg), and estimated meat yield (%), and these could be augmented with other traits.

For these changes to occur, several difficulties need to be addressed. The first is to demonstrate that the supply of cattle can be improved, both in the short term and the long term³⁸. In the short term, increased feedlotting, better feedlot management and better selection of feeder cattle will lead to improvements in meat quality. The Japanese market has often preferred British breeds for the higher value markets, a preference that discriminates against many Queensland cattle with the infusion of *Bos indicus* in them. There is some evidence that current trends towards meat quality specifications is allowing more meat from *Bos Indicus* infused cattle to be used (ACiL, 1993). This is increasing Queensland exports at the expense of southern states.

Baud et al (1993) report that existing breed groups in Queensland have the potential to target the Japanese B2 grain fed market specification. 64 % of steers trialled met market specifications after 150 days on grain. Large variations between vendors was reported, particularly for liveweight gain, dressing percentage and marbling. Careful selection of feeder cattle and genetic improvement in breeder herds are necessary to ensure feedlots met market specifications. The development of live assessment techniques will help predict

³⁶ At least one feedlot in Queensland will pay a subsequent bonus for feeder cattle that go on to meet certain quality criteria.

³⁷ There is currently little genetic selection on the basis of meat quality. Research from the Animal Genetics and Breeding Unit (University of New England) suggest that heritability estimates for eye muscle area, rib fat, marbling, dressing percentage and retail yield range from medium to high.

³⁸ Processors are cautious about more specific orders, particularly for various cuts, because of the difficulties in purchasing suitable cattle and in marketing the rest of the carcass.

optimum turnoff times and target genetically superior cattle.

The second difficulty to address is the problem of information flows. Most processors felt that the market would move towards offering premiums on a price grid for chiller assessment characteristics. This would mainly occur with interested producers rather than across the market. Competitive pressures, habit and tradition in the industry, and the complexities of a large pricing system make it difficult to introduce change³⁹. Many processors argue that information flow is more important than price signals, and that carcass competitions, feedback and publicity will lead to change in the industry.

Large amounts of chiller assessment data already exist in raw form. Producers not only need feedback in the form of raw data, but analysis to show variations between order requirements and industry/district standards. The development of software packages to process data into a more user friendly form for producers will help information flows.

Another possibility is that a secondary trade in meat products may develop. For example, all abattoirs reported having some carcasses with high marbling scores that they packed into their lower specification packs. The possibility of trade to other meat processors with orders for those carcasses would allow premiums to be collected.

10. Conclusions

The Japanese beef market demands a range of quality characteristics in beef from Queensland that include consistency, freshness, appearance and eating qualities. Chiller assessment has allowed exporters to target markets more closely, but is only one means of targeting quality. This is because chiller assessment relates principally to the appearance of meat. Japanese buyers use trade names and days on feed to target eating quality, and processors develop infrastructure and quality assurance to improve consistency and freshness qualities. The increase in the use of chiller assessment and the prevalence of grain feeding indicate the growing importance of quality to the Japanese market.

Information about chiller assessment is transmitted very poorly in the cattle industry, despite the fact that it is widely used by processors and feedlotters in purchasing cattle. Substantial price averaging occurs across both grain

³⁹ A technical problem often raised is that ownership of a beast in the weight and grade system changes at the scales, at the end of the slaughter floor. This is prior to chiller assessment, so prices involving quality characteristics can not be determined at the point of ownership change. ACIL (1993) argue this is not a problem as the industry will accept subsequent price adjustment on chiller assessment. There is still a question about ownership of chiller assessment data.

fed and grass fed carcasses. The use of chiller assessment as an inhouse filter rather than as a trading language partly explains the poor information flow back to cattle producers. Improvements in meat quality as a result of chiller assessment feedback have already been gained through targeting management practices in feedlots. However large variations in the performance of cattle from difference vendors suggest that significant potential exists to improve the genetic base of cattle bound for the Japanese market.

The use of days on feed as a measure of quality by the Japanese market is not efficient. The relationship between feedlotting and meat quality factors is not strong, and cattle tend to be overfed to compensate for poor genetic and feeder backgrounds. This means that there is a direct cost to the industry of those cattle which are overfed, and an indirect cost because there are no price signals being sent to the cattle breeders about the desired genetic characteristics.

The addition of eating quality characteristics (particularly tenderness scales and measurement) to the chiller assessment language is needed to make it a comprehensive guide to meat quality. The use of chiller assessment as a trading language for meat sales will stimulate the payment of premiums and discounts for quality characteristics and enhance information flows back to producers. Continued growth in meat exports to Japan and the trend towards more specific orders can only be satisfied by improvements in the supply of cattle. Price signals are essential for that process to occur, and the continued development of chiller assessment as a trading language is the key to improved access in the Japanese market.

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