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THE ECONOMIC IMPACT OF THE BAN(S) ON HORMONAL GROWTH PROMOTANTS: STRATEGIES FOR AUSTRALIA

Greg Darwell

Australian Meat and Live-stock Corporation
Sydney

The European Community's (EC) ban on imports of meat products derived from animals that have been treated with hormonal growth promotants (HGPs) has greatly influenced producers' production decisions and has the potential to alter international trade patterns within the next few years. This paper analyses the impact of the EC's ban on the Australian beef industry, as well as the possible impact should the ban spread to other major importing or supplying countries.

The EC's ban has effectively included the HGP status of cattle as a variable that determines the prices paid for cattle. A regression analysis of cattle sold through Computer Aided Livestock Marketing (CALM) revealed that HGP status did not significantly affect prices paid for most categories of cattle. However, a premium was revealed for HGP treated cattle in the heavy steer, medium steer and yearling categories.

The EC's ban has spread to other Western European countries and the United Arab Emirates. While these are only small markets, a ban by a major importer is not impossible. With production in the United States heavily reliant on HGP use such a ban would immediately place them at a distinct disadvantage. With the current low level of HGP use in Australia and an accepted control system including the world recognised National Residue Survey in place we are in a very strong position to be able to supply HGP free product to markets requiring it, while, at the same time, continuing to obtain the production benefits from HGP use.

The views expressed in this paper are those of the author and do not necessarily reflect the official view of the Australian Meat and Live-stock Corporation. The help of CALM and the suggestions of the AMLC's Trade Policy section are acknowledged.

Introduction

In December 1985, in response to consumer pressure, the European Council of Ministers announced that, from 1 January 1988 there would be a total ban on the use of hormonal substances for the purpose of fattening cattle. After further Directives detailing various aspects of the ban it was announced that imports of meat products from third countries would only be permitted, after 1 January 1989, from animals that had not been treated with hormonal growth promotants (HGPs) at any stage of their life.

The EC's ban disregards all available scientific evidence which has proved that HGPs are in no way detrimental to human health and are in fact, amongst the safest of all veterinary products available. However, in today's consumer driven market producers must supply product to market specifications if they wish to remain competitive in the long run.

The EC's ban raised a number of important issues for the Australian industry, including;

(1) the appropriate response of the Australian industry i.e. should Australia comply or ignore the ban;

(2) the likely effect on the industry, especially in terms of cattle prices; and

(3) the likelihood, and probable effects, of the ban spreading to other countries, both importing countries and competitors.

Of particular importance was the effect on prices. Reports from saleyards throughout 1989 claimed both discounts and premiums for cattle that had been treated with HGPs but due to inconsistencies in various yards with the green paint identification system these claims were not statistically substantiated. The HGP status of an animal has the potential to alter producers' returns and also determines the products availability for various markets.

It is the intention of this paper to extend previous work on factors influencing the prices paid at auctions to include the HGP status of animals and to review the extent to which the HGP issue may change market access (and agreements) and affect the international beef trade.

Factors Influencing Auction Prices

Previous Studies

Hogan and Todd (1979) undertook a study aimed at examining some aspects of the efficiency of pricing in the livestock auction system, using readily available data. They found that lot size was the major factor explaining price differences between two centres and that it was also a significant source of price variation within both large and small auction centres. For individual sale centres they showed lot size to have a significant negative effect on price in five out of eight cases, although the number of buyers purchasing cattle did not significantly affect price levels. It was considered that premiums were paid for larger lots because they allowed quality specifications to be met more easily.

Todd and Cowell (1981) studied within sale price variation at cattle auctions with the aim of providing some empirical evidence on the effects of a range of factors on prices at auctions. On the basis of technical and economic research, the model developed had price as a function of the following:

$$P = f(W, S, F, A, B, D, H, LS, T)$$

where

P = lot price ($/head or ¢/kg - these were modelled as alternative dependant variables to see which provided the better specification);

W = cold carcase weight including internal fats (hot carcase weight less 2 per cent shrinkage);

S = sex, either heifer (S_0) or castrated (S_1);

F = cold carcase measurement at the 12th - 13th rib interface;

A = dummy variables for the number of permanent incisors (A_0<2, A_1>=2)

B = dummy variables for breed: Shorthorn (B_0), Hereford (B_1), Angus (B_2), other (B_3);

D = dummy variables for district of origin: Adelaide Hills (D_0), Upper South-East (D_1), Mid-North (D_2), Peninsulas (Eyre, York)(D_3), Far North (D_4);

H = dummy variable for horned (H_0), hornless (H_1) and mixed lots (H_2);

LS = number of cattle within a sale lot; and

T = time of sale in terms of pen numbers within the sale, the sale being split into four periods.

The factor 'horns' (H) was included as a proxy for bruising and 'district of origin' (D) as a proxy for distance travelled (bruising) and an indication of the feeding regime.

Of the nine factors included in the model, seven were found to be significant. The cold carcase weight was found to be a highly significant explanator of price variation at the cattle auction, as was the fat depth of the animal. Age was not significant in itself but became so when the age:weight interaction term was included. The time of sale was significant as buyers tended to hold off on early lots while a 'market price' was being established. The sex variable was significant, as expected, with premiums paid for steers. Breed did appear significant in the dollars per head model, with Hereford cattle attracting a price premium over Shorthorn cattle. However, this result should be treated cautiously as there appears to be no technical basis for the existence of such a premium. Lot size was significant with a premium paid on each unit increase in lot size. District of origin was found to be a significant explanator of within sale price variation, but horn status was not.

It should be noted that the price data used in the Todd and Cowell study was collected from one auction on one day. A sample of seven buyers was selected who would generally purchase approximately 40 per cent of the cattle offered at the auction.

The benefits and shortcomings of this previous research together with comments on Todd and Cowell's paper by Naughtin (1983) have been drawn on greatly in this paper to set up a model to determine whether or not the HGP status of a beast affects auction price.

The Effect of HGP Status on the Prices Paid for Cattle at CALM Auctions

As discussed, it has been shown that many variables influence the prices paid for cattle at auction. The European Community's ban on HGPs and the growing interest in the issue has brought another variable into the equation - the HGP status of the cattle.

In order to determine whether HGP status has any effect on the prices paid it was necessary to obtain accurate sales information on prices and details of the animal as well as their HGP status. With the problems that have been observed in the saleyard with the current control and green paint system it was decided to use CALM auctions for the data. Reports from physical auctions at yards have claimed everything from premiums to discounts for HGP treated animals but with no sustainable proof in either case.

The current declaration system has not made it legally necessary for the vendor to advise the agent as to the HGP status of his cattle going to the yards. Under CALM the assessor is required to reveal the HGP status of the lot on the assessment form. It would not have been possible to obtain such accurate information from saleyard figures (which would also have required sampling). In this study every lot sold through the CALM system from 1 January 1989 to 30 June 1989 has been included.

The Difference from Previous Analysis

In previous studies (saleyard data) the level of accuracy has been influenced by the sample size underlying the price reports, as well as by errors that arise from the buyer subjectively under or over estimating the carcase characteristics - factors such as fat scores, muscle score and carcase weight (dressing percentage). Objective description by accredited assessors in CALM minimises these errors.

CALM also reduces the scope for buyer collusion because those operating in the market in any one day are unsure of the other participants. Simultaneous auctions (where up to 40 lots can be auctioned at one time) help to remove the problem of buyers 'hanging off' the first few lots at saleyards while a 'market price' is established. Thus the time that each lot is sold during any one sale is unlikely to have a significant effect on the prices received.

The price data used by Todd and Cowell (1981) was collected from an Adelaide auction where the majority of cattle at the sale were purchased for the domestic market. The CALM figures include the whole quality spectrum from Kimberley cattle sold for manufacturing at 138 ¢/kg carcase weight to Murray Grey calves set for the feedlot and then the Japanese market at 376 ¢/kg carcase weight.

While CALM provides four basic selling options of dollars per head, cents per kilogram liveweight, cents per kilogram carcase weight and cents per kilogram carcase weight and quality (grid), all data gathered was converted to cents

per kilogram carcase weight. Todd and Cowell (1981) pointed out that the adjustment for weight variation incorporated in the dollars/head pricing model is inevitably less than perfect. It is viewed, by Naughtin (1983), that rather than the dollars per head price the cents per kilogram carcase weight equivalent reflects more accurately the value of the carcase meat, and that this is the primary valuation made by (commercial) buyers (through CALM). The data used also includes an objectively measured average liveweight of each lot - a variable that was not available to Todd and Cowell.

Data

The price data used in this study was collected from the two Friday and the Monday CALM sales as well as 'special' sales for the six months from 1 January 1989 to 30 June 1989. Price data was collected on a per lot basis together with information on the date of sale, the CALM stock category, the average liveweight of the animals in the lot, the lot size and whether or not the lot was treated with HGPs.

The Model

The general model was as follows:

$P = f(T, LW, LS, H)$

Where:

- P = price per animal, cents per kilogram carcase weight equivalent;
- T = time of sale in terms of week sold (1-26);
- LW = average liveweight of the animals in the lot;
- LS = number of cattle within a sale lot; and
- H = dummy variable for HGP treated cattle (H_1), and non-treated cattle (H_0).

With prices increasing for all types of cattle during the time period of this study due to nation-wide herd rebuilding and increased export demand, it was deemed necessary to include a time variable with weekly categories. The regression was carried out for nine individual categories of cattle (vealers, yearlings, young cattle, light steers, medium steers, heavy steers, heifers, cows and bulls) and six aggregated categories.

The regression analysis utilised the SHAZAM econometrics computer program. The main hypothesis to be tested was that the price paid for hormonal growth promotant treated cattle does not differ significantly from that paid for non-treated cattle.

Results and Discussion

The results of the regression are presented in Table 1. These results show that for at least three categories of cattle (heavy steers, medium steers and yearlings) there appears to be a premium being paid for cattle treated with hormonal growth promotants, rejecting the hypothesis that the price paid for HGP treated cattle does not differ significantly from that for non-treated cattle.

TABLE 1: CALM REGRESSION RESULTS

Stock Category	Degrees of Freedom	COEFFICIENTS					R^2	Durbin - Watson	Number of Treated Lots
		Constant	Time (week)	Lot Size	Weight	HGP Status			
Vealer	87	186.2*	2.55*	0.32*	0	4.58	0.56	1.63**	17
		(13.53)	(0.26)	(0.12)	(0)	(4.91)			
Yearling	271	231.1*	2.40*	0.12	-0.1*	5.3+	0.39	1.23***	122
		(9.35)	(0.21)	(0.06)	(0)	(3.16)			
Young Cattle	88	218.4*	1.74*	0.08#	0*	2.57	0.53	1.93	24
		(12.5)	(0.22)	(0.4)	(0)	(3.84)			
Light Steer	116	216.7*	1.49*	-0.07	0	2.45	0.18	1.92	30
		(14.85)	(0.30)	(0.06)	(0)	(4.64)			
Medium Steer	196	204.4*	1.75*	-0.03*	0	3.92#	0.51	1.74**	70
		(11.4)	(0.12)	(0.01)	(0)	(1.84)			
Heavy Steer	197	192.3*	2.05*	0.06*	0	3.46*	0.73	1.18***	107
		(7.26)	(0.09)	(0.02)	(0)	(1.32)			
Heifer	66	245.7*	1.35*	0.18	-0.01*	-7.12	0.45	1.66**	5
		(25.37)	(0.39)	(0.12)	(0)	(11.0)			

\+ significant at the 10 percent level
\# significant at the 5 percent level
* significant at the 1 percent level

Durbin-Watson at the 5 percent level
** inconclusive
*** autocorrelation

Figures in brackets are standard errors

Note: In the calf stock category three lots were sold but none were treated with HGPs
In the manufacturing stock category 16 lots were sold but none were treated with HGPs

Stock Category	Degrees of Freedom	COEFFICIENTS					R^2	Durbin - Watson	Number of Treated Lots
		Constant	Time (week)	Lot Size	Weight	HGP Status			
Cow	154	170.2* (17.9)	1.47* (0.25)	-0.12* (0.05)	0 (0)	-11.53 (18.1)	0.21	1.58**	2
Bull	32	160.0* (21.4)	1.99* (0.56)	-0.02 (0.18)	0 (0)	20.4 (23.75)	0.31	1.73**	1
Calf, Vealer & Yearlings	366	233.8* (7.06)	2.4* (0.156)	0.14* (0.05)	-0.01* (0)	5.92# (2.76)	0.45	1.30***	139
Calf, Vealer Yearling & Young Cattle	459	240.96* (6.03)	2.3* (0.14)	0.04 (0.04)	-0.01* (0)	7.63* (2.3)	0.46	1.29***	163
Yearling & Young Cattle	364	237.8* (7.67)	2.35* (0.16)	0.03 (0.04)	-0.01* (0)	7.17* (2.59)	0.45	1.25***	146
All Steers	519	204.9* (3.79)	1.81* (0.09)	0.02 (0.01)	0* (0)	3.81* (1.32)	0.46	1.55***	207
Heifer & Cow	225	251.5* (12.5)	1.2* (0.22)	-0.15* (0.04)	-0.01* (0)	-3.86 (10.4)	0.29	1.50***	7

\+ significant at the 10 percent level
\# significant at the 5 percent level
* significant at the 1 percent level

Durbin-Watson at the 5 percent level
** inconclusive
*** autocorrelation

Figures in brackets are standard errors

Note: In the calf stock category three lots were sold but none were treated with HGPs
In the manufacturing stock category 16 lots were sold but none were treated with HGPs

The Durbin-Watson statistics indicate that positive first-order serial correlation was present in the yearling, heavy steer and cow categories as well as in all aggregated categories. No attempt was made to correct this serial correlation as it was, most probably, caused by misspecification of the model. Variables previously found to have a significant effect on the saleyard price of cattle such as fat score and fat distribution were excluded from this model due to the complexities associated with averaging such objectively measured variables accross a lot. Other variables presented in the CALM catalogue such as the sex within the lot, quality grade, muscle score, temperament, stock history, grazing conditions, bruising and the assessors comment were also excluded due to similar modelling problems and in an attempt to keep the model simple. Any further analysis should perhaps attempt to include further variables so as to more accurately specify the model. Despite this shortcoming the model still provides an interesting insight into factors affecting cattle prices.

HGP Status

Results show that the HGP status of animals is significant in the heavy steer category (at the 1 percent level), medium steer category (at the 5 percent level) and yearling category (at the 10 percent level). All three coefficients are positive, representing a premium of between 3.46 and 5.3 cents a kilogram for animals treated with HGPs. This result would tend to support the claims that implanted cattle produce better carcases than those without implants, are better conformed and have a lower weight of kidney knob and channel fat. Research has also indicated that dissection of the thick flank shows a higher lean percentage in implanted cattle because of less undesirable intermuscular (seam) fat. Treated cattle are also more likely to go to high priced markets such as Japan due to this quality.

From these results it would also appear that the number of buyers for the EC market using CALM are not sufficient to have any significant negative effect on the price of treated cattle by stepping out of the bidding for treated lots.

The aggregation of stock categories also resulted in significant premiums being paid of between 3.81 and 7.63 cents a kilogram, except in the female stock category where the HGP status was insignificant. It needs to be stressed that these results are not conclusive and as CALM currently represents only 2.5 percent of total sales these results may not be indicative of the situation in saleyards.

Time

The time variable was significant at the 1 percent level in all stock categories. This was to be expected in the time period covered by this analysis. The first six months of 1989 was a period of increasing export opportunities with the liberalisation of the Japanese market and the reopening of the Korean market. This resulted in an increased demand for good quality feeder cattle and breeding stock while at the same time there has been a slowdown in supply.

Lot Size

Hogan and Todd found a premium was paid for each unit increase in lot size. This result did not generally hold in this study, although it was found that a premium was paid for each unit increase in lot size in the vealer, young cattle and heavy steer categories of 0.32, 0.08 and 0.06 cents kilogram respectively. This may be explained by the strong demand for restockers and

good quality carcases for export during the course of this study. However, lot size was found to have a significant negative coefficient in the cow, medium steer and aggregated heifer and cow categories, indicating that larger lot sizes may lead to discounts for these categories.

Live Weight

Unlike previous studies liveweight was found to be insignificant or only slightly significant. The main reason for this is the specification of individual CALM stock categories which minimises the variance of liveweight in each category.

International Trade Effects

While saleyard reports suggest discounting of greenbrand cattle this would appear not to hold for cattle sold through CALM. This analysis indicates that premiums seem to be paid for HGP treated cattle in some stock categories with no sign of the discounting in other categories. The most likely reason for this premium is that cattle treated with HGPs produce meat of a suggested higher quality than non-treated cattle and are destined for high value markets that do not have a ban in place, such as Japan.

The results of this analysis, together with findings in previous studies (e.g. by ABARE), suggest that there are considerable benefits to be obtained, both by individual producers and the industry as a whole, from HGP use. Prices for HGP treated cattle (sold through CALM) are at least as high as for non-treated cattle, and, in addition, the costs of production are lower. The main question from the industry's point of view is whether these benefits, net of the cost associated with losing the EC market, are greater than the net benefits incurred through compliance with importing countries' directives for product endorsed as HGP free.

The hormonal growth promotant question has already changed the international meat trade and has the potential to alter it further. Interest in the position adopted by the EC has spread to other importing countries. Some have already implemented similar bans and others are considering the issue and gaining facts on HGP usage and certification techniques in countries that export bovine meat and offal.

Certification puts Australia in a good position competitively. With the United States, Australia's major competitor in many markets, unwilling to officially certify product as HGP free further bans by importing countries may leave an opening for Australia to increase its market share. In the long term failure to comply with importing countries requirements for HGP free product has the potential to place 34 percent of Australia's beef and veal exports and 72 percent of beef and veal offal exports in jeopardy - as can be seen from tables 2 and 3 and figures 1 and 2. While no scientific justification for the ban exists Australia retains the right to use HGPs but producers are realising that in an increasingly consumer driven market they must supply a product demanded by the consumer and if this necessitates product without HGPs then this is what must be produced.

The benefits, through lower costs or production and greater product yield, available to the Australian producer from the use of HGPs together with an inherent desire to keep all safe, legitimate technologies available to the industry has resulted in the need for a control plan to ensure that animals slaughtered/processed for the EC and other ban markets have not been treated with HGPs. The importance of keeping all international markets open ruled out any option of non-compliance while the desire to keep legitimate technologies available, the problems associated with the development of a blackmarket, and trade related problems rule out the position of national ban.

Australia gave a committment to put in place a system of controls to ensure that meat and offal exports to the EC are derived from animals that have not been treated with HGPs. Three additional control elements complementing existing control procedures already in place at EC approve abbatoirs were implemented. The additional controls are:

1. a verifiable program for monitoring the import and distribution of HGPs in Australia;

2. a livestock industry declaration by the vendor and/or the vendor's agent to the meat processor attesting the elibibility of the livestock for EC processing; and

3. monitoring through the National Residue Survey (NRS) conducted by the Federal Government's Australian Quarantine and Inspection Service (AQIS).

The EC is no longer the only market requiring certification attesting that exports of bovine meat and offal from Australia are free of HGPs. While the small markets of the EC, the UAE, Finland, Norway, Austria, Switzerland and Yugoslavia represented only 1.2 percent of beef and veal exports in 1988 they represented 22 percent of beef and veal offal exports in the same year. It must be considered that the number of markets that require HGP free beef could grow and that these countries are part of the domino effect that appears set to include Sweden, the Middle East and perhaps Korea in the short to medium term.

The level of probability for requiring certification of imports, as used in tables 2 and 3 and figures 1 and 2, were assigned on the basis of official government stances of the respective countries. A 'ban' country is one that already requires imports of bovine meat and offal to be certified as HGP free. A country that has a 'high probability' of banning HGPs is one that may require certification of imports within the next 12 to 18 months. A 'medium probability' country is one that may require certification within the next five years and a 'low probability' country is one that may require certification of imports as HGP free within the next 10 years.

The US and Canada have both been assigned a nil probability of requiring certification of imports based on 'official' governmental policies that refuse to ban HGPs while there is no scientific evidence to do so. However, in the long run, no country has a nil probability. Reports from the US stress the growing consumer pressure groups aversion to additives in food products and the political weight that such groups are gaining. This type of pressure may force an about face of 'official' government policy despite the lack of scientific evidence.

Situation in Countries Importing Australian Product

The European Community

Australia exported 6010 tonnes of beef and veal to the EC in 1988. Of this 5910 tonnes was under the High Quality Beef Quota with the other 100 tonnes probably imported under the GATT or the Balance Sheet quota schemes with the relevant customs duties imposed. Offal imports into the EC are not covered by any quota arrangement but do, however, attract a customs duty ranging between 4 and 24 percent depending on product type. Australia exported 9157 tonnes of beef and veal offal to the EC in 1988 consisting mostly of tongues, hearts and cheeks.

In 1988 the United States exported 7424 tonnes of beef and veal and 60 062 tonnes of beef and veal offal to the EC. The cessation of all imports of US bovine meat and offal from 1 January 1989 has caused severe shortages of fancy meats, especially ox tongues, in the United Kingdom where some offal prices are reported to have increased by up to 100 percent since 1 January. The US/EC trade stalemate was not broken until two small shipments, one of 16 tonnes of US veal offal in May and one of 18 tonnes of primal beef cuts were expected from Texas in early August 1989.

Despite black market rumours, policing troubles and product shortage a European Parliamentary Committee of enquiry confirmed (in March) the need for a ban on meat treated with HGPs and expressed their commitment to enforcing the ban. EC stocks of beef and veal have dwindled from 379 000 tonnes in January to approximately 100 000 tonnes in August, a substantial decrease from the 687 000 held in stocks at the end of December 1987. Even with this Australia should not expect to be able to increase exports to the EC. It is expected that any shortfalls will be compensated through increased imports from traditional large suppliers such as Brazil and Argentina.

Sweden

A ban on the domestic use of HGPs has been in place in Sweden since 1 January 1986 and this has enabled them to retain access to the EC market to which they exported 1490 tonnes of beef and veal in 1987. The possibility of a ban on imports of meat from countries using HGPs was canvassed during discussions at a conference of Swedish meat producers in 1988. No formal action was taken at that stage but the Swedish government stated that they 'planned to tighten regulations applying to imported meat'. In June 1989 Swedish officials informed Australia that they were seeking legislation and as soon as this was achieved they would be making a formal approach to Australia for certification stating that meat imports do not contain HGPs. Sweden is therefore in the high probability category of requiring certification of imports, a requirement that is expected to be finalised in late March early April 1990.

It has been stated that producers in Sweden have been pushing for such a ban in order to reduce the penetration of imports and also that a ban may be a trade off for lower import levies. No reliable methods for tracing low doses of hormones in meat currently exist in Sweden, although the National Food Administration is in the process of developing such methods. The United States already certifies that the beef and veal they export to Sweden (465 tonnes in 1988) is HGP free.

TABLE 2: EXPORTS OF BEEF AND VEAL TO SELECTED COUNTRIES

BY PROBABILITY OF HGP BAN

12 Months Ended December 1988

Country	Tonnes (Shipped weight)	Value A$M (fob)	Percent of Total Exports by Weight	Percent of Total Exports by Value	PROBABILITY OF HGP BAN				
					Ban	High	Medium	Low	Nil
EC	6 010	49.28	1.0	2.6	X				
Sweden	2 530	17.37	0.4	0.9		X			
Norway	72	N/A	-	-		X			
Finland	48	0.23	-	-	X				
Switzerland	312	2.73	-	0.1	X				
Other Europe	50	0.01	-	-				X	
USA	336 079	987.90	57.4	52.3					X
Canada	37 009	109.53	6.3	5.8					X
Japan	135 926	516.46	23.2	27.3				X	
Hong Kong	4 131	18.18	0.7	1.0				X	
Malaysia	3 281	11.24	0.6	0.6				X	
Singapore	1 299	5.29	0.2	0.3				X	
Philippines	626	1.08	0.1	0.1				X	
Taiwan	29 595	105.91	5.1	5.6				X	
Korea	10 114	20.14	1.7	1.1			X		
Other Asia	405	1.89	0.1	0.1				X	
UAE	669	3.12	0.1	0.2	X				
Middle East	1 973	7.71	0.3	0.4		X			
Other	15 049	32.51	2.6	1.7					X
TOTAL	585 178	1 890.58	99.8	100.1					

Source: Export Figures - AMLC
Value of Exports - ABS

TABLE 3: EXPORTS OF BEEF AND VEAL OFFAL TO SELECTED COUNTRIES

BY PROBABILITY OF HGP BAN

12 Months Ended December 1988

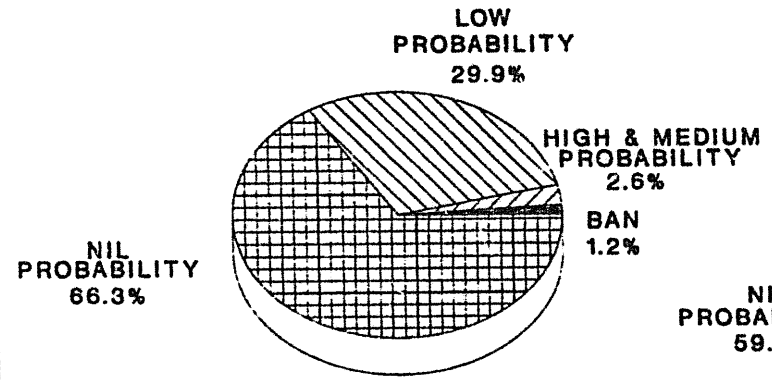
Country	Tonnes (Shipped weight)	Value A$M (fob)	Percent of Total Exports by Weight	Percent of Total Exports by Value	PROBABILITY OF HGP BAN				
					Ban	High	Medium	Low	No
EC	9 157	18.10	20.4	19.5	X				
Sweden	211	0.23	0.5	0.2		X			
Finland	368	0.19	0.8	0.2	X				
Switzerland	104	0.27	0.2	0.3	X				
Yugoslavia	65	0.02	0.1	0.02	X				
USA	3 404	5.66	7.6	6.1					X
Canada	235	0.53	0.5	0.6					X
Japan	10 345	47.87	23.1	51.5				X	
Korea	47	0.07	0.1	0.1			X		
Other Asia	10 252	9.26	22.8	10.0				X	
UAE	254	0.38	0.6	0.4	X				
Middle East	1 277	1.06	2.8	1.1		X			
South Africa	3 634	3.65	8.1	3.9					X
PNG	1 339	1.37	3.0	1.5					X
Other	4 184	4.31	9.3	4.6					X
TOTAL	44 877	92.97	99.9	100.0					

Source: Export Figures - AMLC
Value of Exports - ABS

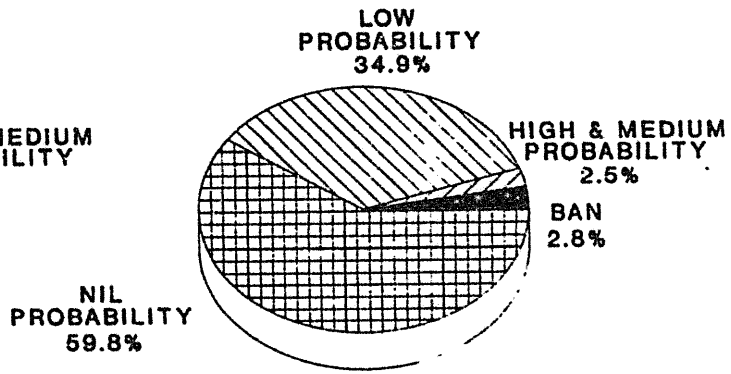
FIGURE 1

BEEF & VEAL EXPORTS TO SELECTED COUNTRIES BY PROBABILITY OF HGP BAN

12 MONTHS ENDED DECEMBER 1988



BY QUANTITY (TONNES)



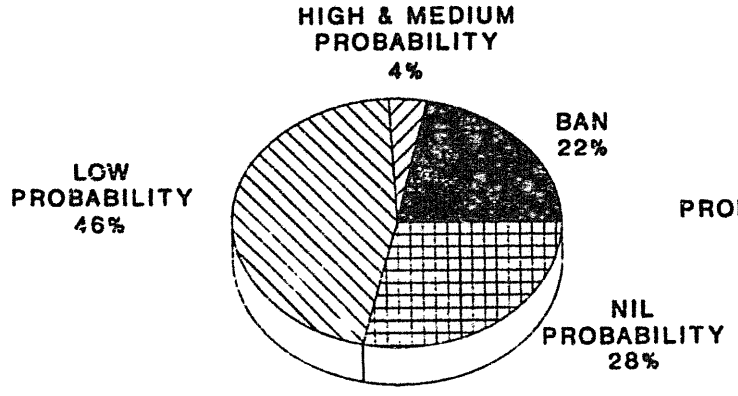
BY VALUE (A$M FOB)

Source: Quantity - AMLC
Value - ABS

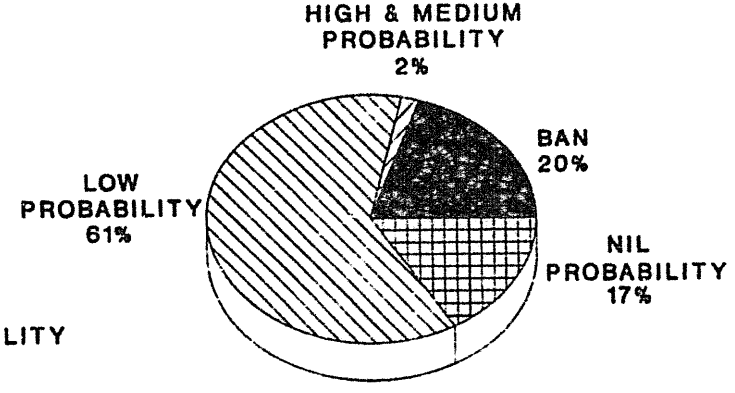
FIGURE 2

BEEF & VEAL OFFAL EXPORTS TO SELECTED COUNTRIES BY PROBABILITY OF HGP BAN

12 MONTHS ENDED DECEMBER 1988



BY QUANTITY (TONNES)



BY VALUE (A$M FOB)

Source: Quantity - AMLC
Value - ABS

Australia exported 2530 tonnes of beef and veal to Sweden in 1988. This quantity fell to 1466 tonnes in the 1989 due largely to the expansion of the Japanese market which is taking premium product at high prices without the large import levies that apply to product entering Sweden.

Swedish consumption of beef and veal has been on a slowly rising trend with 17.4 kilograms carcase weight per capita consumed in 1988. With this in mind this high quality high value market is one Australia should strive to consolidate.

Austria

A domestic ban on HGP use in Austria has enabled Austria to retain the EC market to which they exported 60 770 tonnes of beef and veal in 1987. All product now exported to Austria must be exported in accordance with EC health requirements. This followed a decision on 1 December 1987 to seek the fullest possible participation in 1993 and the EC Single Market. Austria has applied to join the EC, but this is unlikely until after 1992. Australia exported 17 tonnes of beef and veal to Austria in 1987, but in 1989 exported only 16 tonnes of veal offal.

Finland

Exports of bovine meat and offal to Finland require certification attesting that the product does not contain substances with a hormonal or anti-hormonal effect which do not normally occur in meat. Australia exported 48 tonnes of beef and veal and 368 tonnes of beef and veal offal to Finland in 1988, valued at over $400 000.

Switzerland

Switzerland requires certification of veal and veal offal imports. Australia exported 312 tonnes of beef and veal and 104 tonnes of beef and veal offal to Switzerland in 1988 valued at $3 million. In 1989 Australia exported 176 tonnes of beef & veal and only 12 tonnes of beef offal to Switzerland. Switzerland, like other Western European countries, appears to be dove-tailing its legislation with that of the EC as 1993 approaches.

United Arab Emirates

After showing interest in the position adopted by the EC the UAE officially stated in January 1989 that they would be taking steps to stop imports of HGP treated meat from the United States and Europe. After negotiations with Australian officials it was agreed that product packed on and from 30 June 1989 and exported to the UAE be endorsed with the following statement:

> "Based on the results of the National Residue Survey, it can be stated that the meat contains neither substances with a hormonal or anti-hormonal effect, which do not normally occur in meat, nor anti-biotics, chemotherapeutics or any other residues included in the examination."

Australia exported 669 tonnes of beef and veal and 254 tonnes of beef and veal offal to the UAE in 1988, valued at $3.5 million.

Other Middle East

The Middle East has not banned imports of bovine meat and offal treated with hormonal growth promotants but there is a strong probability that a ban will be imposed in the future, especially now that the UAE requires certification of imports. Some Middle Eastern countries have shown great interest in the EC's position. The Middle East imported 243 929 tonnes of beef and veal from the EC in 1987.

Some adverse publicity regarding HGP treated meat has been presented in the Kuwait media. This was successfully counteracted by statements from Australian officials on the safety of products used in Australia, the quality of Australian product and the assurance that no HGPs are approved for use in Australian sheep. Nevertheless, this incident highlights the sensitive nature of the HGP issue in many Middle Eastern countries.

Australia exported 1973 tonnes of beef and veal and 1277 tonnes of beef and veal offal to the Middle East in 1988 valued at just under $9 million.

Japan

Consumers in Japan are very sensitive to health issues and are becoming more aware of additives in foods. Problems have surfaced in the past with anti biotics in pork from Taiwan. Previously thought to be a no risk market due largely to domestic use of HGPs and reliance on imports from the United States, which are almost 100 percent treated, there is now a low probability that Japan may require certification of imports.

Japanese authorities undertook surveys on HGP usage in major meat exporting countries last year. Across-the-board testing of meat imports, including tests for oestradiol, progesterone (natural hormones), zeranol (Ralgro) and trenbolone acetate (a synthetic not available in Australia) began late last year. Trade sources have indicated that as a result of testing (usually 10 percent of product) US imports tested positive, however, there are no standards set in Japan at the moment and this inspection of imports was discontinued at the end of June 1989.

Livestock Industry Promotion Corporation (LIPC) officials have recently been gathering infromation for the Ministry of Agriculture Forestry and Fisheries (MAFF) on the usage of HGPs in Australia and the current compliance scheme for the EC. They stated that Japanese consumers were expressing concern over additives to meat. The officials were somewhat misinformed believing that the United States had sorted out their differences with the EC and were regularly shipping product there.

Australia exported 135 926 tonnes of beef and veal and 10 345 tonnes of beef and veal offal to Japan in 1988, valued at over $564 million. The liberalisation of the Japanese market has presented greater export opportunities to Australia, but to make the most of these opportunities Australia must continue to supply the high quality product demanded by the Japanese consumer which may, in the long term, need to be produced without the aid of HGPs.

Taiwan

Taiwan has tended to follow the United States and the EC measures on the use of animal drugs in the past. Diethylstilboestrol (DES) was banned in 1979 but the use of thyrostatic agents are permitted. Taiwan could be expected to follow Japan on the issue if consumer awareness is raised. Australia exported 29 595 tonnes of beef and veal to Taiwan in 1988, valued at over $100 million.

In the nine months to September 1989 Australian exports of beef and veal to Taiwan totalled 19 254 tonnes. However, on 18 September 1989 Taiwan closed its market to imports only to re-open on 22 September to high quality and carcase beef. This partial market closure included shin shanks, briskets, intercostals and thin flanks, or 60 per cent of Australian exports to Taiwan. Australia was advised that the re-issuing of import licences for these products would take effect from the first trading day of 1990.

Korea

The re-opening of the Korean market has resulted in a large expansion of imports of Australian beef and veal over the past year. However, recent events suggest that it is quite possible that Korea may require certification of imports in the medium run.

Hormonal growth promotants are used in Korea but this was generally not known by the public before the EC's ban. It was reported on 1 February 1989 that the Ministry of Health and Social Affairs decided to request the National Institution to check whether or not there are anti-biotics or growth hormones in imported beef. This was in response to requests from the Korean Women's Association who announced that they would start to boycott imported beef unless the authorities concerned took "appropriate measures" to protect consumer health.

Australia has since been notified that every Korean tender from number LPMO-B-890630, which closed on 30 June 1989, will contain the following requirement:

> "Quarantine inspection shall be performed by the proper governmental authorities of the exporting country prior to loading according to the Korean Government's Health Regulation. Especially the residue test and its safety level of Hormone, antibiotics etc in meat should satisfy the regulation of Korean Ministry of Agriculture, Forestry and Fisheries notification No. 89-23 dated May 22, 1989."

The only compound included in the regulation of relevance to Australia is zeranol (marketed in Australia as Ralgro). The other two "Hormone Agents" listed, diethylstilboestrol (DES) and trenbolone acetate, are not registered for use in Australia.

The Australian Quarantine Inspection Service (AQIS) has explained to the Korean officials that the current world practice is not to include health requirements (such as residue and safety levels) in tender documents as it is unlikely that such guarantees can be provided by commercial suppliers. Such requirements are normally the subject of negotiation and agreement between Governments, who are in a position to provide such assurances. Australian authorities will only issue health certificates for Korea when they are satisfied that the agreed health requirements have been met. Korean officials

informed Australia in December 1989 that they intend testing imports of meat products for growth hormones and antibiotics from 1 December 1990 and that these products will not be released for consumption if residues exceed set Maximum Residue Limits (MRLs).

Australia exported 10 114 tonnes of beef and veal to Korea, valued at over $20 million in 1988. Exports increased to 37 783 tonnes in the eight months to the end of August 1989.

USSR

The USSR has taken a stand on the use of hormonal substances in animal production. A draft protocol regarding imports of Australian mutton to the USSR was signed on 28 October 1988. The protocol excludes entry of mutton if it was derived from animals treated with natural or synthetic oestrogenic substances, hormone substances, thyrostatics, anti-biotics or sedatives administered to animals directly before slaughtering. Australia exported 7656 tonnes of frozen mutton carcases to the USSR in 1988 but did not export any beef or veal.

Yugoslavia

On 31 January 1989, Yugoslavia brought in the need for imports of meat, meat products and edible offals to be certified:

> "Based on results of Australia's national residue monitoring system, it can be assumed that the meat/meat product does not contain residues of antibiotics, sulphonamides, hormonal substances or pesticides in quantities harmful to health."

In 1988 Australia did not export any beef, veal or mutton to Yugoslavia and only 65 tonnes of beef and veal offal.

The Position of Competing Suppliers

Countries competing with Australia in the world market as exporters of beef and veal have responded in different ways to the EC's ban. The responses to the ban range from similar bans on HGP use in Argentina, Brazil and Uruguay, a certification scheme in New Zealand through to total non-compliance with the ban in the United States and Canada.

United States

The United States has remained opposed to the EC's hormonal growth promotant ban since it was first announced. The US argument is based on the lack of scientific justification for the ban. The EC's response that the ban was not imposed for scientific reasons but as a political response to consumer pressure has produced a trade stalemate since 1 January 1989. In 1988 the United States exported some 60 000 tonnes of beef and veal offal to the EC valued at US$96 million and 7670 tonnes of beef and veal valued at over US$32 million. The EC's ban together with developments in other markets will greatly affect US offal exports from 1989 onwards.

The US has traditionally supplied about half of the world's trade in offals (mainly tongue, liver, heart and kidney meat). In 1988 US offal exports increased by one-third in both quantity and value to finish at record levels. Nearly all this growth in 1988 took place in exports to Mexico, Japan and Egypt with exports to the rest of the world holding steady at 1987 levels. A

significant downturn in offal exports has been predicted from 1989 due to policy changes in three of their top export markets. The EC's ban has effectively stopped all offal exports from the US to the EC. Mexico announced that a 10 percent tariff would apply to all offal imports from 15 January 1989, while the Egyptians have decreased the shelf life of frozen liver from 12 months to 4 months. These changes may result in the US seeking to export more offals to Japan (Australia's highest priced offal market) and new markets by undercutting traditional suppliers. This may have the effect of forcing down the price of offal on the world market due to the sheer size of US offal exports. However, if the US vacates other markets such as the EC and Middle East this may create opportunities for other suppliers.

While the US has strongly opposed the ban it is important to put their production into perspective, as the US beef industry is overwhelmingly oriented to the domestic market.

TABLE 11: US BEEF AND VEAL PRODUCTION AND EXPORTS 1988

	Metric tonnes	Percent of Total Production
Total Production	10 620 000	100
Total Exports	228 613	2.15
of which to:		
Japan	163 093	1.54
EC	7 670	0.07

From a production angle the US will maintain its current stance and not ban the use of HGPs while there is no scientific justification to do so, due largely to the domestic orientation of production. A study at Texas A & M University showed that anabolic implants increased the production of lean retail product by an average of 35 lb/head (16 kg) with 15 less days on feed (Beyers & Schelling, 1987). The change in net return from not using HGPs under the same management conditions was a decrease of US$97 (made up of increased feeding costs and decreased returns from a lighter beast). The study states the change in value to the industry for grain fed cattle (22.9 million head) based on 98 percent of grain fed cattle implanted amounts to US$2.17 billion for lot fed cattle alone, and approximately US$2.5 billion for the US industry as a whole. If these cattle were raised under the same production environment without the use of HGPs, production costs would increase by some US29 cents a kilogram product weight (based on US$97 less for the beast and a dressed carcase weight of 330 kg).

On the consumption side, however, producers may have to forego the economic benefits from the use of HGPs in order to cater for the consumer. There is a small but growing demand for HGP free beef by health conscious US consumers who perceive red meat as being unhealthy. This has led to US importers enquiring of the potential for Australian exporters to export HGP free product to the US. The consumption of red meat in the US has been on a downward slide in recent years. Per capita consumption of beef and veal has decreased from a

high of 41.6 kilograms in 1976 to 32 kilograms in 1987 (American Meat Institute, 1988). In contrast, per capita consumption of chicken has increased from 12.5 kilograms in 1975 to 19.7 kilograms in 1987 with turkey consumption increasing from 3.0 to 5.4 kilograms per capita and fish from 5.5 to 7.0 kilograms per capita over the same period. The promotion of "naturally produced chemical free beef" is taking hold in certain areas in the US. The US producer may have to change production techniques and rely less on HGPs in order to cater for this growing health consciousness.

Canada

Canada has exported small quantities of high quality beef and large quantities of offal to the EC in the past. In 1986 the value of this trade was Can$26 million. All veterinary products are regulated in Canada. In order to be registered the safety of a product must be proven, as was the case with HGPs. Canada has a program to monitor residues which includes tests for zeranol and diethylstiboestrol which as yet have not shown up.

Canada aligned itself with the US on the issue and publicly stated in 1988 that they had no intention of complying with the ban and would continue to ship product until the EC would not accept it. Since then an arrangement has been agreed on that does not require certification. Imports of Canadian beef and beef offal will only be allowed from non-treated cows used for dairy production.

New Zealand

New Zealand has an EC High Quality Beef Quota allocation of 170 tonnes in 1989. In the 12 months to September 1988 New Zealand exported 778 tonnes of beef and veal to the EC. This has risen to 997 tonnes for the 9 months to the end of June 1989. The product above their High Quality Beef allocation would probably have been imported under the GATT or Balance Sheet Quota to avoid paying the prohibitive customs levies for product exported outside these schemes.

New Zealand has released another four HGP products onto the market this year Synovex, Revalor (trenbolone acetate), Stear-ex and Heifer-ex. Ralgro and Compudose were already registered. The New Zealand Ministry of Agriculture Forestry and Fisheries (MAFF) has estimated that a maximum of 45 000 animals are implanted yearly, or slightly less than 1 percent of the national herd.

The New Zealand Meat Producers Board (NZMPB) is adamant that producers should have the option to use HGPs and they will not be seen to 'give in' on the issue. The NZMPB has expressed concern over possible flow on consequences to other products should an exporting country ban the use of HGPs to comply with the EC's directives.

The New Zealand certification system involves the life-time identification of treated cattle by an ear tag and point of sale documentation, notifying works in advance if treated cattle are to be processed, as well as verbal declarations at saleyards. For abuse of the system the producer concerned faces a maximum NZ $10 000 fine and has his entire herd placed on 'movement control' (quarantine). The MAFF is randomly checking retail outlets and farms to track HGP use.

The EC Technical Review Team was impressed with the New Zealand certification system. New Zealand will not ban HGPs to satisfy any market. Current minimal usage of HGPs and their effective certification scheme will ensure that New Zealand is able to continue to supply any country wishing to import HGP free beef.

South America

Brazil, Argentina and Uruguay are traditionally large suppliers of beef and veal to the EC, supplying a combined total of 206 997 tonnes in 1987. Argentinian representatives reminded the participants at a conference in Montevideo, Uruguay, in December 1986 on the use of hormonal substances in animals that 70 to 90 percent of the economic system of the countries in the River Plate Basin is contingent upon the trade of agricultural products and that these countries are greatly affected by the protectionist policies of both the EC and the US (IICA,1986). Being foot and mouth endemic these three countries have restricted market opportunities and deemed the EC market too valuable to risk losing. All three countries have banned the use of hormonal growth promotants.

In Uruguay the use of HGPs has been banned since 1962 but their therapeutic use is permitted. Limited testing procedures exist (for DES) with no violations having yet been acknowledged.
Brazilian Directives were published in 1964 and 1969 controlling the use of hormonal substances and prohibiting their use as growth promotants but authorising their use for therapeutic purposes. Despite this, zeranol (Ralgro) was registered in 1976 but its license expired at the beginning of 1986 and was not renewed.

Brazilian officials were required to provide further details on their hormone control procedures in early 1989 when visited by the EC technical review team. The Brazilian testing regime was subsequently approved.

Argentina was the first significant exporter to the EC to announce, in November 1987, that they welcomed the EC's ban claiming that they had seen their natural competitiveness hit by increased world usage of HGPs. Argentina has banned the use of all HGPs (the last being zeranol) and claims to have tightened up its national program on residues, created in 1982, enabling them to meet the requirements of importing countries.

South America's other main export market is the Middle East which imported 42 900 tonnes of South American beef and veal in 1987. The domestic ban on HGP use in South America will place them in a strong competitive position should the Middle East require certification of imports, especially when the declining level of EC stocks, previously exported to the Middle East, is considered.

Possible Future Scenarios

As previously mentioned the hormonal growth promotant issue has the potential to alter international beef and veal trade patterns. The issue is becoming less and less a scientific argument and more an issue of consumer preference. The United States has made their intentions clear that they will not ban HGPs but will allow individual producers, who wish to comply with such bans to do so. New Zealand and Australia both certify export product to ban markets and have the option of banning HGP use in the long term but it would take a major market to ban imports of HGP treated product to bring about such a change.

Ban by Major Importer

A major importing country such as Japan is unlikely to ban imports of meat from animals treated with HGPs in the short term due to domestic usage and reliance on US imports. However, in the medium to long term with increasing pressure from consumers a ban is quite possible.

A Japanese ban would immediately place the US at a distinct disadvantage. Given the high returns from the use of HGPs and the domestic orientation of the US industry the US would, almost certainly, not ban HGP use. After initial resistance it is quite probable that the US would implement some certification scheme either similar to Australia's or the one agreed to with the EC, if only to protect their substantial offal exports to Japan. Production costs in the US would increase and certification costs would have to be met. These would flow through the system to the end user and result in both Australian grass and grain fed product becoming more price competitive.

Low HGP usage levels in Australia and New Zealand would decrease further in both countries with the current certification schemes that have been accepted by the EC probably being sufficient to enable compliance. However, the benefits of continued registration of HGPs in such a ban environment would be limited.

Ban by a Major Competitor

Australia's only competitor in the major fresh and frozen beef and veal markets that may ban HGP use in the medium to long term is New Zealand. New Zealand exported 275 900 tonnes of beef and veal in the 12 months ended December 1988, 211 000 tonnes of which went to the US. New Zealand's other two major export markets were Canada (26 500 tonnes) and Japan (11 000 tonnes).

A New Zealand ban on HGP usage is unlikely in the short term due to the registration of more products this year. A ban, however, would only increase production costs slightly and would not significantly alter their competitiveness with respect to price due to low HGP usage levels.

With the liberalisation of the Japanese market and Japanese consumers becoming more conscious of food additives an opportunity exists for New Zealand to gain a marketing edge and promote "natural HGP free" product if they were to ban domestic usage. New Zealand exports of beef and veal to Japan have increased from 11 000 tonnes in the 12 months to September 1988 to 14 600 tonnes in the 10 months to July 1989. New Zealand has also exported 2634 tonnes of beef and veal offal to Japan over the same period.

Ban by Australia

A ban on the use of hormonal growth promotants would give Australia an extrememly powerful marketing tool in all export markets. However, such an advantage could easily be negated by retaliatory action from the United States, and other potential problems such as the emergence of a black market in growth promoting compounds.

Based on trial results from Ralgro use (shown in appendix 1) a ban on HGP use would increase production costs. Feedlots now account for some 90 percent of HGP sales and gain much of their profit from the weight advantage that HGPs afford. Finishing steer trials showed a daily weight gain of 0.919 kg to

cattle not implanted and 1.087 kg to implanted cattle. Given an average initial weight of 393 kg and 120 days on feed the implanted cattle will finish at 523 kg. The beast not implanted will finish at 503 kg. An extra 22 days on feed will be required to finish the cattle not implanted to the weights of implanted cattle. At a feeding cost of $1.30 per day (for the domestic market, use $1.60 per day for the export market) this increases the costs to the producer by approximately $29.00 per animal. From this some $2 per animal is saved from the cost of the implant and slightly increased management costs leaving the producer some $27.00 per animal worse off for not implanting in the feedlot situation.

These increased production costs would be passed on to consumers and result in slightly higher prices. A ban on HGP use in Australia would have no significant effect on world supply or prices. Any advantage would flow through via an increased demand for Australian product with consumers in some countries perhaps willing to pay an added premium for this HGP free product.

Conclusion

The EC's ban was a direct result of consumer pressure. Illegal and dangerous use of both registered and unregistered growth promotants raised concerns of the safety of consuming meat products. In response, the EC implemented a number of Directives banning the use of hormonal substances for growth promotant use but allowing such substances to be used for genuine therapeutic purposes if administered and recorded by a registered veterinarian. The ban has also required third countries to certify that bovine meat and offal products exported to the EC have been sourced from animals that have not been implanted with HGPs during their lifetime.

The ban has been gaining popularity in other countries importing Australian product with the United Arab Emirates, Finland, Switzerland, Austria and Yugoslavia also requiring certification of imports. Sweden is currently in the process of developing legislation that will also require certification of imports. Other markets importing large quantities of Australian bovine meat and offal have also shown interest in the position adopted by these countries without having themselves implemented bans.

The EC's ban has had widespread effects on the Australian industry. While HGPs have been proven to be beneficial to producers and scientifically safe, usage has decreased from some 12 percent of the national herd in 1987 to a level forecast to be below 5 percent in 1989. Despite this, an analysis of CALM sales indicated that for some stock categories a premium is paid for cattle treated with HGPs while for others the treatment status does not significantly influence the prices paid.

The ban has required that Australia implement a control system. This was done and requires that producers identify the HGP status of their cattle before sale. This system has imposed costs on the industry through higher production costs and the costs of enforcing and policing the compliance system. However, these costs appear to be less than that which would have been incurred if the EC market was lost and product had to be diverted to lower priced markets. These costs are also justified by an industry opinion that all markets should be maintained.

The reality is that the EC's ban has the potential to spread beyond Europe and the UAE. Exporting nations are becoming more aware that the demands of the consumer, whatever they are, must if possible, be met. With the Middle East,

Korea and to a lesser extent Japan and the rest of Asia gaining information on the issue, and reporting on the increasing presence of health conscious consumer organisations, exporting countries must be willing to guarantee the quality of their product if they wish to remain competitive.

If a major importing nation bans imports of bovine meat and offal treated with HGPs there will be winners and losers. The United States will probably be the big loser. Due to domestic reliance on HGPs in production and the strong stance they have adopted against the EC it is unlikely that the US would be willing or able to comply to such a Directive in the short term. Consequently, they would either be forced to vacate these markets or to introduce a control system similar to Australia's, resulting in higher production costs and thus reduced competitiveness. Australia, New Zealand and to a lesser extent South American countries all stand to gain. Current low usage levels or bans in these countries and accepted control systems should be sufficient to satisfy any importing country without a domestic ban being necessary.

Australia rightly retains the right to use HGPs and even if a major market was to ban imports of treated meat there should be no urgent need to ban their use here. Hormonal growth promotants have provided great benefits to the Australian industry in the past. However, the growing concern over the use of production aids in cattle, such as HGPs, is shifting consumer demands to more 'natural' products and this has been reflected in the decreased use of HGPs. Australia must be able to guarantee HGP free product to countries requiring it, and the strengthening of the current control system will help this aim. This is essential to remain competitive in the long run and can only enhance Australia's reputation as a supplier of quality product.

Appendix 1

TABLE 3: SUMMARY OF AUSTRALIAN TRIALS WITH RALGRO

ONE RALGRO IMPLANT. TOTAL OF 77 TRIALS

Animal Class	Number Trials	Sex	Average Trial Length	Average Initial Weight	Average Gain per Day		Treatment Response	
					Control	Ralgro	kg	Percent
Calves	16	Mixed	117	147	0.847	0.946	11.47	10.46
Growing	32	Steers	133	304	0.741	0.886	14.50	16.36
Finishing	21	Steers	122	393	0.919	1.087	14.24	15.45
Finishing	11	Bullocks	106	490	0.983	1.059	17.40	7.16
Feedlot	3	Heifers	72	215	1.073	1.219	11.53	11.97
Growing	2	Heifers	62	232	0.726	0.896	10.59	18.97
Finishing	2	Cows	75	340	0.558	0.699	10.42	20.17
Finishing	1	Spayed Cows	82	379	0.402	0.548	12.00	26.64
Growing	2	Spayed Cows	87	390	0.401	0.655	22.40	38.77

Source: Robb 1987

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