PROCESSING AND MARKETING MARGINS FOR LAMB, MUTTON AND BEEF IN NEW ZEALAND*

G. R. Griffith and W. B. Moore+

ABSTRACT

The New Zealand export meat industry has been through a considerable number of changes in the 1980s. The deregulation of export slaughter facilities, SMP's, Producer Board intervention, declining livestock numbers and domestic cost pressures have all effected the performance of the domestically based processing sector. Major changes in market access and demand have influenced off-shore marketing operations, particularly for sheepmeats. As an example of the impact of these developments on livestock producers, the producer share of UK wholesale market return for a representative prime lamb carcase has fallen from 40 percent in 1978 to 25 percent in 1988.

In this paper the pattern of intervention in the New Zealand pastoral meat industries from the mid 1960s is detailed, emphasising the different environments of the beef and sheepmeat enterprises. Then the principal factors influencing off-shore and domestic margins for these products are empirically examined. Alternate model specifications and alternate estimation techniques are compared and contrasted. The results of these analyses are discussed in terms of the historical patterns of assistance and structural change, and in terms of current rationalisation pressures on the meat processing sector.

1   INTRODUCTION

1.1   Background

The New Zealand meat industry is a major contributor to foreign exchange
earnings with the value of meat and byproducts comprising over 25 per cent of
total merchandise export value. The export marketing of meat is usually
performed by private companies or farmer owned co-operatives subject to a
licence issued by the New Zealand Meat Producer's Board (MPB). The companies
procure, process and distribute the meat products while the MPB controls
grading, negotiates shipping rates and undertakes generic promotion and
research. However, the MPB can procure and export meat and has had the power
to regulate exports and to co-ordinate export marketing.

The domestic segment of the export marketing chain for meat extends from the
farmgate to port. Principal activities include transport and slaughter of
livestock, grading, further processing of carcases and storage. The
slaughtering/processing sector, the largest segment of this chain, employed
over 25,000 persons in early 1989 with value added of approximately $NZ 600
million. Currently the costs of domestic processing and marketing services
absorb 60 per cent of the fob return for lamb and 45 per cent for beef.

Recent analysis has shown that price transmission effects have had a
significant influence on farmgate returns for livestock, along with industry
assistance, exchange rates, world prices, etc. (Wallace and Reynolds 1990;
Reynolds, Moore and Robinson 1990).

Additionally there is concern currently about the role of processing charges
in determining farmgate returns for livestock. In the last 10 years the farm
share of FOB sheepmeat returns has fallen from 65 to 42 per cent (see Section
2.2). During the same period, nominal killing charges for lamb have risen by
150 per cent (principally during 1980-1982). As a consequence of these
developments, lamb returns at the farmgate have risen by much less than the
rise in FOB returns.

Finally there is industry concern about the consequences of processor
rationalisation and declining throughput on processing margins and hence on
farmgate returns. If the processing sector decides on a self-rationalisation
programme, will New Zealand livestock producers share in the expected
benefits? Will the costs of rationalisation outweigh the benefits to these
companies in the short to medium term?

1.2   Aims of the Study

The principal aim of this study is to determine and analyse the factors
causing variation in processing and marketing margins for lamb, mutton and
beef in New Zealand. This will be used in ongoing work to assist in
explaining and predicting farmgate returns for these products.

This aim is achieved by the application of econometric analyses to published
data and to data available to the Ministry of Agriculture and Fisheries. The
following factors are considered to determine their contribution to
variations in long run meat processing margins: market returns; throughput;
costs; byproducts returns; extent of further processing; and industry
assistance. Considerable effort is made to determine correlations between
changes in these factors and variations in processing or marketing margins.
Model specification is based on previous empirical research by Wohlgenant and
Mullen (1987) and Griffith and Shannon (1989), as modified by knowledge of
the market structure of the New Zealand meat processing sector.

The research provides information to those responsible for policy development within the New Zealand meat and livestock industries about the factors determining processing and marketing margins for meats, especially the effects of the decreasing quantity of throughput in the processing sector. Information is generated for subsequent analyses of the distributional impacts of changing industry structure or changing government policies. These impacts are seen in the size of processing and marketing margins, retail prices and farmgate returns, and quantities supplied and demanded (see Griffith and Moore 1990b).

2. INTERVENTION IN THE NEW ZEALAND LIVESTOCK INDUSTRIES, 1965-1989

2.1 Government Policy Changes

This section highlights how market driven adjustments in the meat processing sector were delayed owing to the existing policy environment. This discussion is set against a complex and changing economic and institutional environment. The levels of price intervention have affected the performance of beef and lamb processing and marketing in very different ways.

In 1975 a meat price stabilisation scheme was introduced, with both levy and deficiency payment aspects, and from 1978 the SMP scheme was in place to provide guaranteed prices for up to two years ahead to assist farmer planning. However, it was not until 1981-82 that the SMP's, and the Meat Industry Stabilisation Account (MISA) price supplements, were activated to any extent. These payments were triggered by a raising of the minimum price levels, and by a deterioration of market returns for lamb due to the EC sheepmeat regime, a recession in the UK and by disruptions to the residual Iranian market. Also in this period, several of the main mutton markets were disrupted by the sale of EC intervention beef stocks which depressed sheepmeat prices. From a New Zealand perspective, these conditions were exacerbated by rising sheepmeat production.

On the belief that the world market downturn was to be temporary, and because of the difficulties of exporters in meeting minimum prices, the MPB began purchasing all export sheepmeats from October of 1982. This action was taken after consultations with government in which the Board maintained it could only enhance producer returns in a non-competitive export environment (SMP supplements were paid only on Board purchased meat). The MPB had, in 1981/82, been purchasing livestock in competition with export companies and also began buying carcasses on the UK market (from New Zealand exporters) in an attempt to improve both market and producer returns. From 1983 through 1985 the Board continued to exercise their control over livestock procurement and marketing. Due to continued poor marketing conditions and high production, the Board had to support producer sheepmeat prices by over $NZ 1 billion dollars drawn from the MISA. Producer price assistance and Board control over marketing were ended in late 1985. The 1 billion dollar debt accumulated in the MISA over 1982-85 was written off in 1986 to clear the slate as a one-off assistance and payment to meat producers and as partial compensation for the removal of SMP's.

Changes in levels of sheepmeat and beef assistance are shown in Tables 1-4, and the operation of the two schemes is described in Griffith and Martin (1988). Of particular note in Tables 1, 2 and 3 is the rise in the FOB-farmgate price spread for lamb, mutton and beef during the high assistance years.

The removal of these assistance schemes contributed to an initial rise but then a marked reduction in sheep numbers and throughput at processing facilities (see Table 5). The resulting lower lamb kill from 1986 has

Table 1: Lamb Prices, Margins and Assistance

Lamb

Year	P. 'ce Farmgate c\kg	******plus****** Skin c\kg	Assist c\kg	Market Price c\kg	Domestic Margin c\kg	Export Prices c\kg
1964/65	44	6	0	38	3	41
1965/66	41	5	0	35	2	38
1966/67	33	5	0	28	8	35
1967/68	40	11	0	29	11	41
1968/69	49	11	0	38	7	44
1969/70	44	7	0	38	11	48
1970/71	42	9	0	34	15	49
1971/72	38	10	3	25	20	45
1972/73	68	21	0	47	17	64
1973/74	70	15	0	55	23	78
1974/75	47	8	8	31	39	70
1975/76	73	17	0	56	27	83
1976/77	98	30	0	68	40	108
1977/78	92	27	0	65	45	110
1978/79	109	33	5	71	59	131
1979/80	118	26	4	88	65	153
1980/81	124	9	4	111	75	186
1981/82	164	19	27	118	60	178
1982/83	168	19	94	54	146	200
1983/84	176	26	118	32	166	198
1984/85	191	54	83	55	170	225
1985/86	108	40	56	12	189	201
1986/87	165	88	7	70	203	273
1987/88	124	70	1	54	175	229
1988/89	146	63	1	82	185	267

Export Price - Margin = Market Price equivalent (at farmgate)
Market Price + Assistance = Farmgate Price (actual)

NB:Export prices (FOB) include world prices, exchange rate
    and external margins
  :Domestic margins include degree of value added by processors

Table 2: Mutton Prices, Margins and Assistance

Mutton Year	Price Farmgate c\kg	*****plus***** Skin c\kg	Assist c\kg	Market Price c\kg	Domestic Margin c\kg	Export Prices c\kg
1964/65	18	4	0	13	7	20
1965/66	18	3	0	15	3	18
1966/67	16	1	0	15	5	20
1967/68	16	4	0	12	3	16
1968/69	17	8	0	10	9	19
1969/70	23	5	0	18	6	24
1970/71	17	4	0	12	14	26
1971/72	14	5	2	7	16	24
1972/73	53	11	0	43	-3	40
1973/74	41	6	0	35	28	63
1974/75	15	3	0	12	31	43
1975/76	31	14	0	17	25	42
1976/77	53	22	-6	37	27	64
1977/78	44	20	1	23	53	76
1978/79	55	21	2	32	46	79
1979/80	58	25	3	30	81	112
1980/81	63	7	2	55	63	118
1981/82	55	10	9	35	93	128
1982/83	66	15	17	34	50	83
1983/84	76	21	10	45	98	143
1984/85	92	43	80	-31	159	128
1985/86	22	36	29	-43	258	215
1986/87	58	47	2	10	149	159
1987/88	56	56	1	-1	160	159
1988/89	54	46	1	7	157	164

See notes for table 1
NB: The rise in margin for 1985/86 was due to a large

Table 3: Beef Prices, Margins and Assistance

Beef

Year	Price Farmgate c\kg	*****plus***** Hide c\kg	Assist c\kg	Market Price c\kg	Domestic Margin c\kg	Export Prices c\kg
1964/65	27	7	0	20	27	47
1965/66	37	7	0	29	25	54
1966/67	33	7	0	27	34	60
1967/68	42	6	0	37	32	69
1968/69	45	6	0	39	43	82
1969/70	59	7	0	52	35	87
1970/71	55	6	0	49	45	94
1971/72	51	7	0	44	57	101
1972/73	73	10	0	64	55	119
1973/74	48	8	0	40	88	128
1974/75	31	7	0	23	61	84
1975/76	54	8	0	47	59	106
1976/77	60	12	0	48	72	120
1977/78	66	12	2	53	86	139
1978/79	119	13	5	101	98	199
1979/80	122	19	-1	103	142	245
1980/81	124	14	7	103	150	253
1981/82	148	15	16	117	148	265
1982/83	162	15	13	132	206	338
1983/84	169	26	3	140	197	336
1984/85	236	41	1	194	214	408
1985/86	165	36	4	126	195	321
1986/87	164	38	3	123	250	372
1987/88	172	47	2	124	233	356
1988/89	222	41	2	179	230	409

See notes to table 1

Table 4: Payments to Farmers Under the SMP Scheme and MISA Account Balances ($M)

COMMODITY	SEASON							TOTAL
	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85 (a)	
Lamb	0	0	0	93.9	146.5	213.2	93.8	547.4
Mutton	0	0	0	8.7	11.6	48.4	37.9	106.6
Wool	1.4	0	0	184.2	176.7	78.8	0.7	441.8
Sheep Industry	1.4	0	0	286.8	334.8	340.4	132.4	1095.8
Beef	0	0	1.9	53.3	17.6	0.0	0.0	72.8
Dairy	17.4	0	0	0.0	0.0	0.0	0.0	17.4
TOTAL	20.2	0	1.9	340.1	352.4	340.4	132.4	1186.0
MISA Account Balance	32.0	22.9	(0.9)	(64.6)	(350.6)	(495.6)	(852.2)	(1010.0) (approx)

Sources: NZ meat Producers' Board Annual Reports and MAF Agricultural Statistics - various issues.

(a)   payments from a transitional lump sum grant.

Meat season ends 30 September
Wool   "   "   30 June
Dairy "   "   31 May

highlighted problems with overcapacity and exacerbated problems with relatively high unit processing costs.

Entry into the export processing sector before 1981 was controlled by strong licensing regulations. In addition to stringent hygiene requirements, an "economic need" criteria was used in determining whether a licence would be issued. This criteria proved to be an effective barrier to entry with only a handful of new processing plants opening in the period between 1934 and 1980, despite a 350 per cent growth in industry throughput. It has been suggested by a number of observers that the lack of competition amongst processing firms caused inefficiences to develop and sectoral adjustment was hindered by this regulatory regime (Sheppard and Fowler 1984). As a result of licensing protection and the seasonal nature of the industry, high cost structures (and union award rates) were maintained with the result that export slaughtering/processing costs were estimated to be 50-100 per cent higher than for the costs of processing in other countries (Pappas et al 1985).

The economic need criteria of the licensing regulations was removed in 1980, so that firms need only meet hygiene standards and local authority requirements to receive a licence to establish facilities to process export meat. This has allowed freer entry into the processing sector in order to increase the competitiveness of meat processing facilities. However, it was not until 1986 that most of the significant adjustments commenced with restructuring still ongoing through 1990.

Most of the effects of delicensing were not felt until after the removal of the SMP's which was coincident with the relinquishing of sheepmeat trading by the MPB. The SMP payments and MPB trading losses served to artificially maintain both levels of throughout and profitability of processing and marketing activities (see also Griffith and Grundy 1988). In addition, exporters and processors were able to shift the risk or liability of a deteriorating sheepmeats market onto the Government and the MPB as they were paid on a commission or fee basis. Beef processing and marketing was much less affected by these events and producers received only small amounts of SMP and MISA payments.

2.2 Trends in Livestock Numbers, Prices and Margins

Trends in prices are provided in Tables 1-3 above. Trends in pastoral sector outputs (processing throughput) are shown in Table 5 and Figure 1. Note the effects of the asymmetrical treatment of sheepmeats under the assistance policies in particular. The Livestock Incentive Scheme from the mid 1970's helped to stimulate a 25 per cent increase in sheep numbers over a six year period to 1981 (beef and wool production also slightly increased).

As shown in Table 3 and Figure 2 export beef processing margins (farmgate to port price spread) in the 1980's have largely followed export returns. Companies have faced a stable institutional and marketing environment with relatively little government intervention in the form of output assistance or through marketing arrangements.

Sheepmeats presents a contrast. Lamb margins both domestic and off-shore, experienced a dramatic increase from 1983 and have only recently benefited from competitive market pressures.

Figure 2 shows market returns with fob and farmgate equivalents for representative lamb and beef products during the period 1979-1989. The price spread between market and farmgate returns for beef has largely followed the increasing market returns, and with domestic processing margins only increasing slightly in the post-1984 period. A relatively stable external

Table 5: NZ Inspected Livestock Slaughterings

| Seasons Ended 30 Sept.	Lambs	Adult Sheep	Adult Cattle
		('000 head)	
1970-71	27,118	9,270	1,814
1971-72	27,842	8,613	1,771
1972-73	26,684	10,328	2,031
1973-74	22,997	8,762	1,790
1974-75	25,428.4	7,094.4	2,136.8
1975-76	25,961.2	6,591.8	2,573.1
1976-77	25,417.2	6,900.1	2,287.3
1977-78	26,392.1	7,705.7	2,407.6
1978-79	26,050.8	7,378.2	2,133.1
1979-80	28,692.2	7,459.7	2,014.9
1980-81	32,305.7	9,143.3	2,056.2
1981-82	32,115.1	9,021.2	2,172.9
1982-83	35,994.9	9,234.0	2,156.4
1983-84	34,710.8	8,895.3	1,770.9
1984-85	39,961.2	10,739.6	1,980.6
1985-86	34,669.0	6,709.0	1,882.2
1986-87	31,627.0	9,302.0	2,278.6
1987-88	30,413.5	7,926.8	2,221.8
1988-89 p	30,302.2	9,757.1	2,289.0

Kill at ME and AB only.
p - provisional

Source: NZ Meat Producers' Board.

Figure 1

TOTAL SHEEP BEEF AND DAIRY NUMBERS

SHEEP (Thousands)

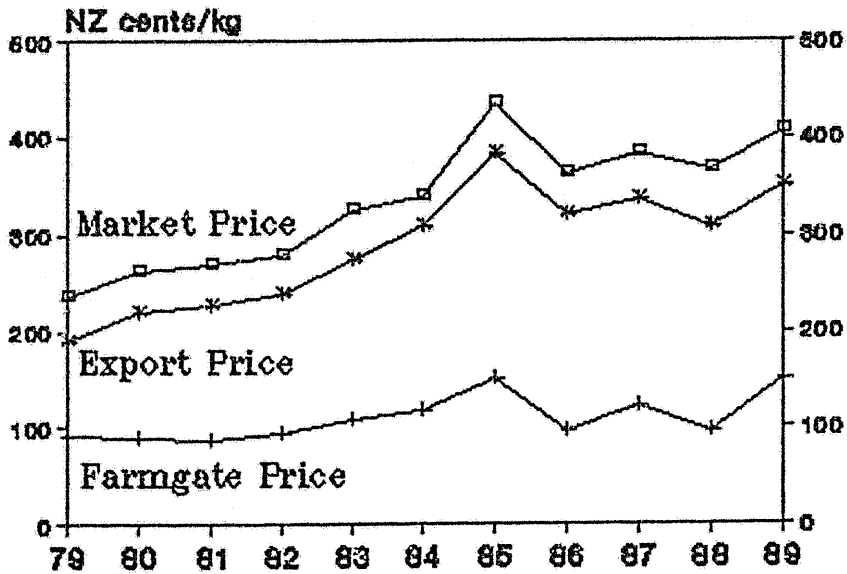BEEF AND DAIRY (Thousands)

YEARS

—— SHEEP   —+— BEEF   —*— DAIRY
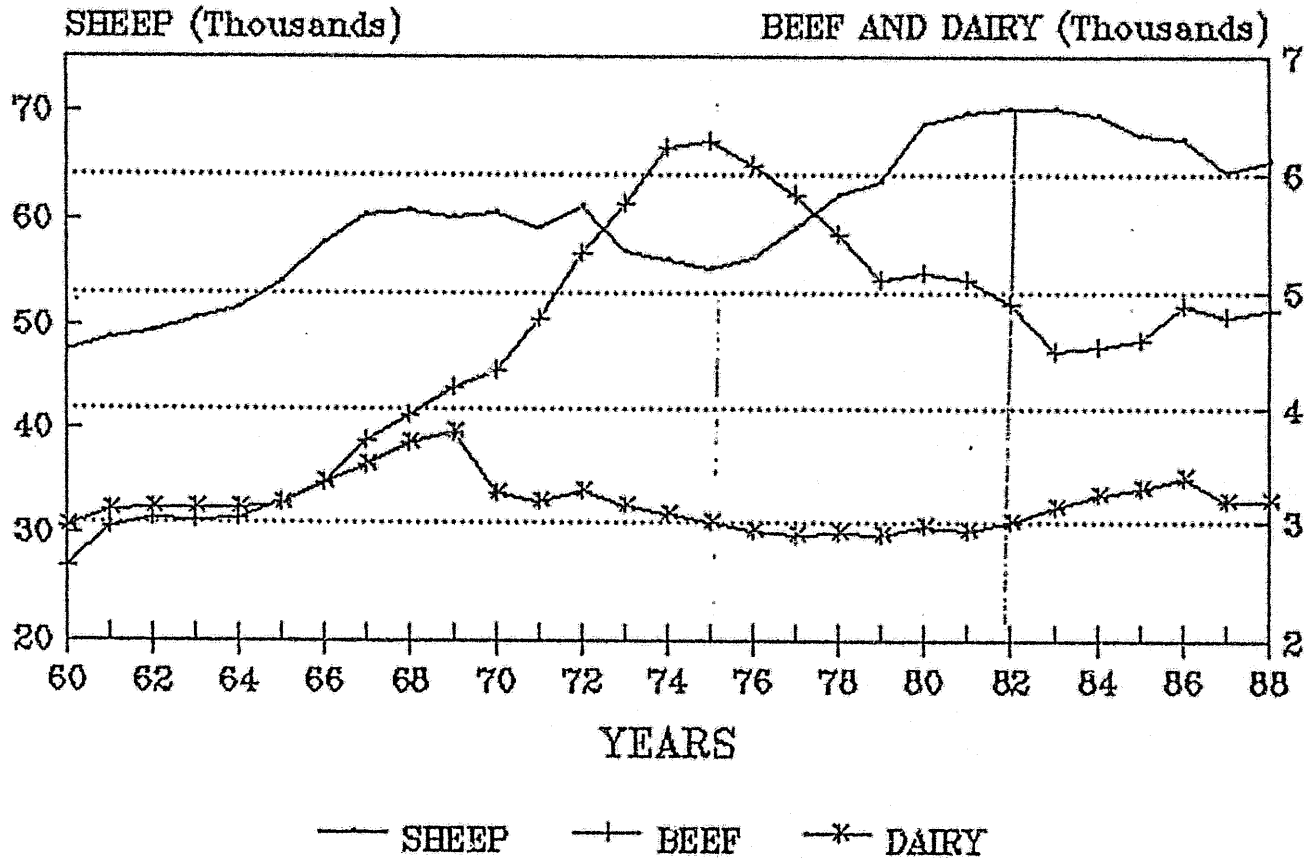
Figure 2 : Returns to Meat Exports
1979-1989
PM Lamb to the UK
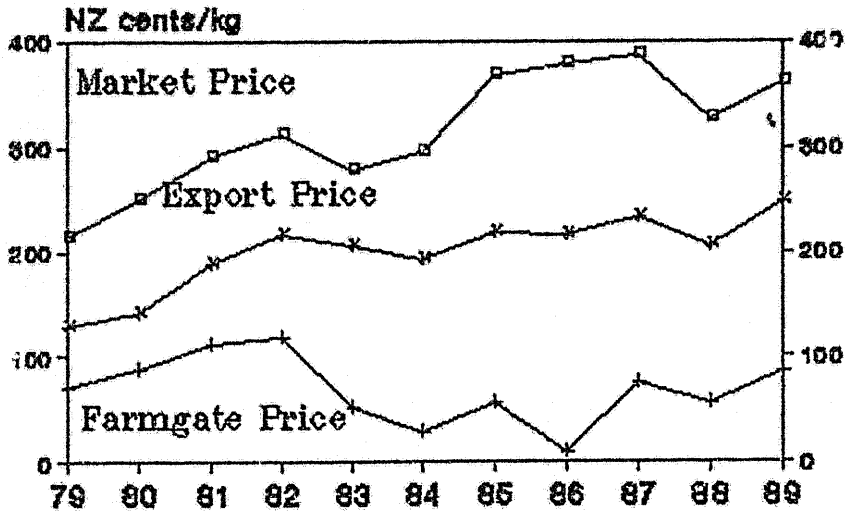
(NB: Farmgate Prices net of assistance and skin values)

Manufacturing Beef to the USA

Sources: MAF, NZDS, NZMWBES

trading environment, competition for stock by processors and the lack of significant assistance payments have contributed to relatively competitive and stable processing margins. In contrast, the effects of both MPB trading activity and price support payments over the 1982-1985 period can be seen on price spreads for lamb. First, there is little direct correspondence between market returns and producer price owing to the distortions caused by assistance payments and from increasing processing costs over this period. Second, both the SMP's and MPB payment systems allowed scope for processors to pass on cost increases in the form of higher charges. Rising processing costs during this period were also due in part to an increased amount of further processing of carcasses done by companies at the request of the MPB. Marketing costs beyond New Zealand ports have increased for lamb, but these are mostly beyond the control of New Zealand marketing operations.

2.3 Processor Adjustments

As a consequence of these disruptions of market signals, major downsizing adjustments in the processing sector mainly occurred prior to or after the 1983-85 period of MPB control. In all 12 sheep and beef chains closed in 1981/82 and 41 to the end of 1989. Only 4 chains (2 works) closed during the period of high assistance.

General adjustment in the processing sector has occurred both through company expansion and contraction, as well as by firms exiting the sector altogether. These closures have been offset in part by the opening of a considerable number of mainly small export plants using newer technology and located nearer to the supply of stock. In addition a number of local market abattoirs have been upgraded to meet export hygiene requirements. It has generally been the older multi-chain plants that have closed. Average plant size has decreased with these changes, but productivity of the processing sector has actually increased (Savage 1990). The industry still has overcapacity (estimated in 1989 at 40-45 per cent) with further rationalisations occurring amongst processors. A major ownership change in 1989 has furthered the adjustment process. Waitaki International was bought out by two large producer cooperatives, AFFCO and Alliance. These companies have begun closing a number of chains to consolidate capacity in line with lower expected throughput on both Islands.

The changing size structure of the firms and the continued overcapacity in the industry is partly caused by the cost efficiencies of developing smaller plants and the high costs of large traditional plant closures. There are high costs associated with redundancy payments and debt write downs which have limited unilateral shutdowns and most closures have been a part of complex ownership changes which have effectively shared the costs of closure amongst the larger competitive firms in a region.

Due to historically high product returns, regulatory protection and seasonality of employment, wages in the meat processing sector have been 50 per cent higher than national averages. As labour comprises over 60 per cent of domestic processing costs, considerable effort has been given by processors to control wages and improve employment flexibility during the economic liberalisation. The cost-price squeeze faced by processors since 1985 has effectively forced wage restraint so that real wages have fallen and in 1989 wages rates were only 20 per cent higher than the national average. Industry rationalisation had reduced total employment in mid 1989 by 30 per cent while output per employee had risen by 25 per cent (Savage 1990).

3. MODEL SPECIFICATION AND DATA

3.1 Background

The analysis of marketing margins or price spreads has progressed down two paths (see Digby 1989). The first type of analysis deals with the <u>short-run behaviour of margins</u>. Here the emphasis is on disequilibrium behaviour by market participants and the dynamics of price formation and transmission. Typically data of weekly or monthly periodicity, or sometimes quarterly, are used in these models. Hypotheses examined include price levelling and price averaging (Parish 1967; Griffith 1974; Naughtin and Quilkey 1979); the influence of risk in the short-run (Griffith and Duff 1989); asymmetric patterns of behaviour (Heien 1980; Ward 1982; Kinnucan and Forker 1987; Schroeder 1988) and the influence of short-run variations in throughput (Griffith 1974; Griffith and Duff 1989; Griffith and Shannon 1989).

The second type of analysis relates to the <u>long-run behaviour of margins</u>. Static equilibrium models are the norm with annual or rarely quarterly data being employed. These models tend to examine the effects of throughput and costs (Gardner 1975; Fisher 1981; Wohlgenant and Mullen 1987); risk response (Brorsen et al 1985,1987; Grant et al 1985) or the influence of changes in market structure (Hall, Schmitz and Cothern 1979; Griffith and Gill 1985).

In this study the latter type of analysis is used, for two main reasons. The ultimate objective of the project is to provide an empirical framework for the evaluation of the distributional consequences of restructuring proposals and possible changes in Government policy toward the New Zealand meat industries (Griffith and Moore 1990b). Since the policy analyses are predominantly concerned with longer term issues, then the framework used to derive the expected outcomes needs to be long-term as well. Second, long-run empirical frameworks commonly used in these policy analyses (see for example Freebairn, Davis and Edwards 1982) shares the same theoretical foundations as the long-run marketing margin models. Outputs from the margin estimation will provide consistent inputs into the policy analysis model.

3.2 Alternate Equation Specifications for a Competitive Margin Model

The specification of the processing and marketing margin model for each meat type, assuming a competitive marketing environment, is taken from previous work by Wohlgenant and Mullen (1987). Based on earlier theoretical developments by Gardner (1975) and Heien (1977), they derive two alternate models. The first is the "relative price" specification,

Margin = f(retail price, (retail price*quantity), costs)

Thus the relationship between the margin and the retail price changes as output and relative marketing input prices change. In the results the term (retail price*quantity) is denoted as "revenue". The emphasis on the "retail" price comes from the domestic market orientation of the Gardner model and the fact that most previous work related margins to retail price in a simple markup model (see for example George and King 1971). Of course since the analysis is concerned not with margins in the domestic market but with margins at various stages of the export marketing chain, the "retail" price is actually the price at the upper level of the market sector being analysed. This form is numbered equations 2 and 3 in the Appendix Tables.

The second is the "real price" specification

Margin = f(quantity, costs)

This specification is based on the notion of the marginal value of market services being equal to their marginal cost of provision in a competitive market. This is equation 4 in the Appendix Tables.

Wohlgenant and Mullen compare these two models and a standard markup pricing model (equation 1 in the Appendix Tables) using non-nested testing procedures. They find the relative price spread specification best explains variations in United States beef margins.

3.3   Alternate Equation Specifications for a Non-Competitive Margin Model

In addition to these basic theoretical specifications of the beef, lamb and mutton margin equations, variables related to value added, levels of industry assistance and byproduct returns are also considered as potential determinants of New Zealand meat margins, given the discussion above.

Thus the most general specification would include retail price, quantity, and costs as well as all these augmenting variables.

Margin = f(retail price, quantity, costs, assistance, edible byproducts, hides/skins, value added)

These are equations 5 and 6 in the Appendix Tables, where 6 is usually the preferred specification.

3.4   Data and Methods

3.4.1 Margin Calculation Procedures

The theoretical basis on which meat price spreads have been calculated and analysed have been well developed over the past two decades. The original work was done at the USDA (see for example USDA 1972) with the procedures modified for local conditions by Griffith and colleagues (1989) in NSW Agriculture & Fisheries. These procedures are now well documented in various publications and are not spelt out in detail here. The one critical check that needs to be made is that the prices at the different levels of the marketing system must be in terms of an equivalent quantity of product. In the analyses which follow, all prices are expressed on a per kg basis in terms of carcase weight.

3.4.2 Data Definitions and Sources

The definitions of the variables used in the following analyses and their sources are given in Appendix A.

3.4.3 Estimation Techniques

Two estimation techniques are employed in the following analyses. In the results reported in Table B1 and Tables B3 to B7, ordinary least squares regressions are run on the specified equations. In the results reported in Tables B2 and B8, seemingly unrelated regressions are run on the domestic lamb, mutton and beef equations together, and the off-shore lamb and beef equations together, respectively. This method is used to account for the interrelationships between the margins. Most large works have both beef and sheepmeat chains and the possibility therefore exists of cross-subsidisation between the different species.

4. RESULTS

The detailed results of the analyses for lamb, mutton, beef and the aggregate form are reported first in Appendix B, and then the behaviour of lamb and beef external margins are highlighted. In each Appendix Table the explanatory variables are listed on the lefthand margin and the specified equations across the top. Under each estimated coefficient are the computed t values and calculated elasticities at the data means for coefficients of statistical interest. Note that the R^2 from the OLS, AR1 and SUR methods are all calculated slightly differently and so are not directly comparable. The preferred results are reported in Tables 6 and 7 below.

4.1 Lamb Domestic Price Spread

4.1.1 The Competitive Equations

Equations (1) - (4) in Table B1 represent the three theoretically based specifications as discussed in Section 2. Firstly, the R^2 of these equations are quite low and there are potential autocorrelation problems with the residuals. Price shows a consistent negative sign although significant, and cost and throughput are the only significant explanatory variables. The size of the estimated elasticity values suggests that lamb processing in New Zealand may be a cost-plus activity. The revenue specification is not significant. It is certainly not evident that the specification favoured by Wohlgenant and Mullen (1987) provides an enhanced explanation with this data set. Correcting the equations for autocorrelation gave an insignificant RHO.

4.1.2 The Augmented Equations

Equations (5) - (6) represent the equation specifications with variables added according to our understanding of the structure and operation of the New Zealand meat processing sector. These additional variables include industry assistance payments, byproduct revenues, skin revenues and the extent of value added processing. Cost remains a significant variable but with a reduced elasticity value, and assistance payments and the extent of value added are also highly significant. Skin value is reasonably significant and price is still negative but not significant. The R^2 are also improved. Further, these results hold for alternate measures of skin values and for an aggregate of all byproduct revenues.

Autocorrelation-corrected versions of equations were run as well, but in each case the t value on the estimated RHO coefficient was insignificant. Additionally the R^2 fell and there was no appreciable change in coefficient values or their significance levels.

The SUR results for lamb are reported in Table B2 along with those for mutton and beef. The first equation in each set is the full specification, while the second is the preferred equation based on that in the individual result Tables. The results for lamb are very close to the OLS results except that the byproduct price was found to provide a better explanation than the value added variable. This may be due to different patterns of collinearity with the residual series.

4.2 Mutton Domestic Price Spread

4.2.1 The Competitive Equations

Equations (1) - (4) in Table B3 again represent the three theoretically based specifications as discussed in Section 2. The R^2 of these equations are again low (especially 4) and an autocorrelation correction was required for all

Table 6: <u>Preferred Estimates, Farm-FOB Margin, Real Values, 1967-1988</u>

Explanatory Variables	Lamb	Mutton	Beef	Aggregate
C	0.280 (1.12)	1.007 (3.47)	−0.318 (−1.70)	0.585 (1.63)
FOB Price		0.745 (9.77) [0.78]	0.612 (8.73) [1.06]	0.288 (2.64) [0.51]
Throughput		−0.005 (−3.80) [−1.08]		−0.0009 (−2.48) [−0.70]
Cost	0.993 (3.15) [0.68]		0.521 (3.91) [0.32]	1.089 (3.96) [0.74]
Assistance	0.518 (3.76) [0.10]	1.293 (6.45) [0.08]		0.898 (4.43) [0.06]
Byproducts	−0.428 (−1.90) [−0.16]		−0.991 (−3.84) [−0.21]	−0.902 [−3.98] [−0.27]
Hides/Skins	0.247 (0.95) [0.10]	−0.629 (−2.25) [−0.18]		0.921 (2.85) [0.21]
R^2	0.76	0.91	0.88	0.86
DW	2.02	1.67	1.90	2.01

t statistics in (.); elasticity with respect to the margin in [.].
See text for details

equations. Price is strongly significant, while throughput effects and the revenue variable are all reasonably significant explanatory variables. Cost is not.

Again the specification favoured by Wohlgenant and Mullen (1987) does not provide an outstanding explanation, although it is probably the best of this set of equations.

4.2.2 The Augmented Equations

Equations (5) - (6) represent the equation specifications with additional variables include industry assistance payments, byproduct revenues, and skin revenues. Price remains a significant variable as does throughput, assistance and skin return, while cost, and byproduct revenues are not significant. The R^2 are substantially improved. Further these results again hold for alternate measures of skin returns and for an aggregate of all byproduct revenues.

Equation (6) is the preferred equation for this dependent variable, and we note that this equation has a much greater explanatory power than the lamb equation.

The SUR results for mutton reported in Table B2 are again very close to the OLS results and in addition the R^2 is markedly improved and the residual pattern is acceptable without the autocorrelation correction. Again this may be due to inter-relationships between the residual series and the set of explanatory variables.

4.3 Beef Domestic Price Spread

4.3.1 The Competitive Equations

Equations (1) - (4) in Table B4 again represent the three theoretically based specifications as discussed in Section 2. Firstly, the R^2 of these equations are generally high (except for (4)) and there are no obvious autocorrelation problems with the residuals. Price, throughput effects and cost are all significant explanatory variables. The revenue specification favoured by Wohlgenant and Mullen (1987) does not provide a good explanation with this data set.

4.3.2 The Augmented Equations

Equations (5) - (6) represent the equation specifications with variables added. These additional variables include industry assistance payments, byproduct revenues, hide revenues and value added. Cost and price remain significant variables although throughput does not, and byproduct values are a significant addition, but hides revenues, value added and assistance levels are not significant. The R^2 and residual structure are markedly improved.

Equation (6) is the preferred equation for this dependent variable, and we note the marked increase in explanatory power of this equation compared with the sheepmeats equations.

Table B2 reports the results of the seemingly unrelated regression estimation of the system of lamb, mutton and beef equations. The results for beef are almost identical to the OLS results and the equation summary statistics are improved slightly.

4.4   Aggregate Domestic Price Spread

4.4.1 The Competitive Equations

Equations (1) - (4) in Table B5 again represent the three theoretically based
specifications as discussed in Section 2. Firstly, the R^2 of these equations
are very low and there are obvious autocorrelation problems with the
residuals which had to be corrected. Cost is a highly significant explanatory
variable, while price effects are of lower significance levels. Throughput,
and the revenue specification favoured by Wohlgenant and Mullen (1987), do
not provide a good explanation with this data set.

4.4.2 The Augmented Equation

Equation (5) represents the specification with variables added. These
additional variables include industry assistance payments and byproduct
revenues. Cost remains a significant variable, all new variables are
significant additions, and the significance levels of price and throughput
are substantially improved. Assistance payments in particular are very highly
correlated with the aggregate farm-FOB margin. The R^2 are much higher and the
residual structure is very good.

4.5   Lamb External Price Spread

This margin is for a subset of total lamb exports - PM grade lamb to the UK
market. All five equations in Table B6 evidence high explanatory power and
reasonable Durbin-Watson statistics. Cost is always a highly significant
explanatory variable, while price and throughput effects are of lower
significance levels. This is probably due to a highly elastic demand curve
for this product which implies that costs are passed back through the
marketing chain. The revenue specification favoured by Wohlgenant and Mullen
(1987) does not provide a good explanation with this data set.

Equations (2) and (5) offer the best prospects for explaining the lamb export
price spread.

4.6   Beef External Price Spread

Again this margin is for a subset of total beef exports -- manufacturing beef
to the US - but the US is the largest single market for New Zealand beef. All
six equations in Table B7 show very low R^2 and there are obvious
autocorrelation problems with the residuals which required correction. Price
is a highly significant explanatory variable, while all other variables are
insignificant. World price explains the beef fob-market margin alone. This is
probably due to the shortness of the marketing chain compared with lamb.

The SUR results for the lamb and beef external margin system are reported in
Table B8. They are very similar to the preferred OLS results and in addition
the summary statistics are improved.

5.   CONCLUSIONS AND IMPLICATIONS

5.1 Summary

Statistical analysis of New Zealand meat processing margins has indicated
that the price formation mechanism in the sheepmeat industry has been
markedly different from that experienced for beef.   In the case of lamb the
study found that output price assistance, processing costs and revenues from
byproducts and skins were the main determinants of margins and hence farmgate

Table 7: Preferred Estimates, FOB-Market Margin, Real Values, 1967-1988

Explanatory Variables	Lamb	Beef
C	-0.301 (-2.14)	0.014 (0.07)
World Price	0.166 (2.93) [0.49]	0.147 (3.00) [0.94]
Cost	0.747 (7.44) [0.81]	
R^2	0.87	0.55
DW	1.50	1.61
RHO		0.60 (3.67)

t statistics in (.); elasticity with respect to the margin in [.].
See text for details

returns from exports. The amount of further processing was also important in some versions of the lamb equation. For mutton, export prices and throughput were the major determining factors, but assistance and skin revenue were also significant. Thus sheepmeat processing and marketing firms were able to increase margins during high assistance periods. The important result is that price transmission has been disrupted by government intervention.

Beef margins on the other hand were principally found to be determined by export prices, costs and byproduct revenues, suggesting greater efficiency and competition than with sheepmeats.

Despite the termination of assistance measures in 1985, actual reductions in lamb margins only occurred with the 1987/88 season. For the 1988/89 season, processing margins (relative to fob price) have returned to roughly 1983 levels. Beef margins have risen in absolute terms but have remained a constant share of fob return. Thus, the benefits of "de-licensing" and lower real wage costs have been slower to filter through to lamb producers than for beef. In addition, lamb producers have not benefitted from improvements in market prices as much as beef producers. If such rationalisation activities can reduce domestic and off-shore costs then the benefits to sheepmeat producers would appear substantial.

5.2   Lessons

This paper has highlighted how adjustment in the meat processing sector was initiated and then disrupted by government and MPB price policies, particularly for sheepmeats. By overriding market signals, producers and processors had less incentive to adjust livestock production or processing costs and capacity. While responding rationally to the signals provided by the price support policies, the need for structural adjustment was delayed until removal of assistance measures in late 1985. Hence the price support policies delayed rationalisation in the processing sector by nearly four years, an unintended but negative consequence of Government and Board intervention. The discussion of meat processing costs highlights the manner in which government policy and producer boards can influence the rationalisation process which would normally occur as a part of a liberalisation programme.

The role of the MPB was significant in implementing government policy and also in recent changes in processing sector ownership. There is considerable debate over how well the Board performed in its period of control over sheepmeat marketing (Griffith and Martin 1988). Since relinquishing control of sheepmeat trading, the Board has been active in processing industry reorganisation. The Board has made funds available its commercial subsidiary Freesia to invest in processing/exporting companies and influenced rationalisation and new processing activities. This commercial involvement has not always been viewed as beneficial to industry restructuring, however. It also highlights the potential conflict between the Boards "player and referee" roles.

Government involvement in marketing activities has been substantially reduced in recent years. However, it is important to recognise that statutory organisations such as producer boards are still a form of intervention which may require increasing levels of government monitoring to ensure national returns are maximised from agriculture exports.

5.3   Further Work

The next stage of this research program involves the application of the results obtained here to an analysis of the distribution of the economic

impacts across producers, consumers and the processing and marketing sector of the benefits from further cost efficiences in the processing sector and the possible further rationalisation of the overcapacity problem.

For lamb, beef and the three meats in aggregate, the cost elasticities are positive and highly significant. For mutton the cost elasticity is positive though insignificant. A ten per cent reduction in the costs of processing may be expected to lead to about a 7 per cent reduction in the aggregate processing margin, cet. par. The benefits of this should flow to processors and marketers, to producers and to domestic and foreign consumers. The actual distribution of these benefits can be assessed by applying the Freebairn, Davis and Edwards (1982) type of analysis.

However for mutton and the three meats in aggregate, there is a highly significant negative effect of throughput on domestic processing margins. Thus as the New Zealand pastoral livestock sector contracts, margins will expand if the current structure remains. This again indicates the overcapacity in processing resources as it reflects a downward sloping processing supply curve. Implications arise for the application of the standard models when such a situation occurs, particularly for measuring the benefits to the processing sector.

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Appendix A: Data Definitions and Sources

Variable Name	Definition (all $/kg except where noted, 1967-1989 June Year)	Source
	1. Domestic beef margin data	
PSBFNZ	Farm-FOB price spread = PFOBBFNZ-PFBFNZ	calculated
PFOBBFNZ	Average FOB price for all beef exports	NZMABES (1989a)
MCBFNZ	Total costs for processing, storage, transport and overheads (including profits) of a representative 160kg cow	NZMPB Survey
PFBFNZ	Average baremeat schedule price for manufacturing and prime beef, exclusive of subsidies	MAF database
DPBFNZ	Total beef production, bone-in, local and export slaughter (000 tonnes)	MAF database
PHDBFNZ	Value of "hide credit" to producer	NZMPB (1989) NOTE 1
ASSBFNZ	Value of supplementary minimum prices and stabilisation payments to beef	MAF (1987) Griffith and Martin (1988)
	2. Domestic lamb margin data	
PSLBNZ	Farm-FOB price spread = PFOBLBNZ-PFLBNZ	calculated
PFOBLBNZ	Average FOB price for all lamb exports	NZMABES (1989a)
MCLBNZ	Total costs for processing, storage, transport and overheads (including profits) of a representative 14.2kg lamb	NZMPB Survey
PFLBNZ	Average baremeat schedule price for all lamb grades, exclusive of subsidies	MAF database
DPLBNZ	Total lamb production, bone-in, local and export slaughter (000 tonnes)	MAF database
PPWLBNZ	Average schedule price for pelt and wool for all lamb grades	MAF database
ASSLBNZ	Value of supplementary minimum prices and stabilisation payments to lamb	MAF (1987) Griffith and Martin (1988)
	3. Domestic mutton margin data	
PSMTNZ	Farm-FOB price spread = PFOBMTNZ-PFMTNZ	calculated
PFOBMTNZ	Average FOB price for all mutton exports	NZMABES (1989a)
MCMTNZ	Total costs for processing, storage, transport and overheads (including profits) of a representative 20kg ewe	NZMPB Survey
PFMTNZ	Average baremeat schedule price for all mutton grades, exclusive of subsidies	MAF database
DPMTNZ	Total mutton production, bone-in, local and export slaughter (000 tonnes)	MAF database

| PPWMTNZ | Average pelt and wool schedule price for all mutton grades | MAF database |
| ASSMTNZ | Value of supplementary minimum prices and stabilisation payments to mutton | MAF (1987) Griffith and Martin (1988) |

4. Domestic Aggregate margin data

PSALLNZ	Farm-FOB price spread = PFOBALL-PFALLNZ	calculated
PFOBALL	Average FOB prices of lamb, mutton and beef weighted by production volumes	NZMWBES (1989a)
MCALLNZ	Total costs for processing, storage, transport and overheads (including profits)	NOTE 2
PFALLNZ	Average baremeat schedule price for lamb, mutton and beef, weighted by production volumes, exclusive of subsidies	MAF database
DPALLNZ	Total lamb, mutton and beef production, bone-in, local and export slaughter (000 t)	MAF database
PBYALL	Byproduct revenue received by processing companies for sale of all byproducts except skins and hides	MEA NOTE 2 NZ Dept Stats
ASSALLNZ	Average of supplementary minimum price payments and stabilisation payments weighted by production volumes	MAF (1987) Griffith and Martin (1988)

5. External lamb data

PSLBEX	FOB-market price spread = PWLBEX_PFOBLBEX	Calculated
PWLBEX	World lamb price, average Smithfield Market price (ex-hooks) for a PM grade lamb Monthly data, simple average	NZMWBES (1989a)
MCLBEX	Total costs for shipping, tariffs and UK internal storage/handling charges for a representative 14.2 kg lamb	NZMPB (1989b)
PFOBLBEX	FOB value of a frozen prime grade lamb (13-16kg) shipped to the UK	NZ Dept Stats
QELBEX	Volume of prime grade lamb shipped to UK	NZ Dept Stats

6. External beef data

PSBFEX	FOB-market price spread = PWBFEX-PFOBBFNZ	Calculated
PWBFEX	World beef price, average New York CIF price for a boneless manufacturing cow Monthly data, simple average	NZMWBES (1989a)
MCBFEX	Total costs for freight and insurance for a representative 160 kg cow from FOB to New York	NZMPB (1989b)
PFOBBFNZ	FOB value of frozen boneless cow and steer boxed beef shipped to the USA	NZ Dept Stats
QEBFEX	Volume of frozen boneless cow shipped to the USA	NZ Dept Stats

7. Other data

CPI	NZ consumer price index, base 1978=100	NZ Dept Stats
NTI	NZ wholesale non-tradables price index, base 1982=100. To 1976, wholesale price index of service industry outputs; from 1976 producer price index of outputs	NZ Dept Stats

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NOTE 1: This is normally offset against processing charges but is treated as a separate variable here (available 1976 onwards).

NOTE 2: 1967-1974: NZ DEPARTMENT OF STATISTICS, Statistics of Industrial Production
1974-1987: MIA, Surveys
1988-1989: Interpolated using previous relativities between MIA data and average of individual product costings from NZMPB
The MIA survey changed the measurement of throughput starting in 1984. These new "kill units" were not able to be reconciled with previous production figures. Unit cost figures were interpolated using the relativities between total production and previous survey figures for 1984-1987.

Appendix B: Detailed Regression Results

Table B1 : Lamb Farm-FOB Margin, Real (NTI) Values, 1967-1988

Explanatory Variables	Equation Number					
	1	2	3	4	5	6
	—————competitive models—————				—augmented models—	
C	0.233 (0.75)	0.141 (0.43)		-0.924 (-2.68)	-0.901 (-0.59)	-1.812 (-2.24)
FOB Price	-0.295 (-2.23) [-0.63]	-0.411 (-2.70) [-0.88]	-0.392 (-2.21) [-0.84]		-0.196 (-0.90) [-0.37]	
Throughput				0.0026 (2.36) [1.08]	-0.0009 (-0.47) [-0.37]	
Revenue		0.0007 (0.89) [0.49]	0.0008 (1.10) [0.56]			
Cost	2.008 (5.70) [1.38]	1.705 (3.48) [1.17]	1.738 (3.66) [1.19]	1.354 (3.54) [0.93]	1.304 (2.52) [0.89]	0.998 (2.99) [0.68]
Assistance					0.668 (2.74) [0.13]	0.653 (4.13) [0.13]
Byproducts					-0.024 (-0.06)	
Hides/Skins					0.352 (1.16) [0.15]	0.284 (1.10) [0.12]
Value Added					1.412 (1.31) [1.60]	1.774 (2.45) [2.01]
R^2	0.60	0.60	0.61	0.63	0.71	0.74
DW	1.58	1.58	1.53	1.65	2.67	2.62

t statistics in (.); elasticity with respect to the margin in [.].
See text for details

Table B2 : Lamb, Mutton and Beef Farm-FOB Margins, Real (NTI) Values, 1967-1988 (Seemingly Unrelated Regression)

Explanatory Variables	Beef		Lamb		Mutton	
	1	2	1	2	1	2
C	-0.360 (-0.88)	-0.318 (-1.70)	0.823 (0.99)	0.280 (1.12)	1.392 (3.15)	1.007 (3.47)
FOB Price	0.602 (7.72) [1.04]	0.612 (8.73) [1.06]	-0.099 (-0.53		0.747 (9.76) [0.78]	0.745 (9.77) [0.78]
Throughput	0.0000 (0.01)		-0.0010 (-0.57)		-0.0054 (-3.42) [-1.16]	-0.005 (-3.80) [-1.08]
Cost	0.521 (3.32) [0.32]	0.521 (3.91) [0.32]	1.030 (2.39) [0.71]	0.993 (3.15) [0.68]	-0.433 (-1.19) [-0.30]	
Assistance	0.170 (0.15)		0.606 (3.05) [0.12]	0.518 (3.76) [0.10]	1.336 (6.08) [0.08]	1.293 (6.45) [0.08]
Byproducts	-0.993 (-3.56) [-0.21]	-0.991 (-3.84) [-0.21]	-0.432 (-1.55) [-0.16]	-0.428 (-1.90) [-0.16]	-0.062 (-0.24)	
Hides/Skins	0.259 (0.26)		0.244 (0.91) [0.10]	0.247 (0.95) [0.10]	-0.751 (-2.27) [-0.22]	-0.629 (-2.25) [-0.18]
R²	0.88	0.88	0.76	0.76	0.91	0.91
DW	1.95	1.90	2.08	2.02	1.84	1.67

t statistics in (.); elasticity with respect to the margin in [.].
See text for details

Table B3 : Mutton Farm-FOB Margin, Real (NTI) Values, 1967-1988

Explanatory Variables	Equation Number					
	1	2	3	4	5	6
	———competitive models———				—augmented models—	
C	-0.336 (-0.94)	-0.236 (-0.68)		1.235 (1.55)	1.018 (2.15)	1.103 (3.27)
FOB Price	0.709 (5.26) [0.74]	1.112 (3.66) [1.17]	1.117 (3.76) [1.17]		0.723 (7.64) [0.76]	0.725 (8.15) [0.76]
Throughput				-0.0050 (-1.46) [-1.08]	-0.0057 (-2.99) [-1.23]	-0.0058 (-3.70) [-1.23]
Revenue		-0.0023 (-1.46) [-0.60]	-0.0025 (-1.65) [-0.65]			
Cost	0.588 (1.07) [0.40]	0.434 (0.79)	0.133 (0.43)	0.881 (1.32) [0.60]	0.114 (0.27)	
Assistance					1.203 (4.50) [0.07]	1.217 (5.12) [0.08]
Byproducts					-0.016 (-0.05)	
Hides/Skins					-0.474 (-1.32) [-0.14]	-0.510 (-1.86) [-0.15]
R^2	0.55	0.58	0.60	0.07	0.80	0.82
DW	1.77	1.78	1.75	1.57	1.69	1.72
RHO	0.67 (4.14)	0.69 (4.31)	0.70 (4.53)	0.47 (2.41)	0.71 (3.97)	0.72 (4.15)

t statistics in (.); elasticity with respect to the margin in [.].
See text for details

Table B4 : Beef Farm-FOB Margin, Real (NTI) Values, 1967-1988

Explanatory Variables	Equation Number					
	1	2	3	4	5	6
	——— competitive models ———				augmented models	
C	-0.063 (-0.27)	-0.062 (-0.25)		1.523 (3.62)	-0.214 (-0.29)	-0.240 (-1.18)
FOB Price	0.390 (6.55) [0.68]	0.397 (4.56) [0.69]	0.388 (4.94) [0.68]		0.564 (5.75) [0.98]	0.586 (7.34) [1.02]
Throughput				-0.002 (-2.41) [-1.70]	-0.0004 (-0.56)	
Revenue		-0.00002 (-0.10)	-0.00003 (-0.12)			
Cost	0.588 (3.34) [0.36]	0.600 (2.72) [0.37]	0.574 (3.04) [0.36]	1.171 (4.05) [0.71]	0.585 (2.84) [0.36]	0.506 (3.42) [0.31]
Assistance					0.181 (0.13)	
Byproducts					-1.014 (-2.87) [-0.22]	-0.909 (-3.14) [-0.19]
Hides/Skins					0.609 (0.50)	
Value Added					0.0054 (0.02)	
R*	0.77	0.76	0.77	0.62	0.81	0.84
DW	2.32	2.32	2.33	2.32	2.01	1.89

t statistics in (.); elasticity with respect to the margin in [.].
See text for details

Table B5 : <u>All Products Farm-FOB Margin, Real (NTI) Values, 1967-1988</u>

Explanatory Variables	Equation Number				
	1	2	3	4	5
	competitive models				augmented model
C	−0.194 (−0.58)	−0.266 (−0.74)		0.127 (0.25)	0.585 (1.63)
FOB Price	0.200 (1.61) [0.36]	0.402 (1.87) [0.72]	0.339 (1.65) [0.61]		0.288 (2.64) [0.51]
Throughput				−0.0002 (−0.42)	−0.0009 (−2.48) [−0.70]
Revenue		−0.0002 (−0.96) [−0.37]	−0.0002 (−0.80) [−0.37]		
Cost	1.154 (2.80) [0.79]	1.210 (2.72) [0.82]	1.007 (3.08) [0.68]	1.545 (4.31) [1.05]	1.089 (3.96) [0.74]
Assistance					0.898 (4.43) [0.06]
Byproducts					−0.902 (−3.98) [−0.27]
Hides/Skins					0.921 (2.85) [0.21]
R²	0.39	0.40	0.40	0.35	0.86
DW	2.07	2.16	2.10	1.97	2.01
RHO	0.52 (2.82)	0.64 (3.80)	0.61 (3.51)	0.42 (2.09)	

t statistics in (.); elasticity with respect to the margin in [.].
See text for details

Table B6 : Lamb FOB-Market Margin, Real (NTI) Values, 1967-1988

Explanatory Variables	Equation Number				
	1	2	3	4	5
	———	competitive models	———		augmented model-
C	-0.322 (-1.94)	-0.259 (-1.85)	-0.258 (-1.84)		-0.258 (-1.52)
World Price	0.129 (1.73) [0.38]	0.160 (2.67) [0.47]	0.093 (0.96) [0.27]	0.0088 (0.09)	
Throughput	0.0008 (0.73)				0.0019 (2.02) [0.15]
Revenue			0.0004 (0.89)	0.0004 (0.85)	
Cost	0.809 (5.24) [0.88]	0.726 (6.98) [0.79]	0.822 (5.47) [0.90]	0.823 (5.16) [0.90]	1.016 (10.01) [1.11]
R*	0.86	0.86	0.86	0.86	0.85
DW	1.51	1.54	1.50	1.32	1.41

t statistics in (.); elasticity with respect to the margin in [.].
See text for details

Table B7 : Beef FOB-Market Margin, Real (NTI) Values, 1967-1988

Explanatory Variables	Equation Number					
	1	2	3	4	5	6
		competitive models			augmented models	
C	-0.039 (-0.13)	0.061 (0.31)	-0.013 (-0.04)		0.544 (2.18)	-0.027 (-0.09)
World Price	0.145 (2.58) [0.99]	0.142 (2.70) [0.93]	0.137 (1.98) [0.88]	0.135 (2.94) [0.88]		0.146 (2.68) [0.93]
Throughput	0.0003 (0.20)				0.0012 (0.73)	
Revenue			0.00012 (0.26)	0.00012 (0.28)		
Cost	0.157 (0.33)		0.148 (0.31)	0.133 (0.44)	-0.194 (-0.36)	0.175 (0.39)
R²	0.30	0.36	0.31	0.34	0.13	0.34
DW	1.57	1.60	1.56	1.58	2.05	1.60
RHO	0.63 (3.57)	0.61 (3.58)	0.63 (3.61)	0.63 (3.71)	0.69 (4.23)	0.61 (3.53)

t statistics in (.); elasticity with respect to the margin in [.].
See text for details

Table B8 : Lamb and Beef FOB-Market Margin, Real (NTI) Values, 1967-1988.
(Seemingly Unrelated Regression)

Explanatory Variables	Lamb		Beef	
	1	2	3	4
C	-0.348	-0.301	-0.207	0.014
	(-2.27)	(-2.14)	(-0.70)	(0.07)
World Price	0.120	0.166	0.156	0.147
	(1.69)	(2.93)	(3.17)	(3.00)
	[0.35]	[0.49]	[1.00]	[0.94]
Throughput	0.0010		0.0004	
	(0.92)		(0.32)	
	[0.09]			
Cost	0.845	0.747	0.354	
	(6.04)	(7.44)	(0.82)	
	[0.92]	[0.81]	[0.27]	
R*	0.87	0.87	0.57	0.55
DW	1.46	1.50	1.59	1.61
RHO			0.60	0.60
			(3.74)	(3.67)

t statistics in (.); elasticity with respect to the margin in [.].
See text for details