AN ANALYSIS OF FACTOR COSTS IN THE NEW ZEALAND MEAT PROCESSING INDUSTRY

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ABSTRACT

This thesis analyzes the factor costs of killing and processing sheep and lambs from works gate to ex-works in a New Zealand processing company.

It examines the effect of throughput numbers on these factor costs using capacity utilization as a measure of cost efficiency.

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I am grateful to Grant English for his time and assistance on graphing and Diane Lenz for assisting in figure illustrations.

I would also like to thank my wife, Susan, and my sons, Steve and Ben for putting up with me through a difficult period. Now we can go to the beach.

Finally, I would like to thank Susan Clemes again, for typing this thesis and doing it with extreme patience.

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CHAPTER 1

INTRODUCTION

1.0 THE TOPIC

The New Zealand Meat Industry makes a large contribution to New Zealand export earnings, $1,546,500,000 ($1979) NZMPB (1979) and its overall contribution to the New Zealand economy is significant, New Zealand Freezing Companies Association (Inc.) (Anon., 1979).

This major industry faces many problems both in its overseas markets, Begg (1978) and within New Zealand, Rattray (1979).

Rising killing and freezing charges have often been suggested as a major internal problem as the charges represent approximately 80% of the total costs incurred by a lamb carcase from farm gate to f.o.b., Rattray (1979).

These charges are also important as they represent a direct cost to the on-farm producer. In addition, these charges (costs to the industry) are primarily internal in origin and are therefore costs that are within the control of New Zealand.

One way to increase real returns to livestock producers (apart from real increases in their product prices) is to limit or reduce any real increases occuring in killing and freezing charges.

The first step in limiting or reducing any real increases occuring in these charges must be to identify all the industry costs that affect the charges.

This study attempts to do this accurately, and then provide insight into ways which may limit or reduce future killing and processing costs thereby increasing real returns to producers.

1.1 BACKGROUND TO THIS STUDY

Chudleigh, Clemes, and Woods (1978) identified trends in unit marketing charges for New Zealand export livestock from farmgate to f.o.b. for the 1971 through 1976 seasons ending September 30.

They suggested that nominal killing and freezing charges increased at a far greater rate than the other charges in the marketing chain and at a greater rate than either the consumer price index or the wage rate index.

The relative increase in these charges compared to the other charges and the absolute size of the national killing and freezing charge for meat, $181,000,000 ($1976), indicated that a factor cost study of the freezing works operation was required to further investigate killing and freezing charges, Chudleigh et.al. (1978).

This thesis provides an economic interpretation of killing and processing factor costs for sheep and lamb (later expressed as lamb equivalents). The confidential factor costs were provided by a New Zealand Freezing Company for the 1971 through 1979 seasons ending August 31.

1.2 OBJECTIVES

The specific objectives of this study were;

1. To identify all the factor costs of killing and processing sheep and lamb (including the processing of by products) from works gate to ex-works, in a representative New Zealand Freezing Company.
2. To identify the relationship between the freezing companies operational structure and its associated factor costs.

3. To analyze any real increase in the costs of killing and processing livestock.

4. To identify the relationship between stock throughput numbers and real killing and processing costs, using capacity utilization as a measure of cost-efficiency.

5. To model real killing and processing costs and predict these costs.

6. To examine the implications on the company and the industry of any real increases or decreases in these costs arising from different capacity utilization levels.

7. To suggest ways to limit any cost increases that may occur in the future.

1.3 KILLING AND PROCESSING COSTS

In this study, killing and processing costs pertain to actual company costs of killing (slaughtering) stock and processing the resulting carcases and by products.

Published killing and freezing carcase charges, such as those in the New Zealand Meat Producers Board Annual Reports, pertain however to charges (costs to the producers) for carcases only. The costs (unpublished) of processing by products are off-set by the processing companies using revenue from the sale of the by products.

1.4 LAMB EQUIVALENTS (LE)

This study concentrates on the factor costs of killing and processing export sheep and lambs, expressed as lamb equivalents (LE).

Factor costs for processing lambs only were not made available and thus all sheep throughputs have been converted to lamb equivalents using the historic ratio of 1.25 lambs to 1 sheep.

This ratio is used by the company providing cost information in arrangement with its killing and processing facilities.

CHAPTER 2

REVIEW OF PROCESSING CHARGES AND COSTS

2.0 PROCESSING CHARGES

Since the early 1970s, the New Zealand Meat Producers Board has been monitoring increases in published killing and freezing carcase charges for export lamb, Harrison (1974).

Several studies since 1970 have concentrated on the increasae in these published charges and commented on the effect of these increases on producer returns, Harrison (1975), Calder (1977), Rattray (1979).

Cameron (1976) examined trends in the published killing and freezing charges and provided some insight into their factor make-up by suggesting that lamb labour contributed between 56 to 65 per cent to the total per carcase charge. Cameron also implied that increases in lamb labour costs were partially responsible for increases in killing and freezing charges, with hygiene requirements also contributing to increases in the charges.

Many additional studies investigating killing and freezing charges have relied on the New Zealand Meat Producers Boards published charges to make relative cost comparisons between industries or discuss cost increases, Chudleigh, et.al. (1978), Foster (1979).

2.1 PROCESSING COSTS

Two recent major meat industry commissions have been held in 1969 and 1979 with detailed papers prepared for both by the New Zealand Freezing Companies Association (Inc.). These papers have covered a wide range of industry topics with meat slaughtering and processing costs receiving a

significant degree of attention.

In the most informative public release issued from these 1979 papers, the Association (Anon.,1979) suggested that in a typical New Zealand processing works, wages and salaries contributed 60% to processing costs, with activities such as packaging, processing, repairs and maintenance contributing the remaining 40%.

Further, the Association suggested increases in these costs since 1970 were primarily due to expenditure for hygiene and increases in the costs of goods and services used by the industry.

In addition to the above costs breakdown, the Association (Anon.,1979) broadly outlined the procedure followed in setting killing and processing charges under the Stabilization of Prices Regulation 1974.

While these publications did illustrate the cost activities associated with processing livestock, i.e. wages, salaries, interest, they did not quantify processing factor costs or factor cost increases.

In the same papers the Association recognized the possibility of spreading the seasonal livestock kill to provide better utilization of labour and plant to reduce or limit increases occuring in their costs.

The Association's comments on reducing costs by improved capacity utilization through spreading the seasonal livestock kill were preceded by Herlihy (1970) following the 1969 meat industry commission. Herlihy suggested that a better spread of the actual kill could indirectly aid producers by decreasing freezing company costs through better plant and labour utilization. However, he did not quantify any processing cost decreases that might occur through improved utilization.

Brodie and McCarthy (1974) estimated a long run average cost function for processing different combinations of sheep, lambs and beef using a synthetic approach due to anticipated difficulties in obtaining complete, actual factor cost data. They estimated a total capital cost function for an integrated New Zealand processing works indicating the lowest cost solutions were associated with fully utilized, larger processing works.

Silcock and Sheppard (1981) provided some insight into the factor costs of cutting lamb to determine the value of further processing of meat in New Zealand. Lamb killing and freezing (per kg.) charges were derived using published per carcase killing and freezing charges. Lamb cutting and packaging charges provided by the NZMPB and based on the actual lamb cutting costs from a larger meat processing company were updated.

One benefit to the industry Silcock, et.al. associated with any further processing of meat was an increased level of labour and plant utilization.

Sheppard (1982) examined the relationship between seasonality and overcapacity in the New Zealand meat processing industry reviewing the fixed/variable nature of its costs, concentrating on wage costs for lambs. He suggested a close relationship between the costs of operating a freezing works and its labour costs.

Concentrating on wage costs and using a case study works, Sheppard concluded that potential costs savings of $.12 per unit (LE) equivalent could exist if utilization levels were improved.

Sheppard also suggested spreading the kill from the seasonal peak and reducing overall capacity could lower per unit processing costs in the future.

In addition to these industry studies, several others, including Shadbolt (1981), have suggested spreading the seasonal livestock kill as a method to increase capacity utilization and limit increases in processing costs.

Many of these freezing industry studies have suggested a relationship exists between higher capacity utilization levels and lower processing costs with some identifying certain factor costs associated with processing sheep and lambs.

However, to date no study has identified the complete factor costs of processing sheep and lambs and attempted to determine what effect capacity utilizations may have on these factor costs.

The following chapters are an attempt to identify these factor costs and investigate their relationship with capacity utilization levels.

CHAPTER 3

STRUCTURE,OPERATION AND COSTS

3.0 INTRODUCTION

This thesis is an analysis of confidential factor cost data supplied by a New Zealand Freezing Company. The company is a "processor" of sheep and lamb throughputs for export and is a licensed meat exporter.

Factor costs for processing sheep and lambs have been supplied on a multi-works (multi-plant) basis covering 9 seasons, 1970/71 through 1978/79.

The multi-works factor cost approach was used to ensure the "confidentiality" requirements set out in the company's terms of reference for this thesis.

The number of processing works owned by the company and their combined throughput capacity has changed during the 9 season study period. Adjustments have been made to allow for these changes in combined capacity.

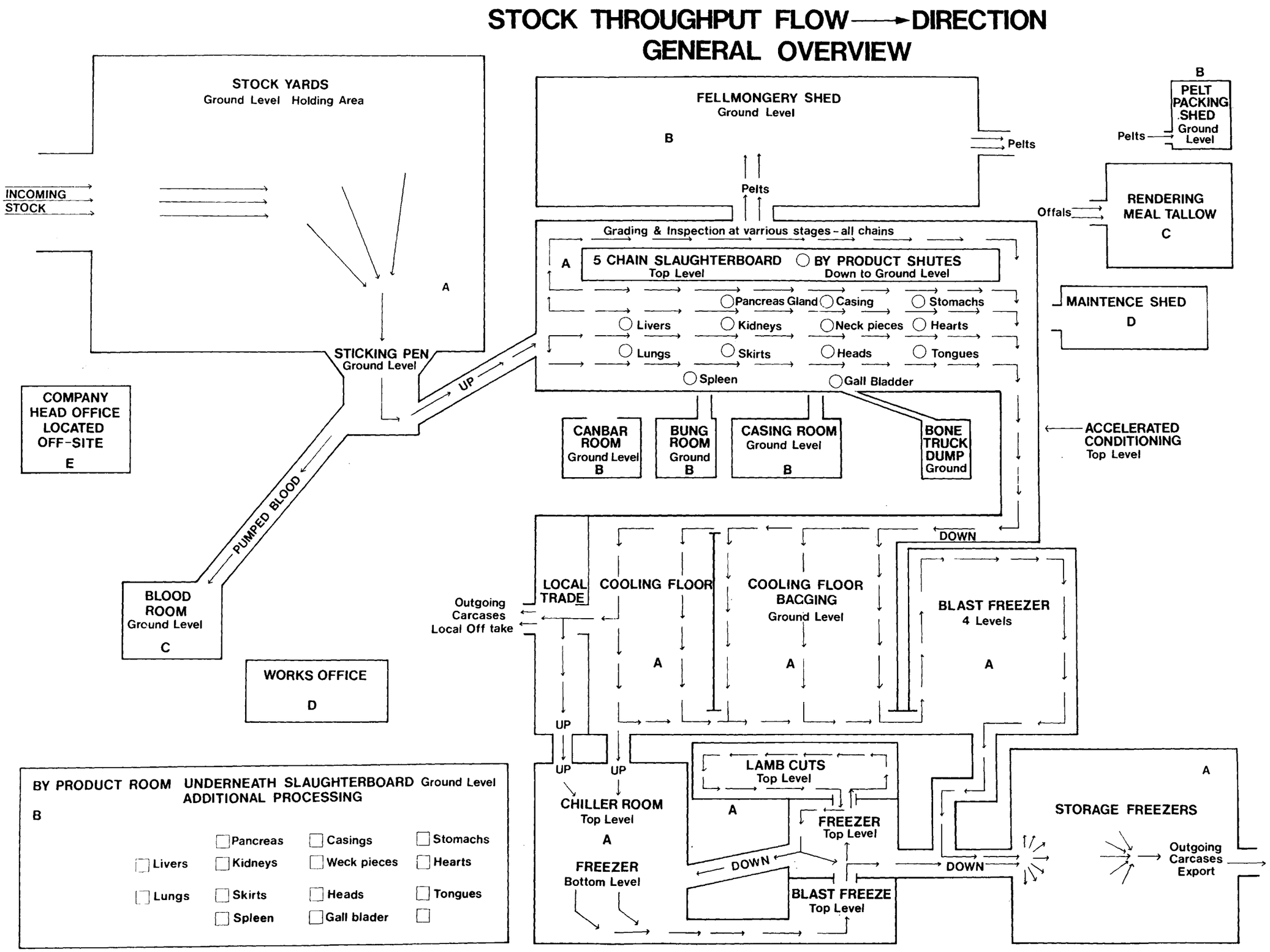
In order to complete an accurate and realistic analysis, the relationship between the freezing companies operational structure and its associated factor costs is clearly identified.

To assist the reader, the physical movement of sheep and lambs through a representative processing works is described using a flow chart.

The particular operational-cost structure of the freezing company is explained using divisions and departments as guidelines.

The methods used to determine the nominal and real costs of processing sheep and lamb throughputs are then described.

FIGURE 3.1


STOCK THROUGHPUT FLOW ⟶ DIRECTION
GENERAL OVERVIEW
STOCK YARDS
Ground Level Holding Area
A
INCOMING STOCK
STICKING PEN
Ground Level
UP
PUMPED BLOOD
BLOOD ROOM
Ground Level
C
COMPANY HEAD OFFICE LOCATED OFF-SITE
E
WORKS OFFICE
D
FELLMONGERY SHED
Ground Level
B
Pelts
B
PELT PACKING SHED
Ground Level
Pelts
Offals
RENDERING MEAL TALLOW
C
MAINTENCE SHED
D
Grading & Inspection at varrious stages - all chains
A
5 CHAIN SLAUGHTERBOARD
Top Level
BY PRODUCT SHUTES
Down to Ground Level
Pancreas Gland
Casing
Stomachs
Livers
Kidneys
Neck pieces
Hearts
Lungs
Skirts
Heads
Tongues
Spleen
Gall Bladder
CANBAR ROOM
Ground Level
B
BUNG ROOM
Ground
B
CASING ROOM
Ground Level
B
BONE TRUCK DUMP
Ground
ACCELERATED CONDITIONING
Top Level
DOWN
Outgoing Carcases Local Off take
LOCAL TRADE
COOLING FLOOR
A
COOLING FLOOR BACGING
Ground Level
A
BLAST FREEZER
4 Levels
A
UP
UP
UP
CHILLER ROOM
Top Level
A
FREEZER
Bottom Level
LAMB CUTS
Top Level
A
FREEZER
Top Level
DOWN
DOWN
BLAST FREEZE
Top Level
A
STORAGE FREEZERS
Outgoing Carcases Export
BY PRODUCT ROOM UNDERNEATH SLAUGHTERBOARD Ground Level
ADDITIONAL PROCESSING
B
Pancreas
Casings
Stomachs
Livers
Kidneys
Weck pieces
Hearts
Lungs
Skirts
Heads
Tongues
Spleen
Gall blader

3.1 PROCESSING WORKS SHEEP AND LAMB FLOW CHART

The freezing company providing information operates each of its processing works using the "single site" concept prevalent in the New Zealand Meat Processing Industry.

The "single site" concept means that slaughtering, dressing, grading, conditioning, cooling, chilling, packing, freezing and storing meat and edible by products is combined with processing tallow, blood, bone, hides, wool, casings and inedible by products at the same plant.

The representative works illustrated by the flow chart (Figure 3.1) processes only sheep and lamb throughputs. In some cases, New Zealand works process sheep, lambs, beef and pigs on the same site using separate buildings for killing and dressing individual stock classes.

Sheep and lamb carcases are moved through processing works by the mechanical chain system. The number of chains in the representative works illustrated by the flow chart is 5. Actual chain numbers in New Zealand works processing sheep and lambs range from 2 to 6.

The processing works owned by the company providing information each have the same general sheep and lamb throughput flows as the representative works. The physical layout of these works vary according to geographic location, number of chains and year of construction.

The exact internal layout of these works varies slightly, however the mechanical chain system, manning standards and overall processing order is reasonably standardized for all the company's works.

3.2 THE OPERATIONAL-COST STRUCTURE OF THE COMPANY

The company's operational structure is made up of 5 divisions and their departments. These divisions and their departments all have associated factor cost components. When these components are aggregated, they cover the costs of killing and processing sheep and lamb throughputs from works gate to ex-works.

It was noted in the introduction of this thesis that killing and processing costs are the company's total costs of processing both meat and by products. They should not be confused with published killing and freezing carcase charges, which furthermore pertain only to meat.

The operational-cost structure of the company is detailed below. The general location and operational responsibility of each division and their departments in relation to the representative works is designated by areas A through E on the flow chart.

OPERATIONAL-COST STRUCTURE

1. Killing-Dressing Division - Area A

   (a) Divisional Wages and Stores

   (b) Departmental Wages for;

Shepherds	Cooling Floor
Slaughtermen	Freezer
Board Labour	Freezer Loadout

2. By Products Division - Area B

   (a) Divisional Wages and Stores

   (b) Departmental Wages for;

Offals	Bungs and Casings
Guthouse	Wool and Pelts

3. Rendering Division - Area C

   (a) Divisional Wages and Stores

4. Indirect Works Division - Area D; Limited duties in areas A,B, and C

   (a) Departmental Plant operating Costs for;

Energy	Sundry
Wages	Repairs and Maintenance
Salaries	Work Shop Loss
Depreciation	

5. Central Administration Division (Head Office) - Area E; Overides all areas.

   (a) Departmental Overhead costs for;

   General Manager
   Secretary and Administration
   Controller-Finance
   Accounting Services
   Corporate Planning
   Shipping and Distribution
   Processing Division
   Unrecovered Railage and Pool Guarantee
   Stock Procurement

Head Office Departmental Overhead Costs for the Marketing Department have not been included as it operated autonomously during the study period.

Factor costs associated with certain special lamb cuts have not been included to ensure confidentiality.

3.3 FUNCTIONS OF DIVISIONS AND DEPARTMENTS

The divisions and their departments are responsible for the following functions;

1. Killing and Dressing Division

Divisional Wages comprise the aggregate of wages for the following Departments;

Shepherds - Unload, count, sort and move stock through the yards to the sticking pens.

Slaughtermen - Kill stock, dress and trim carcases.

Board Labour - Assist slaughtermen, inspect, hang, and wash carcases, clean and sweep slaughterboard.

Cooling Floor - Grade, count, stamp, weigh and bag carcases.

Freezer - Cut, bone, sort, package and stack carcases.

Freezer Loadout - Ticket, pallet and load carcases for ex-works market destinations.

Division Stores - Part of over 2000 inventory items including gloves, knives, helmets, boots, brooms, bags, cartons, chemicals, hoses and other goods specific to killing-dressing.

2. By Products Division

Divisional Wages comprise the aggregate of wages for the following Departments;

Offals - Trim, clean, inspect and package edible and inedible meat and organs.

Guthouse - Pull, strip and clean edible and inedible meat and organs.

Bungs and Casings - Cut, clean, sort, salt and package bungs and casings.

Wool and Pelts - Scrape pelts, clean and sort wool, preserve hides.

Divisional Stores - Part of over 2000 inventory items including plastic bags, barrels, salt, scrapers, knives, cartons and other goods specific to by products.

3. Rendering Division

Divisional Wages - Wages paid for rendering offals into meal, tallow, blood and bone.

Divisional Stores - Part of 2000 inventory items including canvas bags, chemicals, plastic bags and other goods specific to rendering.

4. Indirect Works Division

Indirect Works Division costs are the aggregate of the Departmental Plant Operating Costs for the following departments;

Energy - Coal, oil and electric power for the operation of each works.

Wages - Works carpenters, engineers, storemen, carriers, first aid workers and all other people employed on a yearly basis using an hourly wage rate.

Salaries - On-works management and salaried office workers.

Depreciation - Depreciation of plant and equipment at each works.

Sundry - Works insurance, rates, rents, laundry, freight for inward goods, cafeteria expenses, stationery, vehicle expenses, inventory losses and associated costs.

Repairs and Maintenance - Works repairs and maintenance, material purchases for works improvements, includes all costs associated with hygiene.

Workshop Loss - Costs incurred providing works staff and employees with meat.

5. Central Administration Division (Head Office)

Central Administration Division costs are the aggregate of Departmental Overhead Costs for the following departments;

General Manager - Salaries, superannuation, printing, stationery, telephone, vehicle, secretarial and other sundry costs of senior company management.

Secretary and Administration - Salaries, superannuation and sundry costs of department management, staff training, public relations, travel, donations, head office depreciation, insurance, lighting and heating.

Controller-Finance - Interest paid on overdrafts and term loans. Net of interest earned.

Accounting Services - Salaries, superannuation, stationery, computer services and sundry costs of the accounting department.

Corporate Planning - Salaries, superannuation, stationery and sundry costs of the corporate planning department. Includes costs for engineers located in the head office.

Shipping and Distribution - Salaries, superannuation, stationery and sundry costs of the shipping and distribution department.

Processing Division - Salaries, superannuation, stationery and other sundry costs of by products administration industrial relations managers and operation of company farms.

Unrecovered Railage and Pool Guarantee - Cost of transporting stock past nearest export works, freight and pool guarantee losses.

Stock Procurement - Net cost of stock procurement, drafters salaries and travel expenses, cost of stock kept on company farms and in holding yards.

3.4 COSTS

Divisional factor costs for sheep and lambs (later expressed as lamb equivalents) were only compiled when accounting records permitted this approach. When accounting records also covered beef throughputs, ratios were used to convert to lamb equivalents.

The methods used to aggregate individual works costs and derive per carcase lamb equivalent costs are described in the following sections.

3.4.1 KILLING-DRESSING, BY PRODUCTS DIVISIONS AND DEPARTMENTAL WAGES - TABLES 3.1 - 3.3

Nominal aggregate sheep and lamb costs were compiled from the accounting records of 2 works processing sheep and lamb throughputs in the 1970/71 and 1971/72 seasons and from 3 works processing sheep and lamb throughputs in the 1972/73 through 1978/79 seasons.

The costs were aggregated for divisional Wages and Stores.

The aggregate costs for wages were compiled from the departmental monthly wages paid for each season.

The aggregate costs for stores were compiled from the invoices for stores for each season.

The monthly wages paid and stores invoices cover combined sheep and lamb throughputs for all 9 seasons as seperate lamb factor costs were not available.

The per carcase lamb equivalent costs represent a throughput weighted average per carcase cost derived from 2 works in the 1970/71 and 1971/72 seasons and 3 works in the 1972/73 through 1978/79 seasons.

The lamb equivalent (LE) ratio of 1.25 lambs to 1 sheep was used to convert sheep to lambs to obtain throughput weights.

Real (inflation adjusted) costs were derived using specific indexes constructed for use in this study (refer to Appendix 1).

Table 3.1: Lamb equivalent real costs, Killing-Dressing Division ($1979)

Season	Wages		Stores		Division Total	
	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	3,278,024	1.4931	716,923	.3266	3,994,947	1.8197
1971/72	3,943,333	1.7612	605,516	.2704	4,548,848	2.0316
1972/73	6,803,260	1.946	1,081,123	.3092	7,884,383	2.2552
1973/74	6,300,245	2.07	958,678	.3150	7,258,932	2.385
1974/75	9,680,269	2.617	1,374,234	.3715	11,054,503	2.9885
1975/76	10,394,070	2.291	1,880,029	.4144	12,274,099	2.7054
1976/77	9,482,310	2.291	1,515,802	.3663	10,998,112	2.6573
1977/78	10,500,861	2.386	1,919,652	.4362	12,420,513	2.822
1978/79	10,163,511	2.855	1,261,912	.3545	11,425,423	3.2095

Table 3.2: Lamb equivalent real costs, By Products Division ($1979)

Season	Wages		Stores		Division Total	
	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	2,370,264	1.0797	766,668	.3492	3,136,932	1.4289
1971/72	2,837,275	1.2671	787,157	.3515	3,624,432	1.6186
1972/73	4,135,313	1.183	1,081,121	.3092	5,216,434	1.4922
1973/74	3,636,726	1.195	958,457	.3150	4,595,213	1.51
1974/75	4,615,013	1.248	1,446,562	.3911	6,061,575	1.639
1975/76	5,228,155	1.152	1,723,360	.3799	6,951,515	1.5319
1976/77	4,691,768	1.134	1,571,942	.3798	6,263,710	1.5138
1977/78	5,029,825	1.143	1,535,721	.3490	6,565,546	1.492
1978/79	4,774,804	1.3413	1,091,388	.3065	5,866,192	1.6478

Table 3.3: Lamb equivalent real costs, Departmental Wages. Killing-Dressing and By Products Divisions ($1979)

Season	Shepherds		Slaughtermen		Board Labour	
	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	131,120	.0597	1,639,012	.7465	458,923	.2090
1971/72	157,734	.0705	1,892,801	.8454	552,067	.2466
1972/73	340,164	.0973	3,061,467	.8756	1,088,521	.3113
1973/74	315,013	.1035	2,646,104	.8659	1,008,040	.3312
1974/75	387,211	.1047	4,065,713	1.099	1,548,843	.4187
1975/76	415,763	.0916	4,573,391	1.088	1,766,991	.3895
1976/77	379,292	.0917	4,267,039	1.031	1,611,992	.3895
1977/78	315,025	.0716	5,040,413	1.145	1,890,155	.4295
1978/79	304,905	.0857	4,776,850	1.342	1,727,797	.4854

Season	Cooling Floor		Freezer		Freezer Loadout	
	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	327,803	.1493	557,264	.2538	159,105	.0725
1971/72	433,767	.1937	709,801	.3170	197,168	.0881
1972/73	816,390	.2335	1,224,588	.3502	272,131	.0778
1973/74	819,032	.2691	1,197,046	.3933	315,013	.1035
1974/75	1,355,238	.3664	1,742,449	.4710	580,816	.1570
1975/76	1,351,228	.2978	1,559,111	.3437	727,585	.1604
1976/77	1,232,700	.2979	1,422,346	.3437	568,939	.1375
1977/78	1,260,104	.2863	1,365,112	.3102	630,051	.1432
1978/79	1,321,256	.3712	1,422,892	.3997	609,811	.1713

Table 3.3 cont'd....

Season	Offals		Guthouse		Bungs & Casings	
	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	568,863	.2591	118,513	.05398	379,242	.1727
1971/72	510,709	.2281	170,237	.076	936,299	.4181
1972/73	909,768	.2602	330,824	.0946	1,199,240	.3430
1973/74	690,979	.2271	363,673	.1195	1,091,018	.3585
1974/75	784,552	.2121	415,352	.1123	1,522,954	.4117
1975/76	941,068	.2074	522,815	.1152	1,620,728	.3572
1976/77	797,600	.1927	422,259	.1020	1,548,283	.3741
1977/78	885,069	.1943	456,683	.1029	1,760,439	.40
1978/79	763,969	.2146	429,732	.1207	1,671,181	.4695

Season	Wool & Pelts	
	Total	Per c/c
1970/71	1,303,645	.5938
1971/72	1,220,029	.5449
1972/73	1,695,479	.4849
1973/74	1,491,057	.4899
1974/75	1,892,155	.5115
1975/76	2,143,543	.4725
1976/77	1,923,625	.4648
1977/78	1,961,631	.4457
1978/79	1,909,921	.5366

3.4.2 RENDERING DIVISION - TABLE 3.4

The nominal aggregate wage and stores costs of rendering offals were available from 3 works in the 1970/71 and 1971/72 seasons and 4 works in the 1972/73 through 1978/79 seasons.

Aggregate rendering costs are not seperated by stock type i.e. sheep, lamb or beef. In order to derive per carcase lamb equivalent costs, total rendering costs were disaggregated from sheep, lamb and beef to sheep and lamb rendering costs.

The disaggregation of rendering costs was based on mean offal rendering yields calculated from the 1970/71, 1971/72 and 1978/19 seasons.

TABLE 3.5

MEAN RENDERING YIELDS SHEEP,LAMB AND EXPORT BEEF

(Kgs per carcase)

	MEAL	TALLOW	BLOOD	TOTAL
SHEEP DRESSING	2.09	2.45	.318	4.858
LAMB DRESSING	1.10	.77	.144	2.014
BEEF DRESSING	22.04	23.50	2.270	47.810
BEEF BONING	23.36	25.72	0	48.080
BEEF TOTALS	44.40	49.22	2.270	95.890

When expressed as rendering stock units these yields approximate the following ratios:

1 RENDERING EXPORT BEEF=47 RENDERING LAMBS

1 RENDERING EXPORT BEEF=19 RENDERING SHEEP

In order to correctly weight sheep as a proportion of sheep and lamb rendering the mean percentage of sheep throughputs as a proportion of total of sheep and lamb throughputs was calculated for the 9 seasons.

This mean percentage .20 was applied to the possible combination of sheep and lambs (66) that could be processed per 2 export beef and not exceed the mean rendering yields.

The product expressed in rendering stock units approximates the following ratios:

1.817 EXPORT BEEF RENDERING UNITS=66 LAMB AND SHEEP RENDERING UNITS

or;

1 EXPORT BEEF RENDERING UNIT=36.3 LAMB AND SHEEP RENDERING UNITS

The export beef throughputs processed by the works during each season were converted to lamb and sheep rendering units using the above ratio.

Aggregate rendering costs for all stock types for each season were then disaggregated on a percentage basis between sheep and lamb rendering units and export beef converted to sheep and lamb rendering units.

Per carcase lamb equivalent costs were then derived by dividing lamb and sheep rendering costs by the respective lamb equivalents (LE) for each season.

Real costs were derived using specific indexes (Refer to Appendex 1).

Table 3.4: Lamb equivalent real costs, Rendering Division ($1979)

Season	Wages		Stores		Division Total	
	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	236,758	.1078	42,307	.0193	289,065	.1271
1971/72	269,600	.1204	53,019	.0237	322,619	.1441
1972/73	422,947	.1210	124,103	.0355	547,050	.1565
1973/74	444,828	.1462	88,754	.0291	533,582	.1753
1974/75	394,071	.1065	82,841	.0224	476,912	.1289
1975/76	355,158	.0783	98,331	.0217	453,489	.10
1976/77	338,272	.0817	78,228	.0189	416,500	.1006
1977/78	316,696	.072	97,319	.0221	414,015	.0941
1978/79	323,429	.0908	64,307	.0181	387,736	.10894

3.4.3 INDIRECT WORKS DIVISION — TABLE 3.6

Nominal departmental plant operating costs were compiled from the accounting records of 1 work processing sheep and lamb throughputs and 1 work processing sheep, lamb and export beef throughputs in the 1970/71 and 1971/72 seasons. The costs of a third works processing sheep and lamb were included in the 1972/73 through 1978/79 seasons.

These departmental plant operating costs were then aggregated for all works to provide consistency with the Killing-Dressing, By Products and Rendering Divisions.

The per carcase lamb equivalent costs represent a throughput-weighted average per carcase cost.

Export beef (EB) throughputs were converted to lamb equivalent throughputs for each department using the conversion factors below;

DEPARTMENT	CONVERSION FACTORS
ENERGY	1 EB = 25 LE
INDIRECT WAGES	1 EB = 20 LE
SALARIES & SUPERANNUATION	1 EB = 10 LE
DEPRECIATION	1 EB = 25 LE
SUNDRY EXPENSES	1 EB = 25 LE
REPAIRS & MAINTENANCE	1 EB = 10 LE
WORKSHOP LOSS	1 EB = 25 LE

These conversion factors were derived from a confidential cost analysis of 2 works, one which processed sheep and lambs and one which processed sheep, lamb and export beef. Real costs were derived using specific indexes (Refer to Appendix 1).

Table 3.6: Lamb equivalent real costs, Indirect Works Division, Departmental Plant Operating Costs ($1979)

Season	Energy		Wages		Salaries		Depreciation		Sundry	
	Total	Per c/c	Total	Per c/c	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	980,879	.3993	460,755	.1916	1,013,750	.4408	1,209,085	.4925	561,761	.2287
1971/72	1,118,556	.4198	435,139	.1687	1,205,708	.5005	1,391,614	.5223	858,468	.3222
1972/73	1,786,390	.4358	452,800	.1138	1,742,219	.4661	1,303,185	.3179	2,036,919	.4969
1973/74	1,687,442	.4623	769,823	.2182	2,208,254	.6720	1,107,405	.3034	1,267,946	.3474
1974/75	1,238,052	.2690	847,526	.1917	3,004,577	.7399	1,657,570	.3602	2,322,727	.5047
1975/76	1,698,302	.2908	797,254	.1492	2,619,650	.5179	1,497,111	.2564	3,953,929	.6770
1976/77	1,692,663	.3284	837,842	.1692	2,538,634	.5586	1,499,795	.2910	2,620,882	.5085
1977/78	1,736,938	.3260	820,723	.1596	2,612,579	.5475	1,424,604	.2674	2,827,746	.5306
1978/79	1,426,751	.3323	892,195	.2152	2,575,343	.6684	1,691,834	.3941	2,356,578	.5489

Season	Repairs and Maintenance		Workshop Loss		Division Total	
1970/71	1,857,482	.8077	0	0	6,084,432	2.5606
1971/72	1.916,152	.7954	26,510	.010	6,952,147	2.7389
1972/73	3,125,516	.8363	0	0	10,447,029	2.6668
1973/74	3,438,888	1.046	121,785	.033	10,601,543	3.0823
1974/75	4,453,535	1.097	162,717	.035	13,686,704	3.1975
1975/76	5,242,564	1.036	108,241	.018	15,917,051	2.9453
1976/77	5,950,334	1.309	77,621	.015	15,217,771	3.1797
1977/78	5,508,006	1.154	0	0	14,930,596	2.9851
1978/79	4,443,515	1.1533	59,152	.014	13,445,298	3.326

3.4.4 CENTRAL ADMINISTRATION DIVISION (HEAD OFFICE)

TABLE 3.7

Aggregate nominal departmental overhead costs were available from 3 works in the 1970/71 and 1971/72 seasons. Two works processing sheep, lamb and export beef throughputs and one work processing export beef throughputs. The costs of a fourth works processing sheep and lamb throughputs were included in the 1972/73 through 1978/79 seasons.

Aggregate head office costs are not available by stock class and it is not possible to disaggregate them between stock classes.

In order to derive per carcase lamb equivalent costs, export beef were converted to lamb equivalents for all departments using a conversion factor of 1 export beef to 10 lamb equivalents.

This conversion factor was derived from a confidential analysis comparing head office departmental lamb costs to export beef costs. The per carcase lamb equivalent costs represent a simple average per carcase cost.

Real costs were derived using specific indexes (Refer to Appendix 1).

Table 3.7: Lamb equivalent real costs, Central Administration Division (Head Office), Departmental Overhead Costs ($1979).

Season	General Manager		Secretary & Admin.		Controller-Finance	
	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	245,623	.0973	1,025,746	.4065	1,075,723	.4262
1971/72	447,673	.1753	953,921	.3655	1,077,606	.4129
1972/73	291,185	.0736	856,205	.2163	666,957	.1686
1973/74	277,191	.0785	911,721	.2583	582,453	.1650
1974/75	283,785	.0662	874,593	.2039	969,615	.2261
1975/76	246,338	.0426	868,769	.1501	1,322,619	.2285
1976/77	217,942	.0418	965,649	.1852	1,231,113	.2361
1977/78	248,568	.0452	1,125,188	.2047	1,604,178	.2919
1978/79	237,749	.0539	1,079,935	.2450	2,025,508	.4595

Season	Accounting Services		Corporate Planning		Shipping and Distribution	
	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	557,639	.2210	313,964	.1244	625,306	.2478
1971/72	633,530	.2428	312,678	.1198	614,705	.2355
1972/73	578,056	.1461	237,593	.06	308,190	.0779
1973/74	632,879	.1793	335,676	.095	280,353	.0794
1974/75	666,007	.1553	398,733	.0929	174,934	.0408
1975/76	673,001	.1163	522,557	.0903	127,481	.0221
1976/77	657,519	.1261	435,125	.083	103,502	.0198
1977/78	815,900	.1485	408,436	.0743	92,160	.0168
1978/79	793,518	.1801	398,039	.0903	95,263	.0216

Cont'd....

Table 3.7 - cont....

Season	Processing Division		Unrecovered railage & pool guarantee		Divisional Total	
	Total	Per c/c	Total	Per c/c	Total	Per c/c
1970/71	315,505	.1250	0	0	4,978,058	1.9724
1971/72	542,799	.2080	0	0	5,917,763	2.2713
1972/73	620,758	.1569	0	0	4,221,397	1.0668
1973/74	780,885	.2212	700,976	.1986	6,636,211	1.8799
1974/75	429,521	.1001	0	0	4,825,282	1.125
1975/76	591,032	.1021	55,528	.01	5,165,344	.893
1976/77	417,758	.0801	249,270	.047	5,328,719	1.0206
1977/78	346,746	.0631	376,305	.0685	5,954,089	1.0834
1978/79	503,812	.1143	93,085	.0211	5,773,099	1.3098

Season	Stock Procurement	
	Total	Per c/c
1970/71	818,552	.3243
1971/72	1,334,851	.5115
1972/73	662,453	.1674
1973/74	2,134,077	.6046
1974/75	1,028,094	.2397
1975/76	758,019	.1310
1976/77	1,050,841	.2015
1977/78	936,617	.1704
1978/79	546,190	.1239

3.4.5 KILLING AND PROCESSING COSTS - TABLE 3.8

Real (inflation adjusted) total and per carcase lamb equivalent costs were combined for all divisions to represent Killing and Processing Costs.

Annual throughput numbers do not agree due to the use of different export beef to lamb equivalent ratios for individual departments (See Table 3.9).

Table 3.8: Lamb equivalent real costs, Killing and Processing ($1979)

Season	Total	Per c/c
1970/71	18,473,434	7.9087
1971/72	21,365,809	8.8045
1972/73	28,316,293	7.6375
1973/74	29,625,301	9.0325
1974/75	36,104,976	9.077
1975/76	40,761,498	8.1666
1976/77	38,224,812	8.472
1977/78	40,284,768	8.4768
1978/79	36,897,748	9.602

Table 3.9: Lamb equivalent throughputs for deriving per carcase costs.

Season	Lamb Equivalents			
	A	B	C	D
1970/71	2,195,368	2,376,174	2,523,858	2,335,836
1971/72	2,239,021	2,538,299	2,605,451	2,426,692
1972/73	3,496,395	3,917,440	3,957,065	3,707,534
1973/74	3,043,242	3,439,491	3,530,087	3,279,856
1974/75	3,698,990	4,280,439	4,289,139	3,977,633
1975/76	4,536,849	5,404,221	5,784,260	4,991,245
1976/77	4,138,383	4,785,914	5,221,163	4,511,899
1977/78	4,401,002	5,001,707	5,495,752	4,752,355
1978/79	3,559,654	4,042,482	4,407,618	3,810,176

A - Lamb equivalents used for the Killing-Dressing, By Products, Rendering Divisions and Departmental Wages.

B - Lamb equivalents used for the Indirect Works Division.

C - Lamb equivalents used for the Central Administration Division.

D - Lamb equivalents used for Killing and Processing Costs.

CHAPTER 4

REAL PER CARCASE COSTS

4.0 INTRODUCTION

In this chapter the real per carcase costs of the company are compared with representative published per carcase charges to assess company efficiency in the usage of its inputs.

Each divisions per carcase cost is expressed as a percentage of killing and processing per carcase costs to determine real proportionate changes in the operational-cost structure of the company during the study period.

Section 4.5 comments on technological change and productivity within the company over the nine year period.

Finally, the relationship between real per carcase costs and throughput numbers is then identified with further analysis of this relationship following in Chapter 5.

4.1 PUBLISHED PER CARCASE CHARGES

The nominal dollar increases in per carcase killing and freezing charges (excluding by products) have been the subject of much discussion the New Zealand Meat Industry since the late 1960's Harrison (1974), Calder (1977).

The nominal dollar increase in freezing works per carcase charges published by the New Zealand Meat Producer Board for a representative South Island lamb from 1970/71 to 1978/79 was 424%. For the same period the nominal dollar increase for a representative South Island ewe was 522%.

Chudleigh et.al. (1978), Rattray (1979) and others have compared these nominal dollar increases with increases in the Consumer Price Index.

The results of these comparisons indicate killing and freezing charges have increased at a higher rate than the increase in the Consumer Price Index over identical periods.

Rattray (1979) for instance, implies a real increase of 59% in these charges from 1974 to 1979.

4.2 REAL PER CARCASE COSTS

The real per carcase Killing and Processing Costs (including by product costs) for lamb equivalents, as derived in Chapter 3, show a much lower real increase than that obtained for killing and freezing charges by Rattray (1979).

From 1970/71 to 1978/79 these lamb equivalent costs have increased 22% in real terms. If By Product Division per carcase costs are removed from the total, the increase for the same period was 23% in real terms.

One reason provided by the company for the real increase in their costs was the large non-productive expenditure on hygiene requirements undertaken during the study period.

Large hygiene expenditures arising from the Hygiene Regulations Act 1971, have been associated with rising nominal per carcase killing and freezing costs for all freezing works in the industry, Nordmeyer (1974).

Davis (1979/80) estimated hygiene expenditure would total $382 million ($1979) for the entire industry to comply with the regulations and concluded the expenditure would lead to associated operating cost increases for all freezing works.

The real per carcase cost increases from 1970/71 to 1978/79 of 91% in the Killing-Dressing Division Wages and 43% for Indirect Works Departmental Repairs and Maintenance support the company's statement.

In the Killing-Dressing Division, slaughtermen, board labourers and inspectors have been added steadily since 1971 to satisfy the hygiene regulations.

Schedules of manning standards are confidential, however standards for one works show the number of hourly workers increased from 704 in 1975/76 to 741 in 1978/79 in the Killing-Dressing Division to fulfill hygiene requirements.

In 1978/79 this required increase added approximately $.09 ($1979) to per carcase costs.

While the additional labour was necessary to satisfy the Hygiene Regulations Act 1971, it has been of no value in increasing productivity per labour hour at the works level.

Indirect Works Departmental Repairs and Maintenance costs include expenditure for the upgrading or replacement of plant and equipment to satisfy the Hygiene Regulations Act 1971.

In almost all cases the upgrading or replacement of plant and equipment to satisfy the regulations has not increased the works' productivity.

Company sources suggest it has had the opposite effect in certain areas of the slaughterboard due to crowding already tight space allocations for equipment and labourers.

A real decrease in per carcase costs over the study period would have been optimum. However, in view of these hygiene requirements, the real percentage increase of 22% in per carcase costs means the company has been relatively efficient in its use of inputs.

The following sections will further investigate what conditions are affecting company efficiency in use of its inputs.

4.3 CHANGES IN THE INPUT MIX

One method for the company to limit the real increase in its per carcase costs would have been to change its input mix during the study period.

Substituting efficient divisional inputs for less efficient ones when possible in the processing system could have limited the real increase in per carcase costs.

If this were the case the real proportion (percentage) of each divisions contribution to Killing and Processing per carcase costs would have changed over the period.

There has however, been no significant deliberate change in the real proportion of each divisions contribution to Killing and Processing Costs over the study period.

In 1972/73 the Killing-Dressing Division's proportion increased but only as a direct result of the increase in manning standards for hygiene requirements.

In 1972/73 the Central Administration Division's proportion decreased due only to the acquistion of a fourth works with no corresponding increase in Division staff numbers. In 1973/74 this Division's proportion increased as staff numbers were increased to cope with the additional throughput numbers.

Then in the following seasons this Division's proportion remained constant as the acquired works became fully operational and higher throughput levels were achieved.

Table 4.1 lists divisional per carcase costs as a proportion (percentage) of Killing and Processing Costs over the nine year period.

Departmental proportional per carcase costs show the same trend as the Divisional per carcase costs, with slight increases or decreases arising primarily from temporary inter-departmental staff movements or cyclical material purchases.

In conclusion, the company did not adjust its input mix over the study period so this condition was not contributing to efficiency in use of its inputs.

Table 4.1: Divisional per carcase real costs as a per cent of total (%).

Division	Season								
	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79
Killing-Dressing	23	23	30	26	33	33	31	33	33
By Products	18	18	19	17	18	19	18	18	17
Rendering	2	2	2	2	1.5	1	1	1	1
Indirect Works	32	31	35	34	35	36	38	35	35
Central Admin.	25	26	14	21	12.5	11	12	13	14
Total all divisions	100	100	100	100	100	100	100	100	100

4.4 TECHNOLOGICAL CHANGES AND PRODUCTIVITY

Technological improvements at the works level could have increased productivity and limited the real increase in Killing and Processing Costs during the study period.

An increase in productivity (stock processed per labour unit) at the works level would have had the same effect on these costs.

Cameron (1976) suggests for the meat industry overall, a slow rate of technological change at the works level and emphasizes the fall in labour productivity.

The company concurs that technological improvements at their works, solely for increasing productivity, have been limited and would not have had a significant affect on per carcase costs during the period.

They also note that productivity (stock processed per labour unit) is fixed by the system of maximum daily kill and this did not alter during the nine seasons.

The individual works maximum daily chain tallies (chains are timed to these tallies) were constant at either 3000 or 3500 lambs per chain from the 1970/71 through 1978/79 seasons, which supports the company's statement.

The absence of significant technological improvements and productivity increases means these two conditions were not contributing to company efficiency in use of its inputs.

4.5 THROUGHPUT NUMBERS

The fourth condition which may have limited the increase in the company's per carcase costs was favourable changes in throughput numbers during the study period.

Seasonal stock throughput numbers (lamb equivalents) processed by the company have varied over the nine seasons.

In the 1970/71 and 1971/72 seasons, throughput numbers were less than 2,700,000 (LE). In the 1972/73 season, throughput numbers increased to over 3,400,000 (LE), due to the acquisition of a fourth works.

In the following season, 1973/74, throughputs decreased approximately 400,000 (LE). In 1974/75 they increased to approximately 4,000,000 (LE).

In 1975/76, 1976/77 and 1977/78 seasonal throughputs were all above 4,500,000 (LE), decreasing to approximately 3,800,000 (LE) in 1978/79.

The increases or decreases in seasonal throughput numbers at the company works follow national trends in seasonal throughput variations (New Zealand Meat Producer Board Annual Reports, 1971 through 1979).

Figures (4.1-4.6) show graphically the companys real per carcase costs plotted against its throughput numbers for seasons ending August 31.

Divisional throughput numbers do not agree due to the use of different ratios when converting export beef to lamb equivalents.

FIGURE 4.1

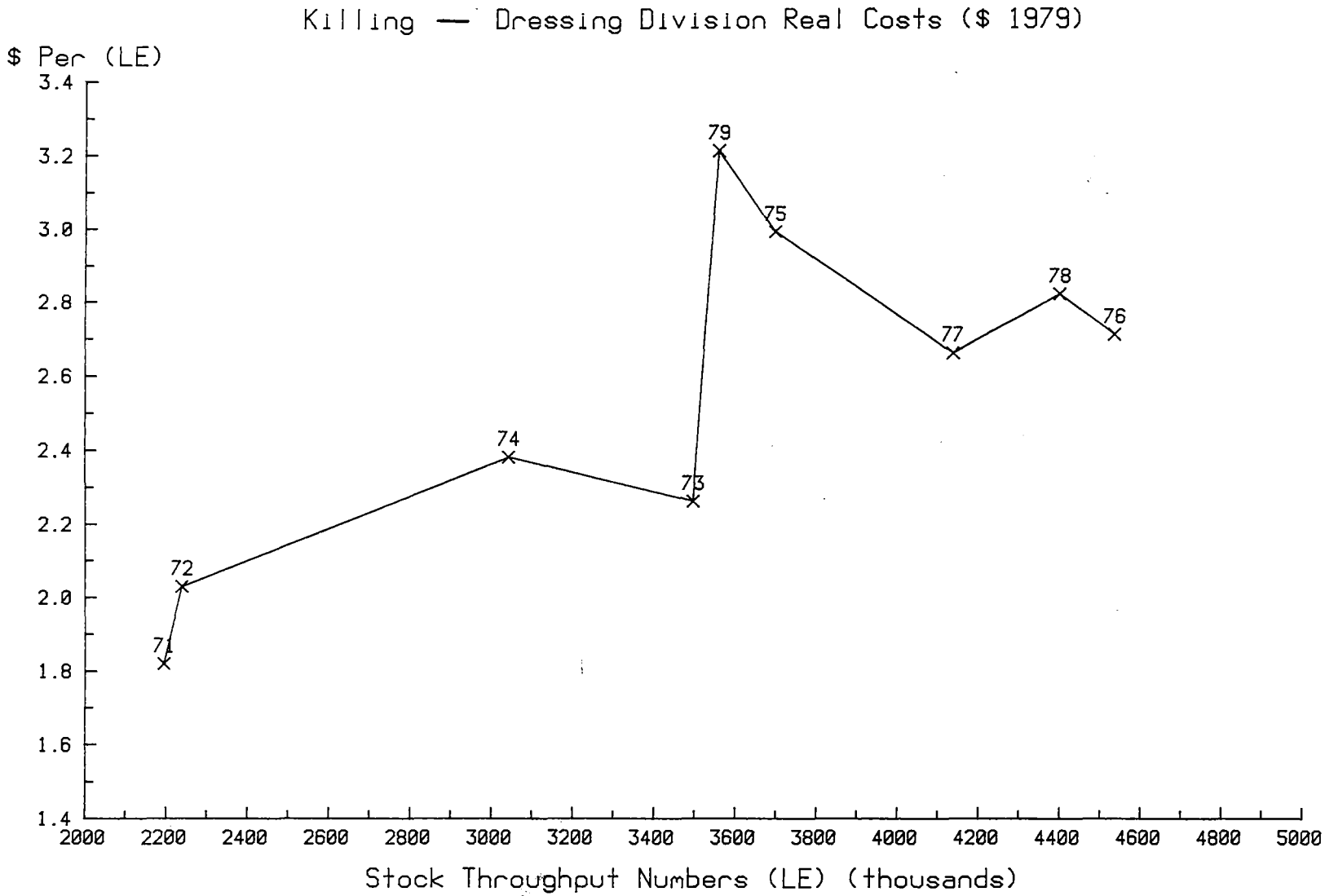

Killing — Dressing Division Real Costs ($ 1979)
$ Per (LE)
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
71
72
74
73
79
75
77
78
76
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
4200
4400
4600
4800
5000
Stock Throughput Numbers (LE) (thousands)

FIGURE 4.2

By Product Division Real Costs ($ 1979)

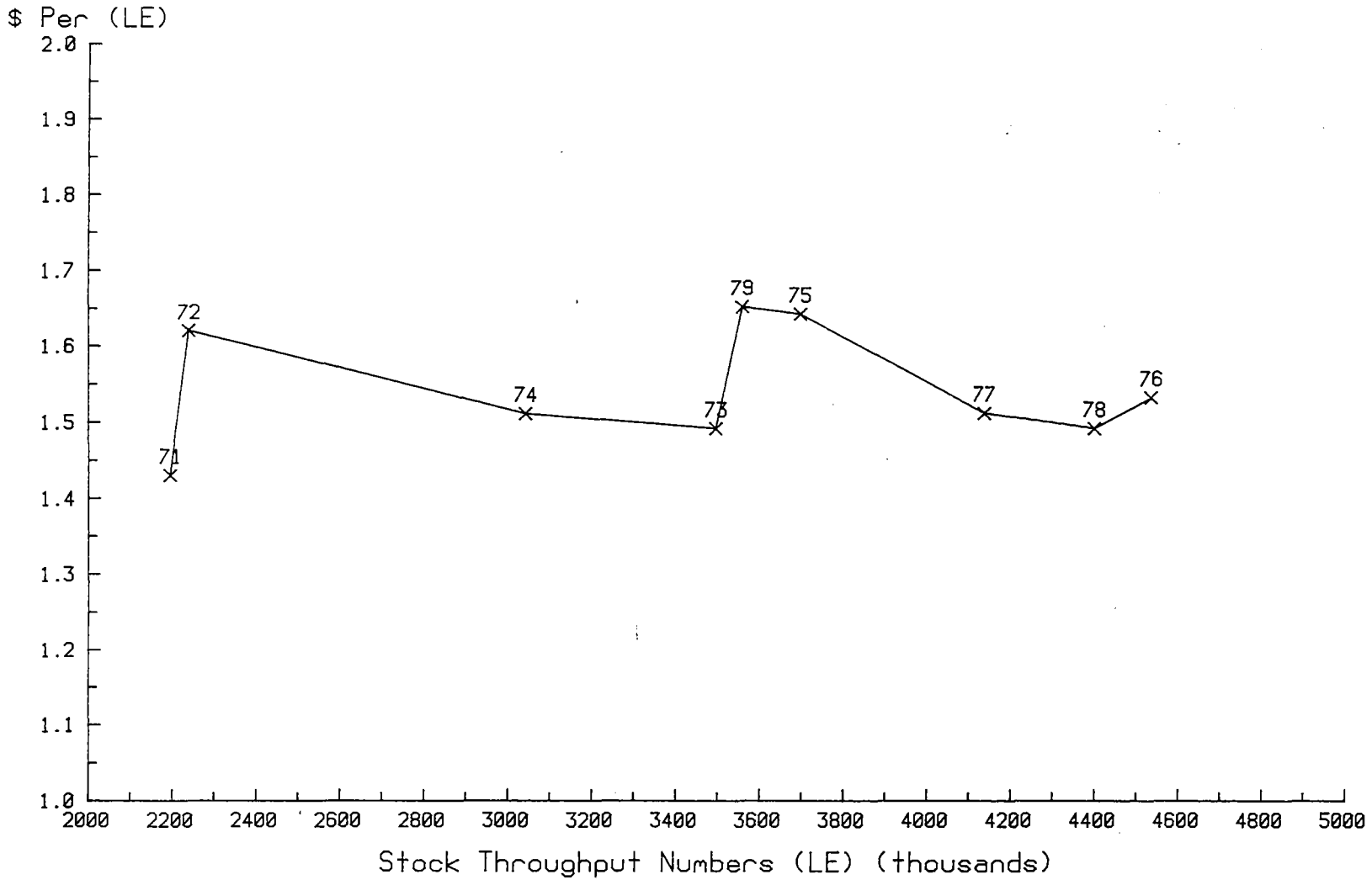


FIGURE 4.3

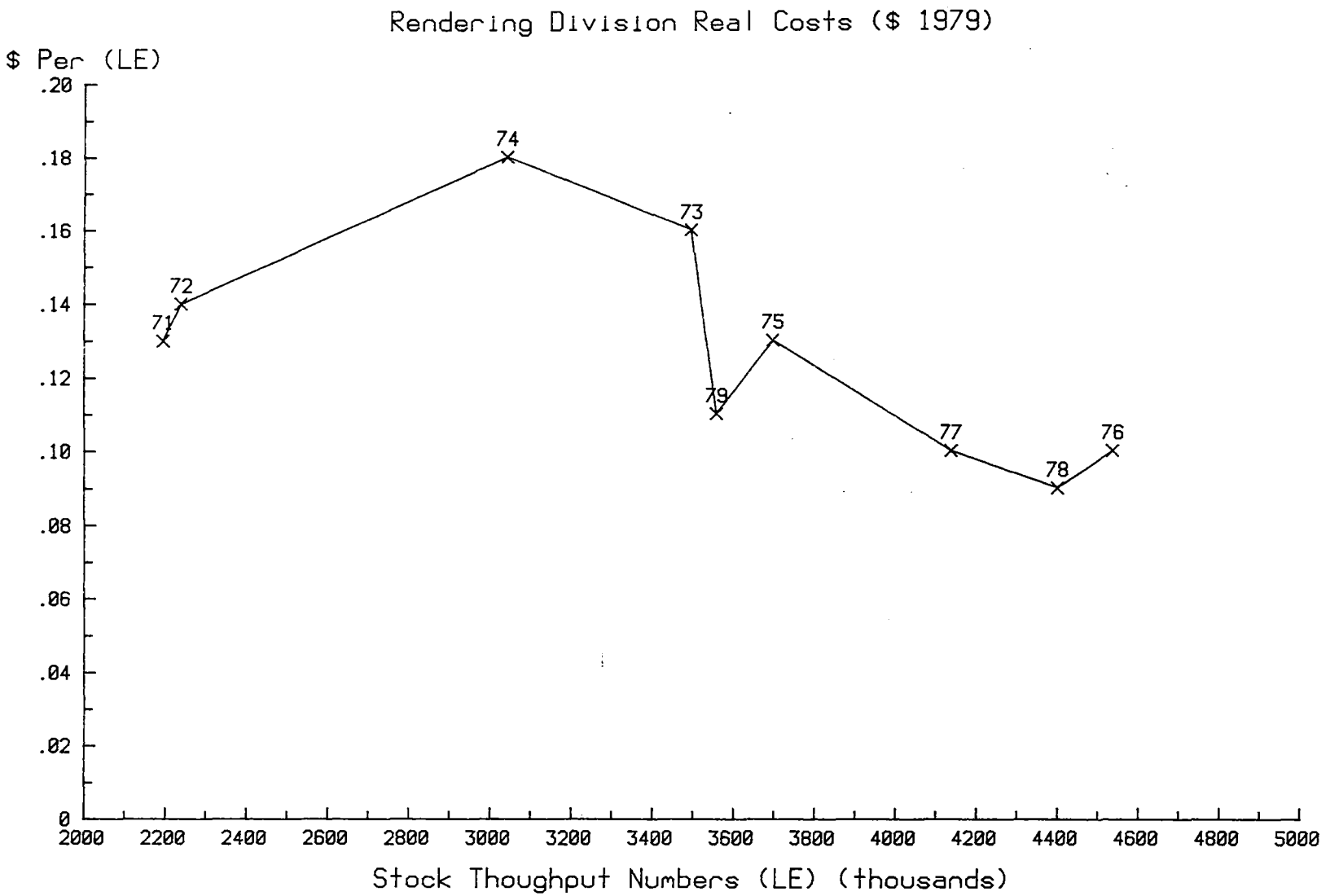

Rendering Division Real Costs ($ 1979)
$ Per (LE)
.20
.18
.16
.14
.12
.10
.08
.06
.04
.02
0
71
72
74
73
79
75
77
78
76
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
4200
4400
4600
4800
5000
Stock Thoughput Numbers (LE) (thousands)

FIGURE 4.4

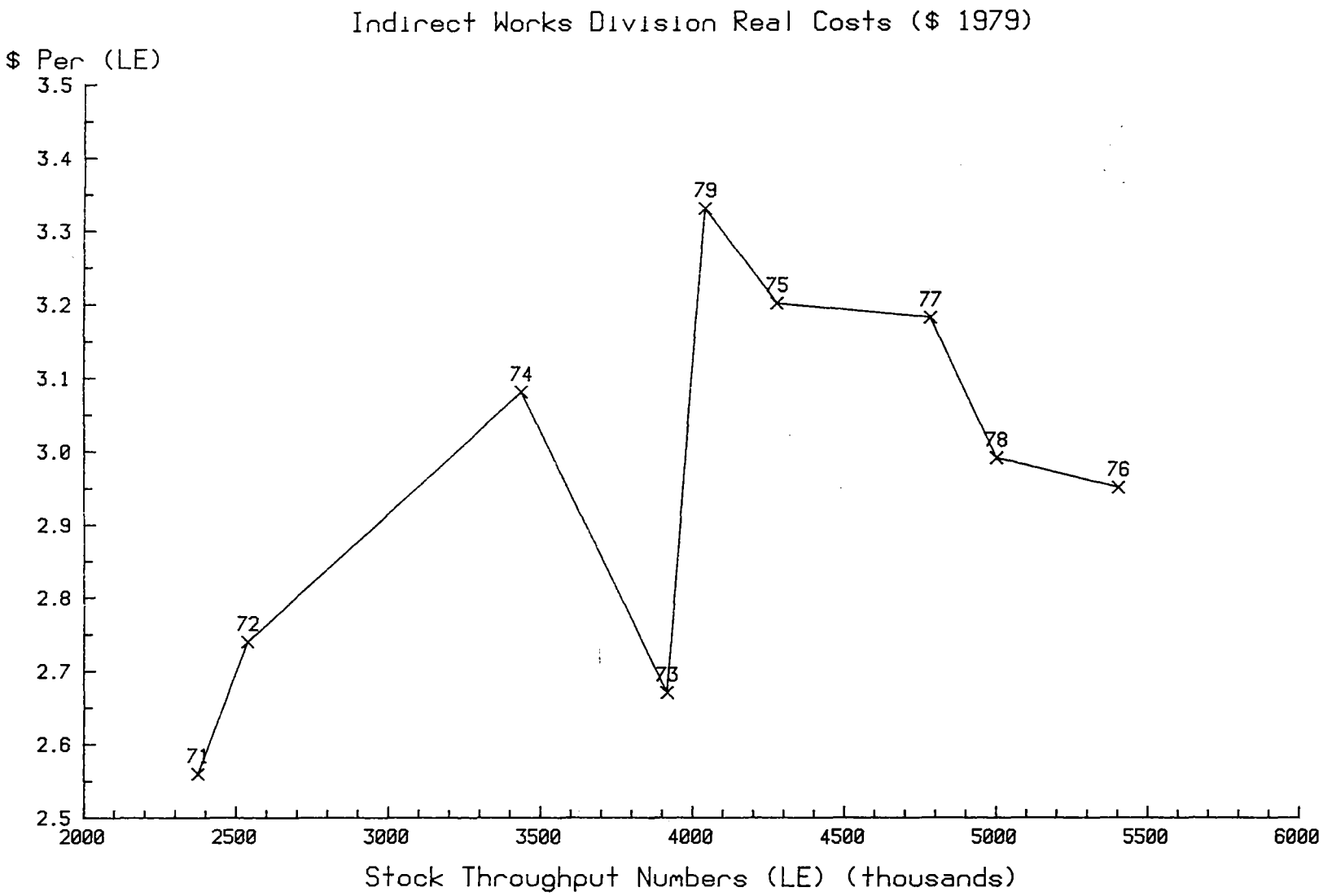

Indirect Works Division Real Costs ($ 1979)
$ Per (LE)
3.5
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
71
72
74
73
79
75
77
78
76
2000
2500
3000
3500
4000
4500
5000
5500
6000
Stock Throughput Numbers (LE) (thousands)

FIGURE 4.5

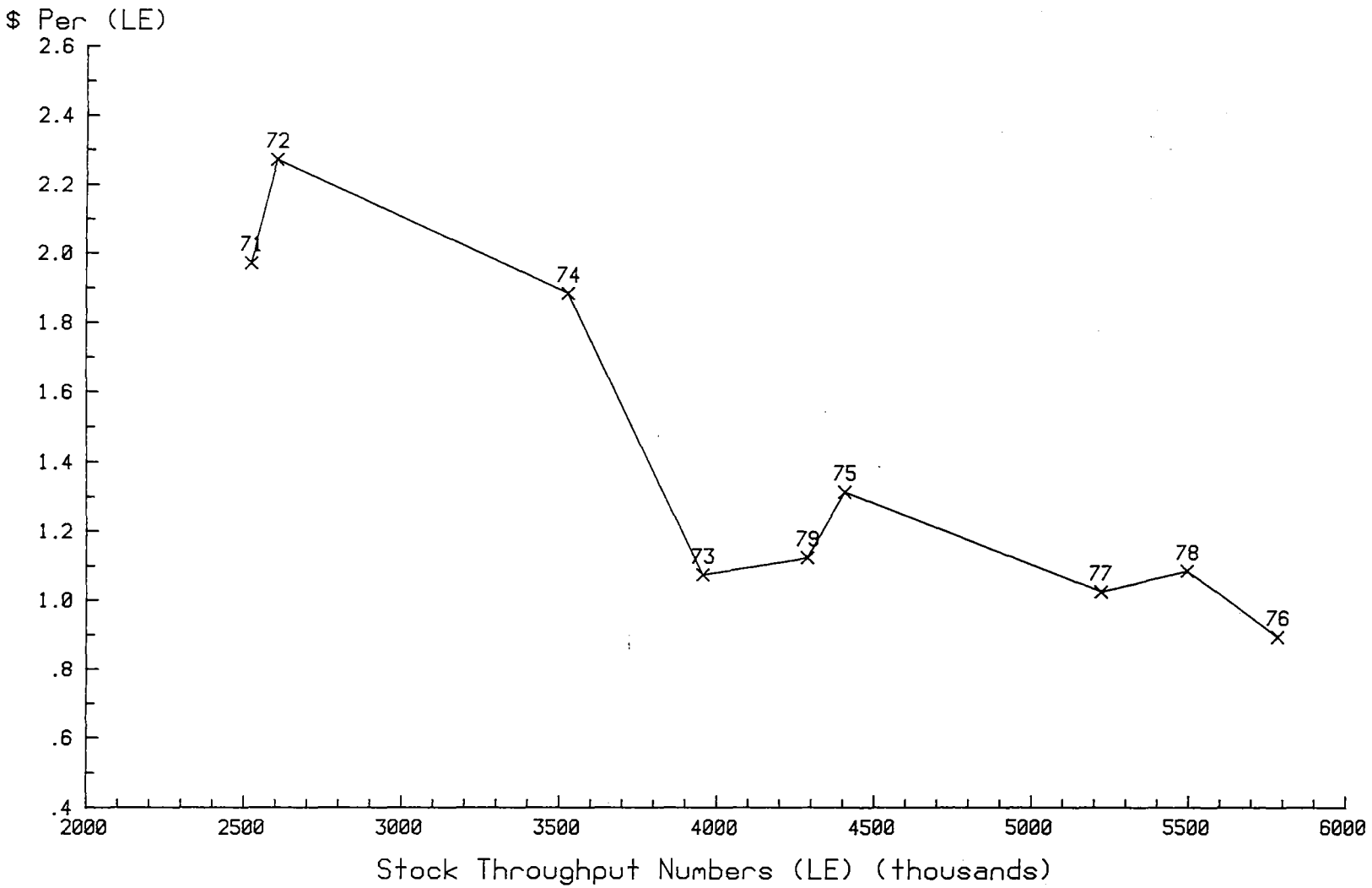
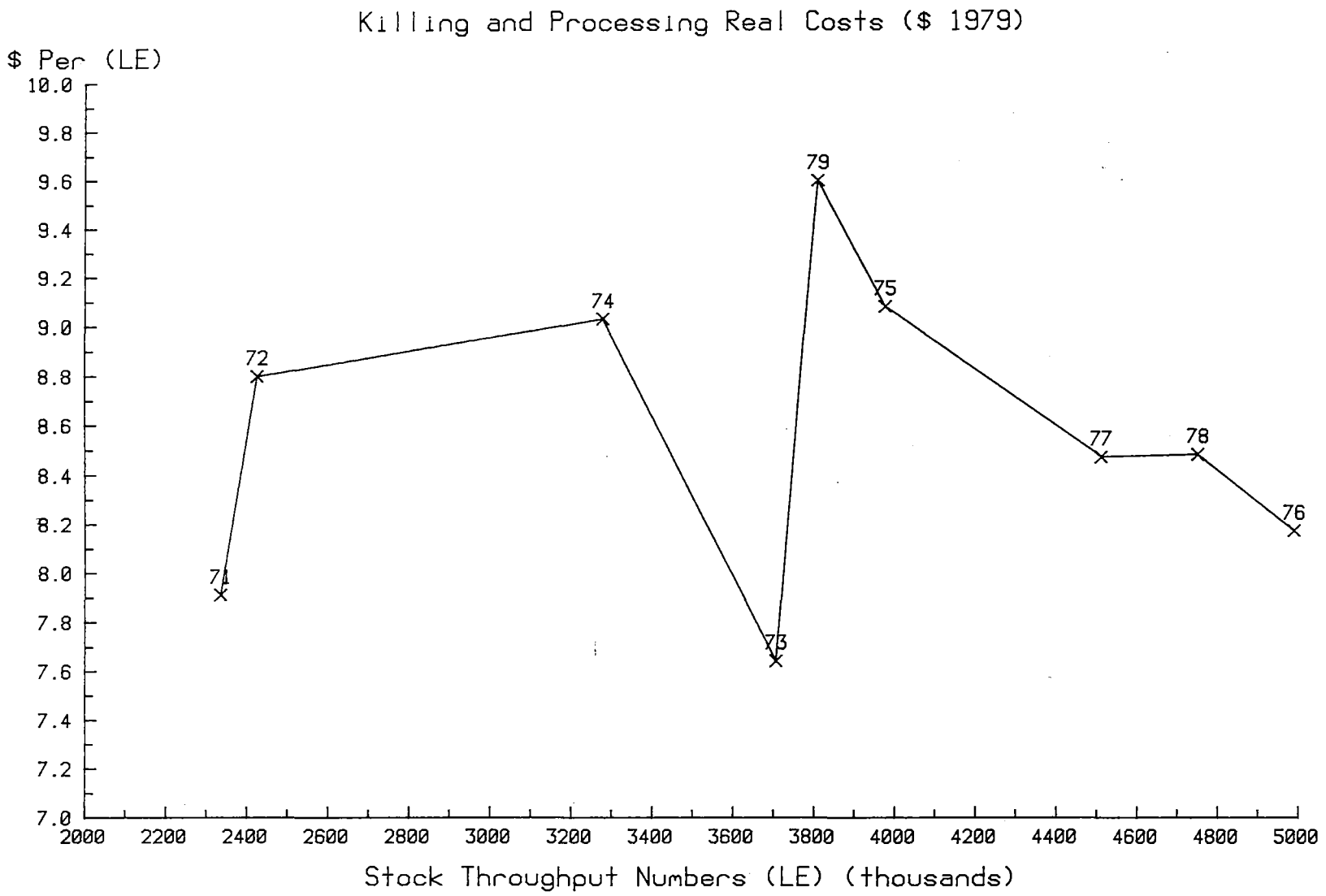

Central Administration Division Real Costs ($ 1979)
$ Per (LE)
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
71
72
73
74
75
76
77
78
79
2000
2500
3000
3500
4000
4500
5000
5500
6000
Stock Throughput Numbers (LE) (thousands)

FIGURE 4.6


Killing and Processing Real Costs ($ 1979)
$ Per (LE)
10.0
9.8
9.6
9.4
9.2
9.0
8.8
8.6
8.4
8.2
8.0
7.8
7.6
7.4
7.2
7.0
71
72
74
73
79
75
77
78
76
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
4200
4400
4600
4800
5000
Stock Throughput Numbers (LE) (thousands)

4.5.1 TRANSITIONARY SEASONS, 1970/71-1973/74

An accurate interpretation of the relationship between real per carcase costs and throughput numbers shown by the graphs relies on knowledge of factors affecting company structure during the 1970/71 through 1973/74 seasons.

During these four transitionary seasons accounting procedures were improved, in part by computers, and thus factor cost information was more defined onwards from the 1972/73 seasons.

In addition, a fourth works was acquired by the company at the end of the 1971/72 season. Rationalization of this works followed at that time, finishing at the end of the 1973/74 season.

4.5.2 COSTS AND THROUGHPUTS OVER TRANSITIONARY SEASONS

For all divisions, the graphs show an increase in both real per carcase costs and throughputs from the 1970/71 to 1971/72 seasons.

This increase in real costs (apart from that due to hygiene expenditure discussed in Section 4.3) was attributed to more accurate factor cost information, rather than a decrease in efficiency due to the higher throughput numbers.

In the 1972/73 season, a marked increase in throughput numbers and a significant decrease in real per carcase costs is shown by the graphs.

The significant decrease in costs in this season was a direct result of the increase in throughputs of approximately 700,000 (LE) from the acquired works, with no increase in managerial or salaried staff numbers.

In particular, the Indirect Works and Central Administration Division graphs show the effect of increasing throughputs without adjusting managerial or salaried staff numbers.

Staff adjustments began early in 1973 in the Indirect Works Division and were completed before the 1973/74 season. Staff adjustments were made just prior to the 1973/74 season in the Central Administration Division.

4.5.3 RELATIONSHIPS BETWEEN COSTS AND THROUGHPUTS

For the 1970/71 through 1978/79 seasons, the graphs show a limited increase in real per carcase costs as throughput numbers have increased, with the exception of the Central Administration Division. This Division's real per carcase costs have decreased significantly as throughput numbers have increased.

The relationship between real per carcase costs and throughputs is shown more clearly in the 1974/75 through 1978/79 seasons, when they are viewed seperately from the 1970/71 through 1973/74 transitionary seasons.

In the 1974/75 through 1978/79 seasons killing and processing real per carcase costs steadily decreased as throughput numbers increased from approximately 3,800,000 (LE) to 4,700,000 (LE).

For these five seasons all the Division graphs show the same trend, with real per carcase costs decreasing as throughputs increase. The only exception is the 2.5% increase in By Product Division costs when throughputs increased approximately 135,000 (LE). This 2.5% increase was due to costs incurred in further processing offals, wool and pelts in response to higher export prices for these products relative to other season's prices during the study period.

4.6 SUMMARY

This chapter has reviewed the movement in real per carcase costs over the nine season study period.

A graphic analysis suggested the main condition limiting the increase in real per carcase costs was an increase in throughput numbers.

The next chapter will discuss reasons why an increase in throughput numbers should have a limiting effect on real per carcase costs.

CHAPTER 5

COSTS, CHAIN OPERATIONS AND CAPACITIES

5.0 INTRODUCTION

The previous chapter suggested the main condition limiting the increase in real per carcase costs was favourable changes in throughput numbers during the study period.

This chapter will first discuss the nature of seasonal throughput flows and explain how adjustments are made at the works using the chain system to allow for these flows.

Section 5.4 explains how this throughput/chain system acts to change the proportion of fixed and variable costs during the course of the season.

The effect of these (throughput induced) changing proportions on real per carcase costs is then determined, using capacity utilization as a measure of cost-efficiency.

Finally, regression analysis is used to model real per carcase costs for the 1970/71 through 1978/79 seasons and to predict these costs for the 1970/71 through 1981/82 seasons.

5.1 SEASONAL THROUGHPUT FLOWS

The seasonal weather conditions of New Zealand mean that stock (sheep and lambs) production is planned for the period of maximum pasture growth which results in a seasonal supply of stock to the works for processing.

One effect of this is the often discussed peak kill period, usually January, February and March in the South Island (Inness and Zwart, 1979). Outside the peak kill period there is a staggered flow rate of stock to the works during October, November and December and April, May, June and July.

The length of the peak kill period and the staggered flow rate depends primarily on feed conditions, individual farming practices, geographic location of the farm, type of lamb produced and also throughput numbers in any one season.

The company has adapted its processing system to cope with their peak kill period and the staggered rate of stock flows to their works, using the chain system.

5.2 THE CHAIN SYSTEM

Chapter 3 explained how stock is processed at the works using the mechanical chain system and detailed throughput flows through a representative works.

The maximum daily kill (set by union negotiations) for the company's works is set at 3000 or 3500 lambs per chain depending on the individual works and can not be exceeded.

The staggered rate at which on-farm stock is sent to the works necessitates the company to open its chains in sequence with the flow rate, while not exceeding the maximum daily kill per chain.

Initially, stock starts arriving at the works in early October and the No.1 chain starts operating at this time. Stock numbers steadily increase through November to December and the No.2, No.3 or (for a 5 chain works) the No.4 and No.5 chains are opened according to the flow, and under the maximum daily kill constraint.

Once the No.3 or No.5 chains are opened, all chains are kept fully operational five days per week (with a Saturday morning kill when necessary during the peak period) until insufficient stock is available for the operation of all chains. At this time, usually May or June, the process reverses with the No.5 (for a 5 chain works) or the No.3 (for a 3 chain works) closing first, with the other chains following on a last-on/first-off basis until all chains are

closed at the end of the season, usually in July or August.

Tables 5.1 and 5.2 illustrate the timing of chain operations with the flow rate of stock for a 3 and 5 chain works in a representative season.

TABLE 5.1
TIMING OF CHAIN OPERATIONS
3 CHAINS

Chain No.		Date	Cumulative Sheep and Lamb Kill
1	on	21 Oct.	0
2	on	11 Nov.	29,386
3	on	24 Nov.	76,095
3	off	3 June	1,229,607
2	off	5 June	1,252,447
1	off	11 June	1,260,840

Period of all-chain operation 76095 to 1229607 sheep and lambs.

TABLE 5.2
TIMING OF CHAIN OPERATIONS
5 CHAINS

Chain No.		Date	Cumulative Sheep and Lamb Kill
1	on	6 Oct.	0
2	on	13 Oct.	17,552
3	on	5 Nov.	89,381
4	on	17 Nov.	122,680
5	on	1 Dec.	206,060
5	off	26 May	1,635,798
4	off	27 May	1,647,796
3	off	3 June	1,690,350
2	off	12 June	1,734,813
1	off	21 July	1,857,089

Period of all-chain operation 206,060 to 1,635,798 sheep and lambs.

Once a chain is opened, manning standards required for processing on that chain are fixed and do not alter until the chain is closed.

Low daily chain tallies do not reduce the manning standards, nor do they reduce the number of paid hours, even if less than eight hours are worked due to the low tallies.

The opening of successive chains is a reasonably smooth procedure as manning standards increase systematically with the increase in stock flows at the beginning of the season.

The closing of chains at the end of the season is not as systematic as manning standards decrease more slowly than the decrease in stock flows. This carry over of excess labour is most noticeable in seasons of low throughput numbers.

5.3 FIXED AND VARIABLE COSTS

Bannock, Baxter and Reeves (1978) define fixed costs in the short run as costs that do not vary with output and variable costs as those costs that vary with output.

The New Zealand Freezing Companies Association (Inc.), (Anon.,1979) imply fixed costs typically make up approximately 12% and variable costs 88% of a works processing cost structure.

The company, at the start of a typical season, classifies its Killing and Processing Costs as "fixed" (12%), "semi-variable" (35%, these are costs that have a "fixed" component) and "variable" (53%).

Analysis of company manning standards (in particular those positions that are manned, irregardless of the number of chains operating) suggest however, that a different breakdown of costs is possible.

This breakdown is based on the economic definition of fixed and variable costs under the convention that any "fixed" component of a "semi-variable" cost is in fact, a fixed cost.

Such a breakdown can be applied to the company's Killing and Processing Costs for a typical season such as the ones in the study period. At the start of such a season, before any chains are opened, fixed costs amount to 33% and variable costs 67%. Once all chains are operating during the season, only 14% of the company's costs remain truly variable.

5.3.1 CHANGES IN COST PROPORTIONS

The proportion of fixed (33%) and variable (67%) costs at the start of the season remains constant only until the first chain is opened. At this time, the manning standards (variable labour costs) required for that chains operation become fixed and remain fixed until the chain closes, as do the variable costs associated with each successive chain.

As was stated in Section 5.3, low daily chain tallies do not reduce the manning standards or paid labour hours, so the only discretionary control the company has over most of their costs is when they open or close a chain.

This situation is common to the New Zealand chain system and means that most variable costs become fixed costs as successive chains are opened, and only become truly variable costs again when chains are closed.

Table 5.3 shows how the cost proportions change as successive chains are opened and closed during the course of a typical season.

The percentage changes of variable costs to fixed costs shown on Table 5.3 are based on the increase in manning standards (and associated inputs) required for operating successive chains.

TABLE 5.3

CHANGES IN FIXED AND VARIABLE COST PROPORTIONS
KILLING AND PROCESSING COSTS=100%

3 Chain Works

No. of Chains opened	Fixed Costs %	Variable Costs %
0	33	67
1	51.8	48.2
2	67.9	32.1
3 (all-chain)	86	14

5 Chain Works

0	33	67
1	43	57
2	53.8	46.2
3	65.2	34.8
4	77.4	22.6
5 (all-chain)	86	14

Note: As the chains are closed the proportions change in reverse.

5.4 PERIOD OF ALL-CHAIN OPERATION

Negotiations with unions set the maximum daily kill, ensure fixed manning standards per chain, and provide for a fixed number of hours pay regardless of actual hours worked.

These factors combine with seasonal stock flows (throughputs) to induce the opening of chains in sequence and change the proportion of fixed and variable costs.

Table 5.3 clearly shows how, as chains open, the proportion of fixed costs increase in relation to the proportion of variable costs.

These changes in the proportions of fixed and variable costs during the season and the duration of these changes have an effect on the season's average per carcase costs.

Once all chains are operating, 86% of the Killing and Processing Costs are fixed. Since these fixed costs are spread over increased throughput numbers, real per carcase costs decrease.

The magnitude of this decrease in real per carcase costs depends on the period during which all chains are operating and in which 86% of all costs are fixed.

Tables 5.1 and 5.2 show this period of all-chain operation for a 3 and 5 chain works to be between cummulative throughput totals of 76,095 to 1,229,607 and 206,060 to 1,635,798 respectively, during a season of average throughput numbers.

In seasons of low throughput numbers (1978/79) the period of all-chain operation decreases (relative to the average) and thus fixed costs are spread over fewer throughput numbers, limiting the magnitude of the decrease in real per carcase costs.

In seasons of high throughput numbers (1975/76) the period of all-chain operation increases (relative to the average) and thus the fixed costs are spread over more throughput numbers, increasing the magnitude of the decrease in real per carcase costs.

In addition, real per carcase costs are highest during periods of low chain and plant utilization. These periods occur when chains are opening at the start of the season and closing at the end of the season.

In seasons of high throughput numbers the company is able to open and fully utilize its successive chains rapidly (move into the period of all-chain operation quickly) and this reduces the effect of these higher per carcase costs on the average costs for the season.

If throughput numbers are low in a season, chain openings and attainment of full utilizations are slower (delaying the move into the period of all-chain operation) and this lengthens the period of high per carcase costs with the effect of increasing average costs for the season.

At the end of a season when successive chains are closed, the carry over of labour makes the changing of fixed costs back to variable costs sticky, with non-productive wages being paid.

In particular, this situation occurs towards the end of a season with low throughput numbers, during which overtime and Saturday morning kills have been restricted.

Once again, this situation has the effect of increasing average real per carcase costs for the season.

5.5 CAPACITY UTILIZATION

The magnitude of the decrease in real per carcase costs can be compared between seasons of low and high throughput numbers using capacity utilization as a measure of the company's cost-efficiency.

Full capacity (100% capacity) is the maximum number of lamb equivalents that can be feasibly processed during a season.

Full capacity for the company's works has been calculated for each of the nine seasons in the study period and for each of the three seasons following, those being 1979/80 through 1981/82. As the company acquired an additional works and rationalized it during the study period, capacity has not been constant.

TABLE 5.4
FULL CAPACITY CALCULATIONS (100% Capacity)
1970-1982

200 Working Days

Season	Lamb Equivalents
1970/71 & 1971/72	3,900,000
1972/73	5,700,000
1973/74 - 1981/82	6,900,000

The full capacities above have been calculated using a 5 day, 40 weeks season. Company sources indicate that running all chains at capacity during a season of this length would necessitate a minimum 12 weeks close-down period for repairs and maintenance. The 40 week period does not include Saturday morning kills, however it is still 8 weeks shorter than the one suggested by Sheppard (1982).

Capacity utilization expressed as a percentage, is the actual number of lamb equivalents processed (obtained capacity) as a proportion of the maximum number of lamb equivalents that could be feasibly processed (100% capacity).

Figures 5.1 through 5.7 show graphically the effect of capacity utilization on real per carcase costs for the 1970/71 through 1978/79 seasons ending August 31. These graphs also show predicted real per carcase costs for the 1970/71 through 1981/82 seasons which will be discussed in the next section.

It should also be noted that capacity utilization percentages for divisions do not agree due to the use of different ratios when converting export beef to lamb equivalents.

With the exception of the transitionary seasons 1970/71 through 1973/74, explained in Chapter 3, all the divisions real per carcase costs decrease as capacity utilization increases. Figure 5.2 shows the trend for Killing and Processing Costs for 1974/75 through 1978/79, which omits the transitionary seasons. The trends are similar in all divisions for the 1974/75 through 1978/79 seasons.

The season with the highest capacity utilization 1975/76 was also the one when throughputs were processed over a prolonged period of all-chain operation.

The season with the lowest capacity utilization 1978/79, was the one when throughputs were processed over a short period of all-chain operation.

Clearly, high throughput numbers extend the period of all-chain operation and increase capacity utilization.

This spreads the high proportion of fixed costs over more throughputs and this decreases real per carcase costs.

High capacity utilization allows a more efficient use of inputs which increases the magnitude of the decrease in real per carcase costs. Low capacity utilization hinders efficiency of input use, limiting decreases in real per carcase costs.

FIGURE 5.1

Effect of Capacity Utilization on Killing and Processing Costs ($ 1979)

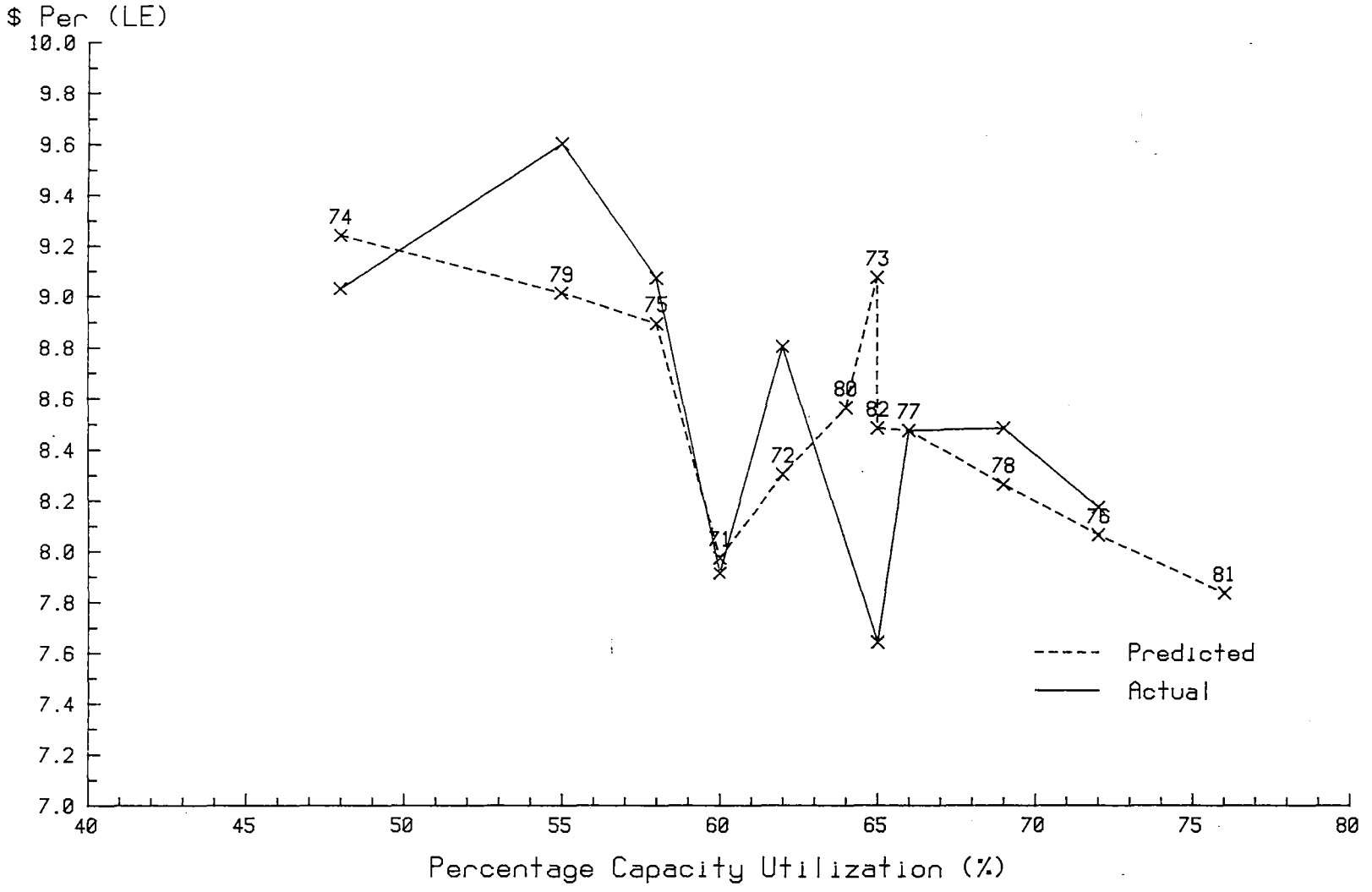


FIGURE 5.2

Effect of Capacity Utilization on Killing and Processing Costs ($ 1979)

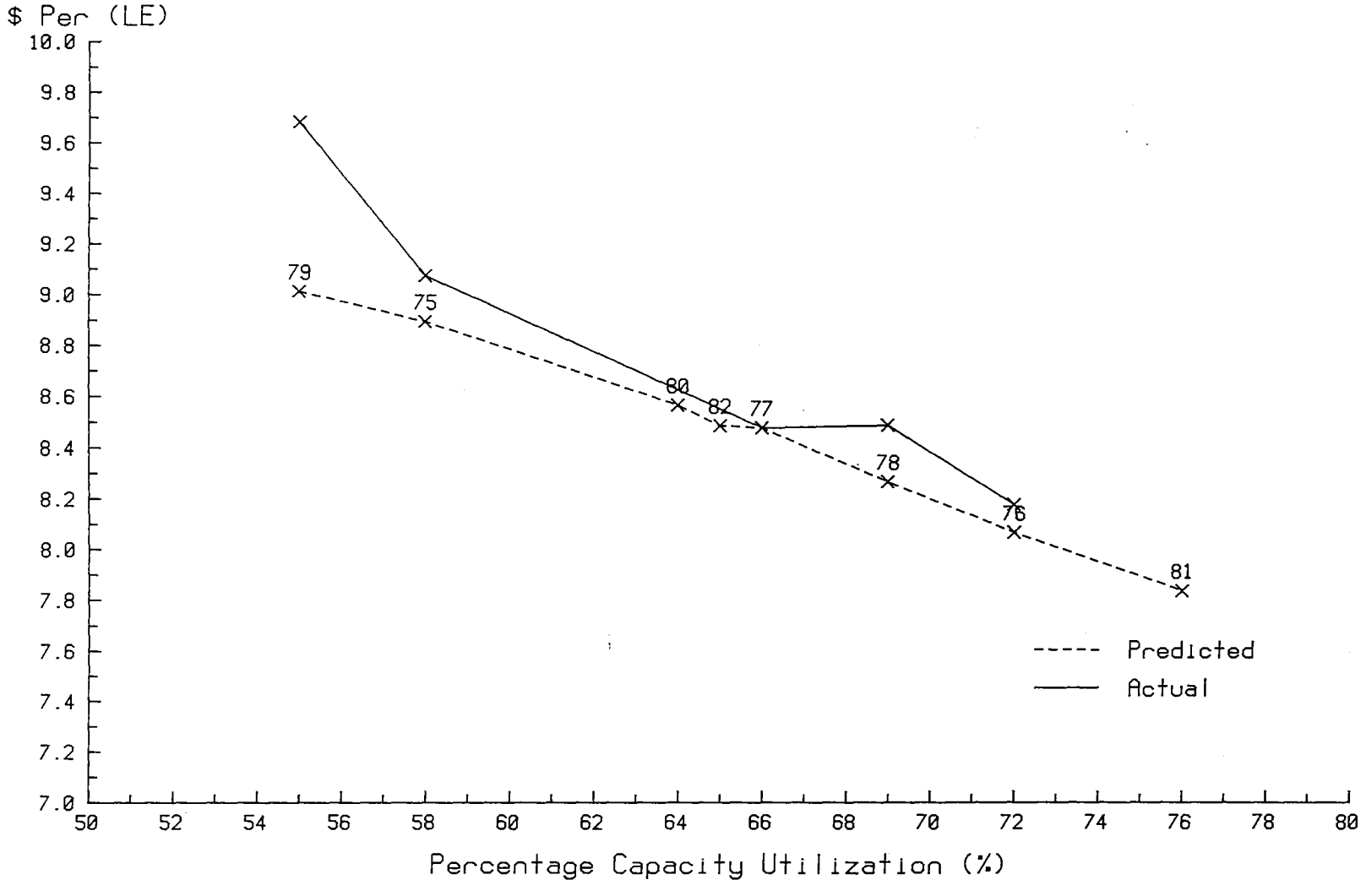


FIGURE 5.3

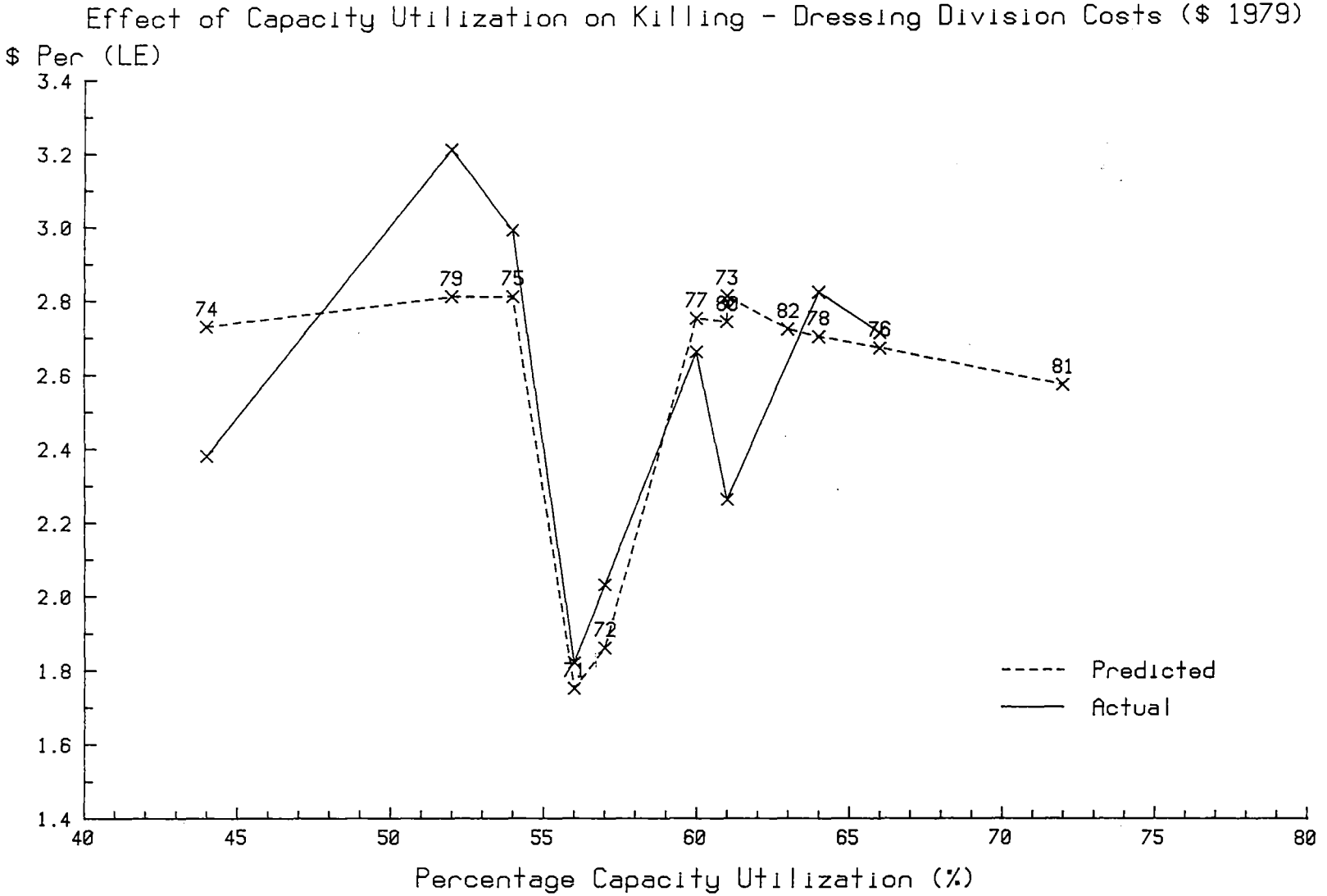

Effect of Capacity Utilization on Killing - Dressing Division Costs ($ 1979)
$ Per (LE)
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
40
45
50
55
60
65
70
75
80
Percentage Capacity Utilization (%)
74
79
75
77
73
82
78
76
81
72
Predicted
Actual

FIGURE 5.4

Effect of Capacity Utilization on By Product Division Costs ($ 1979)

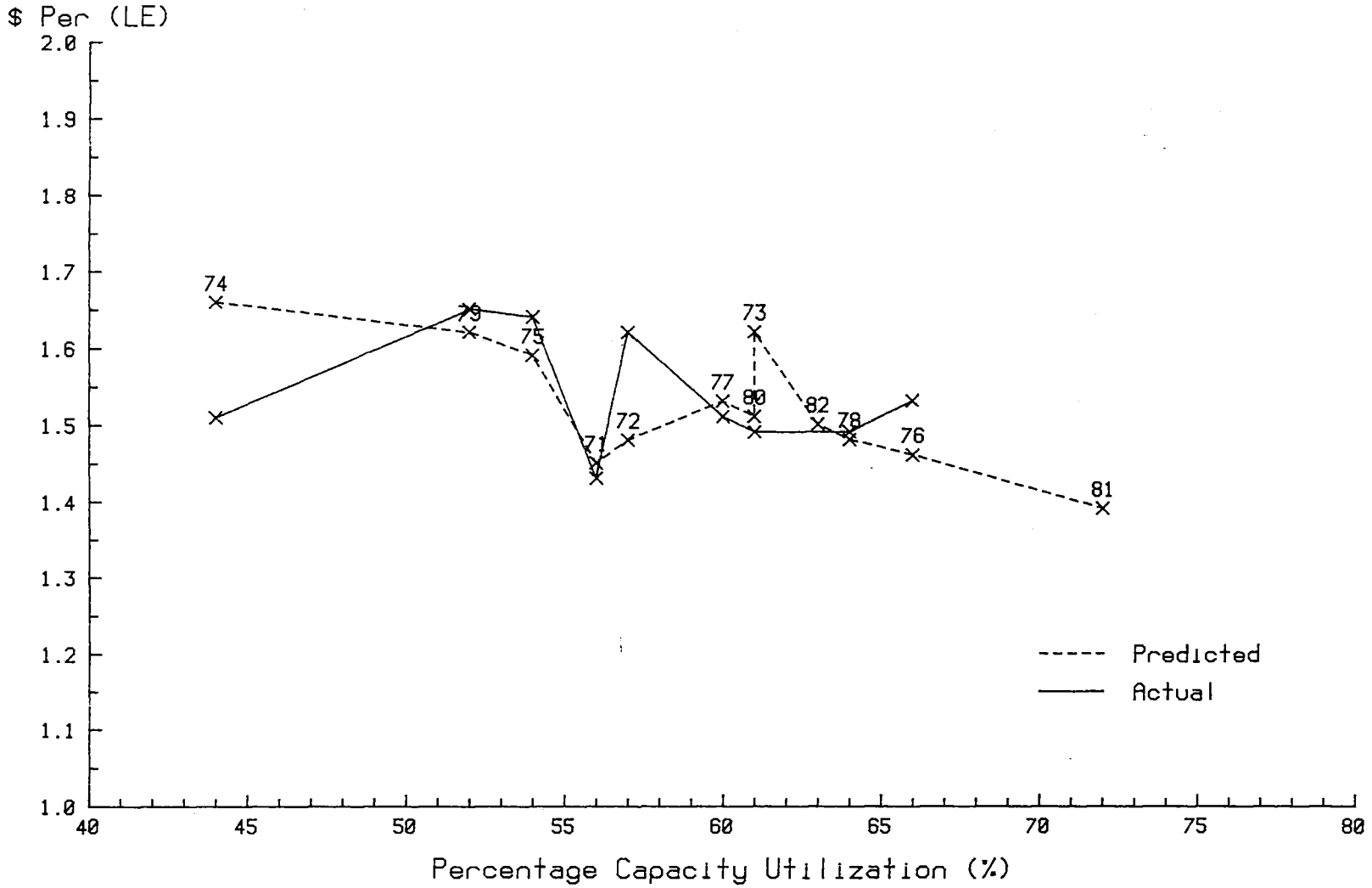


FIGURE 5.5

Effect of Capacity Utilization on Rendering Division Costs ($ 1979)

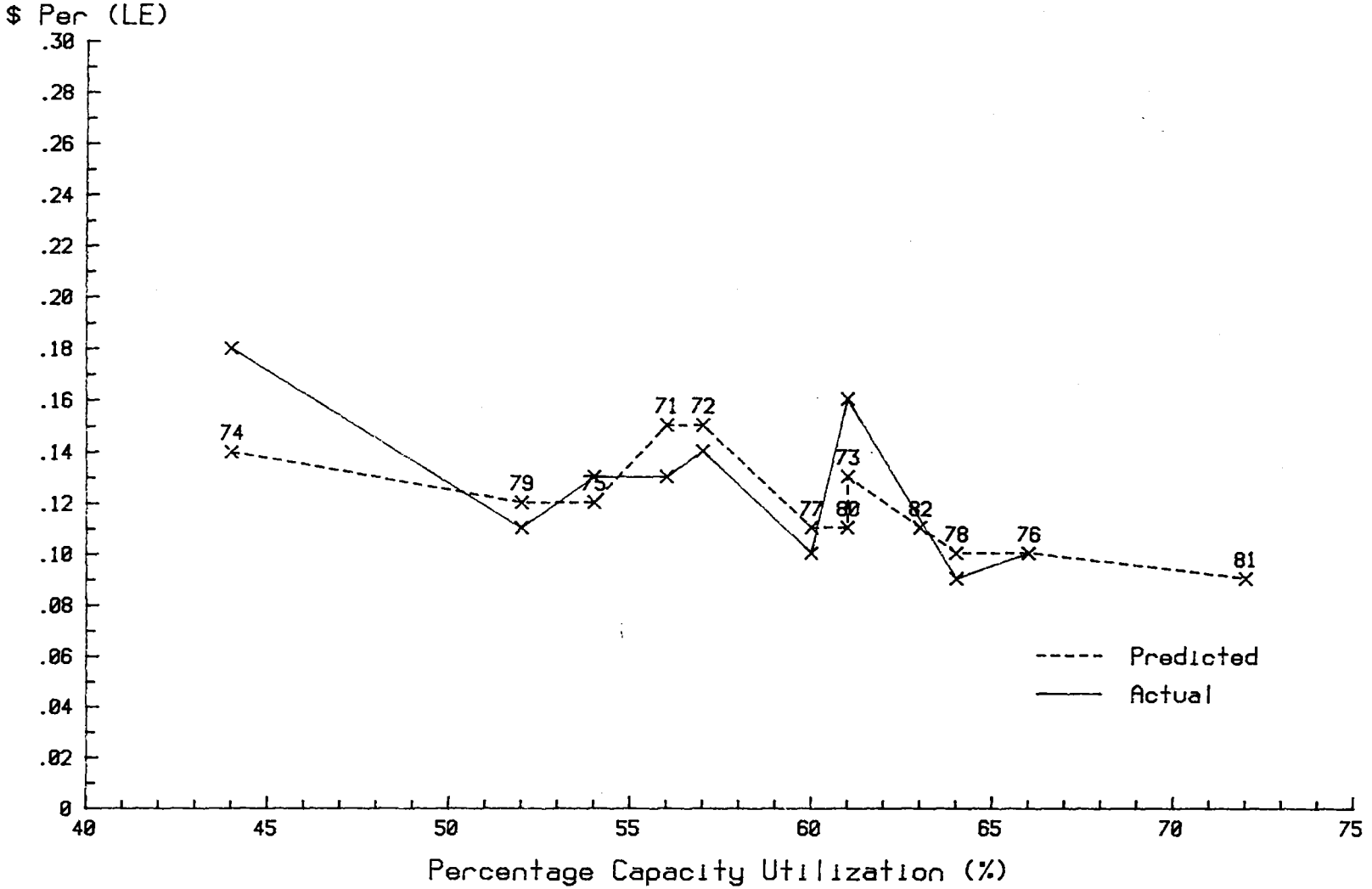


FIGURE 5.6

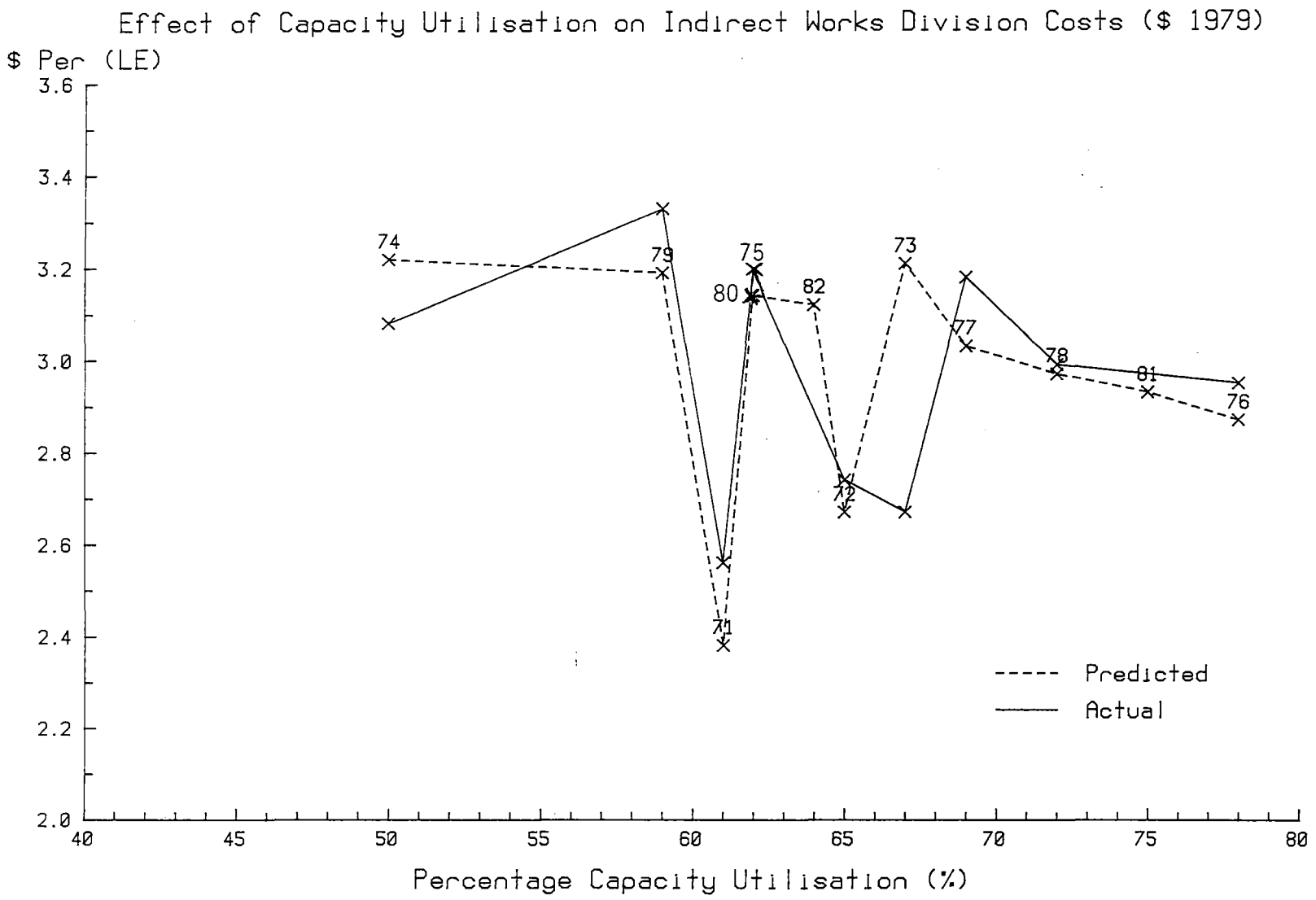
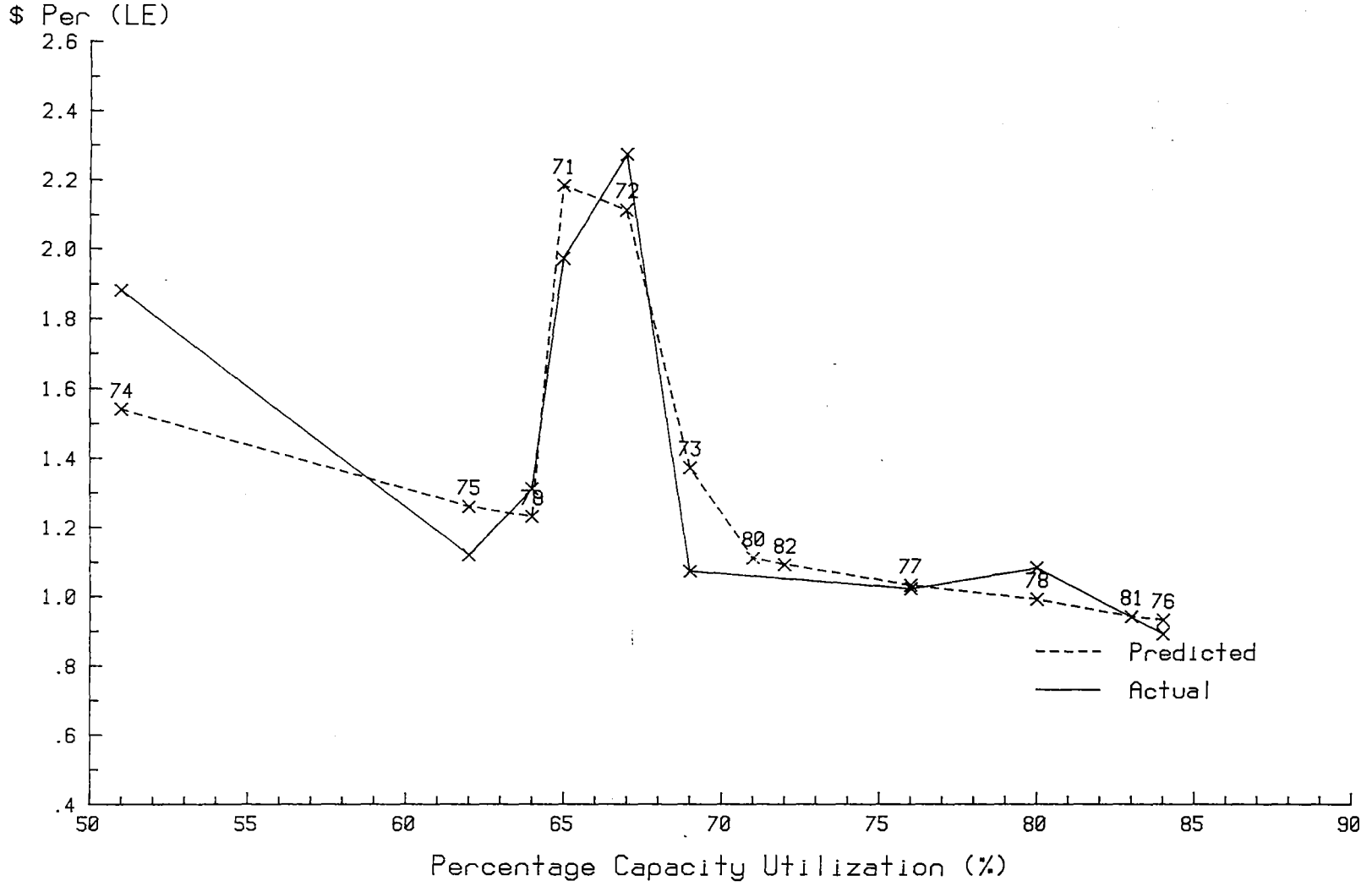

Effect of Capacity Utilisation on Indirect Works Division Costs ($ 1979)
$ Per (LE)
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
40
45
50
55
60
65
70
75
80
Percentage Capacity Utilisation (%)
Predicted
Actual
74
79
75
80
82
73
77
78
81
76
71
72

FIGURE 5.7

Effect of Capacity Utilization on Central Administration Division Costs ($ 1979)



5.5.1 ILLUSTRATING DECREASES IN REAL COSTS

For Killing and Processing Costs, the increase in capacity utilization from 55% (1978/79) to 72% (1975/76) decreased real per carcase costs 17.5% or $1.44 ($1979).

Table 5.5 shows the real increase or decrease in the fixed (33%) variable-to-fixed (53%) and variable (14%) cost proportions (as explained in Section 5.4.1) for the same two periods.

TABLE 5.5
INCREASED CAPACITY UTILIZATION (1978/79)-(1975/76)
($1979)

Cost	Increase + or Decrease - ($ per carcase)
Fixed (33%)	-.82
Variable-to-Fixed (53%)	-.86
Variable (14%)	+.24
Total Decrease	-1.44

The average cost of killing and processing the additional throughputs that increased capacity utilization from 55% to 72% was $3.36 ($1979) per carcase.

The increase in capacity utilization caused an expected decrease in real per carcase fixed and variable-to-fixed costs (all fixed costs once in the period of all-chain operation).

The increase in real per carcase variable costs was attributed primarily to fluctuations in inventories (Stores) which occur over seasons of high and low throughput numbers.

The additional real per carcase costs of killing and processing the additional throughputs decreased. The extended period of all-chain operation occuring in the season (1975/76) of the highest capacity utilization allowed a more efficient use of inputs, as the high proportion of fixed costs were spread over more throughputs.

5.5.2 CAPACITY UTILIZATION AND PREDICTED COSTS

The effect on per carcase costs of increasing capacity utilization (by increasing throughputs) was estimated for Killing and Processing and the divisions shown in Figures 5.1 through 5.6 using regression analysis of the functional form, $Y = a+b/X$ where;

Y = total cost
X = lamb equivalents (throughputs)

The predicted real per carcase costs for the Central Administration Division shown in Figure 5.7 were made using the same form, with Y=per carcase costs. The change in the dependent variable was necessary to obtain significant test statistics as this divisions costs are all fixed.

A summary of the test statistics is given in Appendix 2.

Actual stock throughputs provided for the 1979/80 through 1981/82 seasons were converted to lamb equivalents for each season using the conversion ratios described in Chapter 3.

Full capacity (100%) was 6,900,000 lamb equivalents per season.

For the 1970/71 through 1981/82 seasons actual capacity utilization was highest in the 1980/81 season for all divisions except Central Administration. In this division it was approximately equal to the 1975/76 season which was the highest in the actual study period. As was stated in

Section 5.6 capacity utilizations will not agree for all divisions due to the use of different conversion ratios when converting export beef to lamb equivalents.

5.5.3 ILLUSTRATING DECREASES IN PREDICTED COSTS

In order to predict the additional effect of increasing capacity utilization on per carcase costs a comparison was made between the highest capacity utilization season 1980/81 and the second highest capacity utilization season 1975/76. The cost comparisons were made between predicted costs for 1980/81 and actual costs for 1975/76.

For Killing and Processing Costs the increase in capacity utilization from 72% (1975/76) to 76% (1980/81) decreased predicted real per carcase costs $.34 ($1979).

Table 5.6 shows the increase or decrease in the fixed (33%), variable-to-fixed (53%) and variable (14%) cost proportions for the same two periods.

TABLE 5.6
INCREASED CAPACITY UTILIZATION (1975/76)-(1980/81)
($1979)

Cost	Increase + or Decrease - ($ per carcase)
Fixed (33%)	-.06
Variable-to-fixed (53%)	-.23
Variable (14%)	-.05
Total Decrease	-.34

The increase in capacity utilization caused an expected decrease in predicted real per carcase fixed and variable-to-fixed costs (all fixed costs once in the period of all-chain operation).

The average predicted cost of killing and processing the additional throughputs that increased capacity utilization from 72% to 76% was $1.59 ($1979).

This additional average predicted per carcase cost was $1.79 ($1979) less then that of the 1975/76 season. This lower additional cost caused the average predicted per carcase Killing and Processing Cost in the 1980/81 season to be low relative to that of the actual average per carcase Killing and Processing Cost in the 1975/76 season.

5.6 SUMMARY

This chapter explained how fixed and variable cost proportions change as successive chains are opened and closed, consistent with throughput flows during the course of a typical season.

It determined that increasing seasonal throughputs extend the period of all-chain operation and increase capacity utilization (efficiency) by spreading the then high proportion of fixed costs over more throughput numbers decreasing real per carcase costs.

Increasing throughput numbers were also shown to facilitate the opening and closing of successive chains. This shortens the two periods of highest per carcase costs during the season and aids in reducing the level of average per carcase costs.

Using regression analysis it was predicted that increasing capacity utilization would decrease the average real per carcase cost of Killing and Processing seasonal throughputs. For an increase in average capacity utilization of 72% to 76% this decrease was predicted to be $.34 ($1979) per carcase.

The additional average per carcase cost of killing and processing the additional throughputs that increased capacity utilization from 72% to 76% was predicted to be $1.59 ($1979).

CHAPTER 6

IMPLICATIONS

6.0 INTRODUCTION

This chapter graphically illustrates two different periods of all-chain operation and shows their effect on the company's variable-to-fixed per carcase costs.

The possibilities of further reducing the company's real Killing and Processing per carcase costs by spreading the actual seasonal kill using adjustments to the maximum daily kill combined with further processing and relaxing fixed manning standards are discussed.

Possible implications on the industry of the actual and predicted decreases in the company's Killing and Processing Costs arising from higher capacity utilizations are then examined.

Finally, the possible effects of small scale satellite processing works on the processing costs structure of the larger three and five chain works are determined.

6.1 ILLUSTRATING ALL-CHAIN OPERATION AND COSTS

Two periods of all-chain operation and their effect on real per carcase variable-to-fixed costs are illustrated in Figure 6.1. The two periods show a season of low throughputs (limited period of all-chain operation) and a season of high throughputs (extended period of all-chain operation).

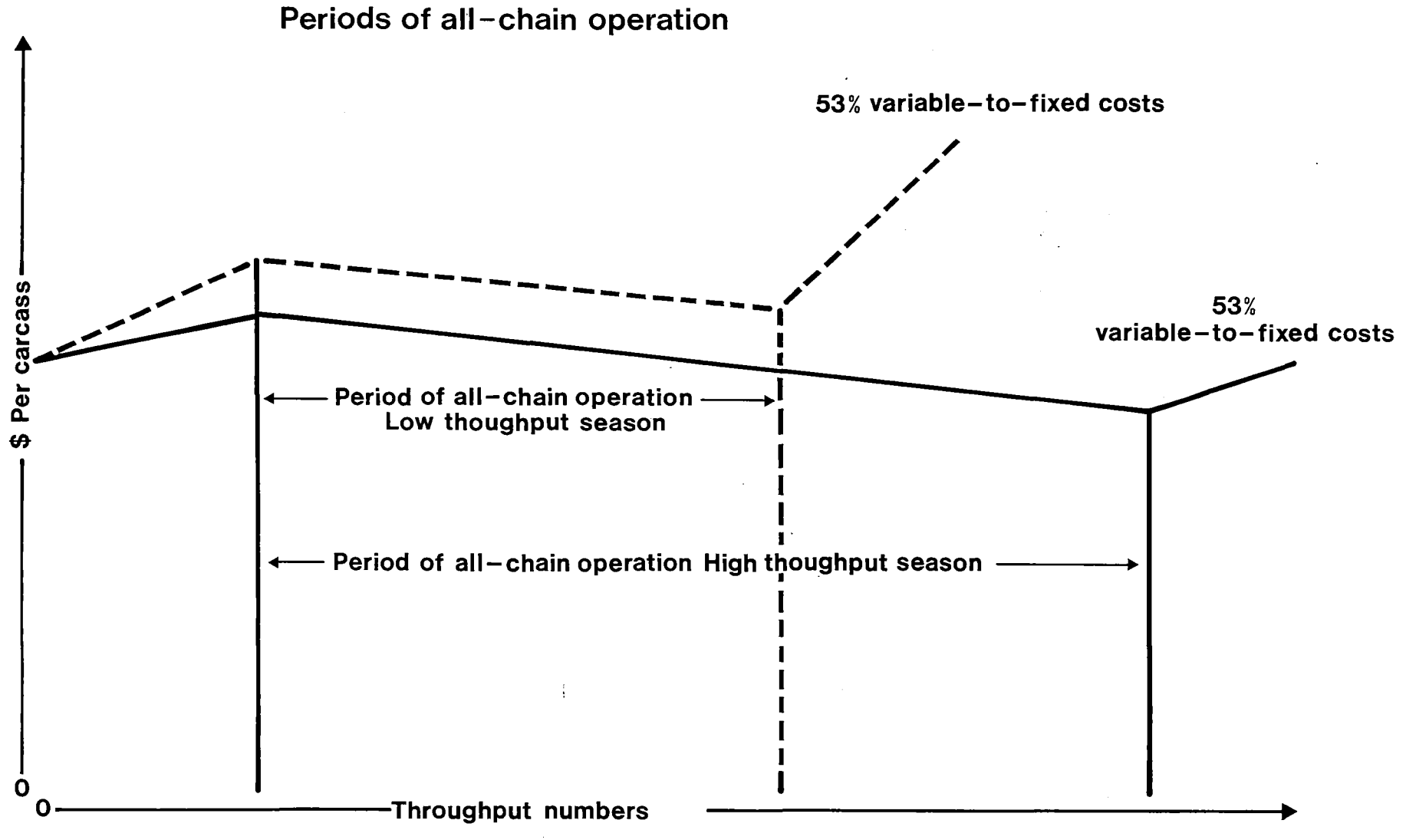
With the limited period of all-chain operation variable-to-fixed per carcase costs are high as throughput flows commence (successive chains are opened). They decrease in the period of all-chain operation as the then fixed costs are spread over more throughput numbers. They then increase again as throughputs decrease (successive chains are closed).

With the extended period of all-chain operation the levels of variable-to-fixed per carcase costs are lower when successive chains are opened and closed relative to those of the limited period. The higher throughput flows facilitate the opening of chains and less carry over of labour smooths the closing of chains. They also significantly extend the period of all-chain operation allowing the then fixed costs to be spread over more throughput numbers.

The effect of the higher throughput numbers is a lower average variable-to-fixed per carcase cost when compared to that of the limited period of all-chain operation.

In addition, the 33% fixed costs are spread over more throughput numbers in the higher throughput season allowing for a lower fixed (33%) per carcase cost relative to that of the low throughput season.

FIGURE 6.1


Periods of all-chain operation
53% variable-to-fixed costs
53%
variable-to-fixed costs
$ Per carcass
Period of all-chain operation
Low thoughput season
Period of all-chain operation High thoughput season
0
0
Throughput numbers

6.2 SPREADING THE ACTUAL SEASONAL KILL

Much discussion on limiting increases in killing and freezing charges has centred on spreading the seasonal kill since the "Spread of the Kill Sub-Committee" of the Agriculture Production Councils Meat Committee reported on its benefits in 1970.

Herlihy (1970) suggested spreading the actual seasonal kill would benefit the freezing companies by allowing a more efficient use of capital (higher capacity utilization) and lower wage rates by providing more permanent employment.

The New Zealand Freezing Companies Association (Inc.) (Anon.,1979) suggested that spreading the actual seasonal kill could be substantially advantageous to the farmer as more efficient use of resources by the freezing industry would ultimately be reflected in lower killing charges.

The cost structure (a high proportion of fixed and variable-to-fixed costs) for the company presented in this thesis would indicate that spreading the actual seasonal kill without (or due to) corresponding increases in throughput numbers would have only a minimal effect on limiting increases in their Killing and Processing costs by improving capacity utilization.

High seasonal throughput numbers directly coincide with high capacity utilization by extending the period of all-chain operation during which significant decreases in average variable-to-fixed (53%) per carcase costs occur and by spreading the truly fixed costs (33%) over more throughput numbers further decreasing Killing and Processing per carcase costs.

Seasons when the lowest real Killing and Processing per carcase costs are achieved thus depend principally on high throughput numbers, not on the number of killing days. Regardless of whether these high throughput numbers are killed and processed in short seasons consisting of either seven day working weeks or double shifts, or whether these high throughput numbers are killed and processed in a longer season (normal weeks, single shifts) killing and processing costs will not greatly differ due to the period of all chain operation being approximately the same for both seasons.

Company sources suggest (assuming adjustments are made in the twenty four hour blast freezer cycle) that it would even be possible to kill and process high seasonal throughput numbers using three eight hour shifts (tripling the maximum daily kill and resulting in a very short season) with little difference in real per carcase costs relative to those in a longer season with identical total throughputs.

Further, an industrial relations manager in the company suggested triple shifts could be accomplished without incurring any additional employee unrest (which is often a significant reason given for extending the actual killing season) over those occuring in a season of longer time duration.

It is unlikely that triple shifts will eventuate at the company's works. However, it is useful to consider other (more viable) alternatives to spreading the actual seasonal kill to reduce Killing and Processing Costs. Some of these alternatives will be discussed in following sections.

For the company's works, the single most important factor in decreasing real Killing and Processing Costs using improved capacity utilization is consistently high throughput numbers over all seasons. In their case spreading the actual seasonal kill without corresponding increases in throughput numbers would not improve their capacity utilization, it would only increase the time duration of their season.

Ensuring consistently high seasonal throughputs depends on a number of factors. Some of the more crucial ones such as world economic conditions, changes in consumer preferences, levels of protection in export markets and New Zealand government incentives or disencentives are beyond the control of the company. However, improved stock rebates and regional production incentives could be used to attract the throughputs required for high capacity utilization in the company works during seasons of low national throughput numbers.

The $3.36 ($1979) average per carcase cost of killing and processing the 1,100,000 additional throughputs that increased capacity utilization from 55% to 72% indicates sizeable rebates and other production incentives could be paid to regional producers to attract stock. These regional incentive payments could then be off-set either by the additional profitability from marketing the 1,100,000 carcases and their by-products, or from the additional processing revenue generated at the works level if the processing was done for non-company meat exporters.

For example, in moving from a potentially low season of capacity utilization (55%) to a high season (72%), the company could have paid a rebate of approximately $1.00 ($1979) per lamb equivalent over all throughputs required to reach 72% capacity utilization and still maintained a $.44 ($1979) per carcase cost savings over processing less throughputs at the low (55%) capacity utilization.

In addition to these obvious cost savings, more consistent high capacity utilization would aid management in corporate planning, inventory control and selecting staff levels which could further improve efficiency and act to limit future real per carcase cost increases.

6.3 ADJUSTMENTS TO DAILY KILLS

Adjustments to the maximum daily kill could further decrease average variable-to-fixed per carcase costs during the period of all-chain operation. These adjustments could also lead to the further processing of meat and by products which may aid in limiting real Killing and Processing Cost increases.

Company sources indicate a higher daily per carcase cost is associated with Saturday morning kills compared with weekday kills. This is because the number of Saturday wage hours (hours worked) do not decrease in proportion to the maximum Saturday morning kill.

Changing from Saturday morning killing (usually done during the peak) to all Saturday killing operating under the maximum daily kill would eliminate maximum daily pay for minimum hours worked and other fixed penalty rates arising from Saturday morning killing.

Changing to all Saturday killing would also have the additional benefit of freeing plant and labour for longer off-season processing of high value added products.

Silcock and Sheppard (1981) suggested that further processing of meat could reduce the seasonality in the meat industry by providing a longer employment period for seasonal meat workers as well as improving plant and capital utilization. The New Zealand Freezing Companies Association (Inc.) (Anon.,1979) also saw potential in processing by products and special lamb cuts in the off-season to extend employment and better utilize works capacity.

The further processing of by products (such as the glandulars requiring limited freezing space) in the off-season could be concentrated in those departments such as Offals, Bungs and Casings and Wool and Pelts which have real per carcase costs that tend to decrease at higher

levels of capacity utilization.

Mechanised tasks (such as mechanical pelt pullers) being developed by the industry will divert labour from the Slaughterboard area. The Killing-Dressing Division primarily operates in this area. Higher capacity utilizations have had the least beneficial effect on this divisions real per carcase costs over the study period. If labour from this division can be re-deployed in the further processing of meat (which company sources indicate requires a high manual input) it could help to maintain employment levels and allow continued mechanisation through less union resistance.

The longer employment period may also help to limit increases in real wage rates , Herlihy (1970) and assist in improving industrial relations, Turkington (1976).

Changing to all Saturday killing would not extend the actual seasonal kill and in fact would have the opposite effect of shortening the time duration of the actual kill. However, it could eliminate on-farm management problems often associated with spreading the actual seasonal kill on classes of farm land that cannot adapt and participate in off-peak production, Barton (1973), New Zealand Freezing Companies Association (Inc.) (Anon.,1979). These producers would be able to have their stock killed more readily during the peak.

6.4 FLEXIBLE MANNING STANDARDS

Figure 6.1 illustrated the effect on 53% of the companies Killing and Processing Costs in a season with high and low throughput numbers (high and low capacity utilization).

Higher capacity utilizations will automatically decrease the per carcase fixed costs (33% of Killing and Processing Costs at the start of a season) as these fixed costs are spread over more throughput numbers. These truly fixed costs are primarily for capital expenditure, salaried staff and other on-going costs, therefore favourable changes in their contribution to Killing and Processing Costs are restricted in the short run.

The 53% variable-to-fixed costs however, are subject to short run adjustments as they are primarily related to wages and other direct running costs.

The New Zealand Freezing Companies Association (Inc.) (Anon.,1979) suggest a reduction in wages (the major industry cost) by replacing labour with automation as one way to increase productivity and arrest the steady increase in processing charges. They further emphasize the need to re-deploy the displaced labour in areas of further meat processing.

Automation aside, more flexible company manning standards could act to limit per carcase cost increases during the opening and closing of successive chains irregardless of seasonal throughput levels.

Department per carcase cost increases for Shepherds, Freezer Loadout and Guthouse could be limited when successive chains are opened if their manning standards were increased in accordance with throughput flows rather than being fixed in number at the start of the season.

In those departments, such as Slaughtermen and Board Labour, subject to the carry-over of labour, a more defined reduction in manning standards when successive chains are closed may limit increases in their per carcase costs at the end of the season.

Any displaced labour from automation should only be re-deployed under more flexible manning standards unless the value added from their further processing of meat is greater than the additional costs associated with fixed manning standards.

6.5 INDUSTRY IMPLICATIONS OF INCREASED THROUGHPUTS

The New Zealand livestock sector is considered capable of substantial increases in its production ,Taylor (1980). However, increasing livestock production (in particular sheep and lambs) is of negligible value to New Zealand if export markets cannot absorb the additional product at acceptable export price levels which demand elasticities for world sheepmeat calculated by Blyth (1982) indicate, or rising internal costs erode the income of producers, New Zealand Planning Council (1978).

Other writers have expressed concern that internal price rises in processing charges could jeopardize export markets by reducing the viability of the New Zealand Meat Industry, Harrison (1975), Calder (1977), aside from complex problems already existing in these export markets, Begg (1978).

The actual and predicted decreases in real Killing and Processing per carcase costs and the low additional real per carcase costs associated with higher capacity utilizations determined in Chapter 5 for the company could have a significant effect on some of these problems facing the New Zealand Meat Industry.

If increased sheep and lamb production leads to consistently higher capacity utilizations the findings of Chapter 5 suggest that real killing and processing costs will reduce because of the low average additional real per carcase costs at the higher capacity utilizations e.g. $1.59 ($1979). This low additional average real per carcase costs should enable the extra production to be absorbed more readily in export markets.

In the 1978/79 season, New Zealand freezing works killed and processed 31,436,007 lamb equivalents for export (NZMPB Annual Report 1978/79) for a total cost estimated at $300 million ($1979), based on the study company's data. There was sufficient average excess capacity available during the season to kill and process additional throughputs, Shepard (1982).

If the industry could have had a 30% increase in throughputs (10,000,000 LE) the additional cost of killing and processing them would have been $33,600,000 ($1979) based on the study company's data. An additional increase of 4% in throughputs (in addition to the 10,000,000 LE) could have been killed and processed for $2,544,000 ($1979).

In accordance with these lower costs, operating at consistently higher capacity utilizations could allow the industry to plan and coordinate production, mechanisation, staffing levels, further processing and marketing activities. This could also help to limit future increases in real killing and processing costs, increase returns to producers (through lower real charges) and ensure the export viability of the industry.

6.6 SIZE OF FREEZING WORKS IN NEW ZEALAND

One often suggested method to reduce costs in the meat industry is a change to smaller (one or two chain satellite works) highly mechanised processing plants, located closer to production points with fewer employees engaged in slaughtering and the further processing of meat during a longer season, New Zealand Freezing Companies Association (Inc.) (Anon.,1979) and various company submissions to the Meat Industry Meeting, Legislative Chamber, 1979.

To date, no studies have calculated or estimated a short run average cost curve for a satellite works processing sheep and lambs. It is possible that satellite works with this described structure could maintain lower killing and processing costs than larger 3 or 5 chain traditional works.

However, the construction of satellite works throughout New Zealand could (without substantial increases in stock numbers) have the following effects on the larger works.

1. It will be most difficult, through the increasing of throughputs, the adjusting of daily kills and the relaxing of fixed manning standards for the larger works to increase capacity utilization and thus to achieve greater economies of scale than at present.

2. As the smaller satellite works are constructed it would slowly decrease throughput flows into the larger works. The resulting lower capacity utilizations would increase average costs at the larger works with the likely outcome being an increase in their charges. Those producers unable to have their stock killed and processed at the satellite works would have to pay the higher charges.

3. The hygiene expenditure over the past decade at the larger works (a sunk cost, but one that would have to be repeated at all satellite works) would be nullified.

   Any large works that did survive may do so on their level of equity and not on their relative current efficiency.

4. If the satellite works do have a lower cost structure however, an industry wide rationalization involving the closing of large should occur. The cost of this rationalization could be justified as one way to ensure the viability of the New Zealand Meat Industry in the long run.

However, before extensive industry rationalization occurs, every effort should be made to discover the relative efficiencies and cost structures of the smaller works.

Further, any industry rationalization that does occur should be done under open, competitive conditions to ensure the maximum efficiency of the processor and minimum killing and processing costs for the producer.

CHAPTER 7

RECOMMENDATIONS

7.0 THE COMPANY

The company (under their present structure) should try to extend their period of all-chain operation and their capacity utilization by attracting throughputs until the marginal cost of attracting the additional throughputs equals the marginal cost of killing and processing them.

They should adjust Saturday morning killing to all Saturday killing operating it under the maximum daily kill. They should trade-off the further processing of meat and by-products against wage rises that may be bargained for as a result of all Saturday killing.

More flexible manning standards should be introduced when successive chains are opened and closed.

Increased mechanization should coincide with the further processing of meat and by products to provide a clear path for continued technological improvements. The increased mechanization should be first applied in those departments whose per carcase costs are least affected by increased capacity utilization. The further processing of by-products should be first undertaken in those departments whose per carcase costs tend to decrease at higher levels of capacity utilization.

No further processing of meat or by products should be undertaken unless the value added from the additional processing is greater than the cost of the additional processing.

Research should be continued on the cost structure of satellite works and on any cost differences that may exist between a 3 and 5 chain freezing works.

7.1 THE INDUSTRY

The industry (under its current structure) should take full advantage of the predicted lower additional average cost of killing and processing throughputs at higher capacity utilizations by encouraging increased livestock production.

More efforts should be directed at killing throughputs (the actual kill) during the peak, without allowing real increases in wage rates to cancel the benefits of greater efficiency days. Emphasis should be placed on the further processing of meat and by products after the actual kill as a means of extending employment periods in the industry.

Marketing should be coordinated to exploit the low additional costs of killing and processing the additional throughputs.

No further processing of meat of by products should be undertaken unless the value added from the further processing is greater than the additional cost of the further processing.

Mechanization-employment trade-offs should be made to ensure a continued increase in technology at the works and provide continued employment.

Industry studies should be undertaken to estimate the cost curves of small (satellite) works versus those of large (traditional) works.

Information from these studies should be freely available for all entrepreneurs so they may make calculated decisions before constructing new satellite works.

Irregardless of what size works are used, every effort should be made to encourage competition in the New Zealand Meat Industry.

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APPENDIX 1
INDEX APPLIED BY DIVISION AND DEPARTMENT TO DERIVE REAL COSTS

Wage Rate Index - Killing-Dressing, By Products, Rendering, Divisional Wages and Departmental Wages, Indirect Works Division, Departmental Wages.

Residual Index No. 1 - Killing-Dressing, By Products, Rendering, Divisional Stores, Indirect Works Division, Departmental Sundry, Repairs and Maintenance, Work Shop Loss.

Salary Rate Index - Indirect Works Division Departmental Salaries.

Residual Index No. 2 - Central Administration Division, Departmental General Manager, Secretary and Administration, Accounting Services, Corporate Planning, Shipping and Distribution Processing Division, Railage and Pool Guarantee.

Residual Index No. 3 - Central Administration Division, Departmental Stock Procurement.

Energy Index - Indirect Works Division Departmental Energy.

Capital Expenditure Index - Indirect Works Division, Departmental Depreciation.

Interest Rate Index - Central Administration Division, Departmental Controller - Finance.

TABLE A.1.1
NOMINAL HOURLY WAGE RATE INDEX
MEAT PROCESSING
WAGE RATES WITHIN THE JURISDICTION OF THE ARBITRATION COURTS

SEASON	INDEX
1970/71	417
1971/72	447
1972/73	495
1973/74	559
1974/75	631
1975/76	696
1976/77	798
1977/78	946
1978/79	1000

INDEX CONSTRUCTION

Meat Processing and Dairy Factories Nominal Wage Index 1970/71 through 1976/77 spliced with Food Beverage and Tobacco Group 5 Nominal Wage Index 1977/78 and 1978/79. Common quarter, December 1977=1348.

(1) Each season index number is the average of 4 quarters, October 1 to September 30.

SOURCE: Department of Statistics.

TABLE A.1.2

RESIDUAL PRIMARY PRODUCE PROCESSING INDUSTRIES INDEX NO. 1

PRICES PAID FOR DOMESTIC AND IMPORTED INPUTS

SEASON	INDEX
1970/71	352
1971/72	355
1972/73	397
1973/74	448
1974/75	491
1975/76	553
1976/77	702
1977/78	761
1978/79	1000

INDEX CONSTRUCTION - Refer text. (1) Index excludes cost of livestock and milkfat as purchased inputs. (2) Each season index number is the average of 4 quarters October 1 to September 30.

SOURCE: Constructed from Department of Statistics Data.

INDEX CONSTRUCTION

The Primary Produce Processing Index based on the prices paid for both imported and domestically produced inputs by primary processing industries was a sub-index of the Wholesale Prices Index group published by the Department of Statistics until September 30, 1977.

At that date, the Wholesale Prices Index group were discontinued and replaced by the General Price Index group which are the indexes currently published by the Department.

The discontinued Primary Produce Processing Index was replaced by The Food, Beverages and Tobacco Group 5 Index which is a component of the General Price Index.

The Food, Beverages and Tobacco Group 5 Index was further subdivided into two groups to isolate primary food processing. This sub-index titled The Primary Food Processing Index is available from December 1977, and can be spliced with the discontinued Primary Produce Processing Index, as both indexes are similar in structure and weightings, common quarter December 1977=2261.

Unfortunately, both indexes include the schedule prices paid for livestock (beef, mutton and lamb) and the price paid at the farmgate for milkfat as purchased inputs.

In order to construct the Residual Primary Produce Processing Industries Index for input factors that excludes livestock and milkfat, the weightings allocated to these commodities were required. These weightings were supplied on a confidential basis.

The weights expressed as percentages were then applied to prices received index for lamb, mutton, steer, manufacturing grade cow and milkfat.

The resulting products were summed and the summed values were then subtracted from the spliced Primary Food Processing and Primary Produce Processing Index for each respective season. The remaining values were then placed on a common base to form the Residual Primary Produce Processing Industries Index.

TABLE A.1.3

NOMINAL SALARY RATE INDEX

ADMINISTRATIVE, MANAGERIAL PROFESSIONAL AND RELATE WORKERS SALARIES WITHIN THE JURISDICTION OF THE ARBITRATION COURTS

SEASON	INDEX
1970/71	372
1971/72	410
1972/73	470
1973/74	527
1974/75	609
1975/76	680
1976/77	800
1977/78	880
1978/79	1000

INDEX CONSTRUCTION

Professional, Technical and Managerial Salaries Index 1970/71 through 1976/77 spliced with Professional, Technical, Related Workers 0-1 and Administrative and Managerial 2 Index 1977/78 and 1978/79, Common quarter December 1977=1414.

(1) Each season index number is the average of 4 quarters; October 1 to September 30.

SOURCE: Department of Statistics.

TABLE A.1.4

RESIDUAL PRIMARY PRODUCE PROCESSING INDUSTRIES INDEX NO. 2

PRICES PAID FOR LABOUR, DOMESTIC AND IMPORTED INPUTS

SEASON	INDEX
1970/71	366
1971/72	394
1972/73	448
1973/74	503
1974/75	573
1975/76	642
1976/77	771
1977/78	844
1978/79	1000

INDEX CONSTRUCTION

The Residual Primary Produce Processing Industries Index No. 1 has been combined with the Nominal Salary Rate Index to form the above index. This combination was necessary to include salaries paid to works staff as a factor input. The index have been combined using percentage weights based on the ratio of inputs used as provided by the Central Administration Division.

(1) Each season index number is the average of 4 quarters; October 1 to September 30.

SOURCE: Constructed from Department of Statistics Data.

TABLE A.1.5

RESIDUAL PRIMARY PRODUCE PROCESSING INDUSTRIES INDEX NO. 3

PRICES PAID FOR LIVESTOCK, LABOUR, DOMESTIC

AND IMPORTED INPUTS

SEASON	INDEX
1970/71	391
1971/72	396
1972/73	518
1973/74	547
1974/75	512
1975/76	621
1976/77	757
1977/78	809
1978/79	1000

INDEX CONSTRUCTION

The Residual Primary Produce Processing Industries Index No. 1 has been combined with the Nominal Salary Rate Index to form the above index. Livestock have been included as input factors. The indexes have been combined using percentage weights based on the ratio of inputs used as provided by the Central Administration Division.

(1) Index excludes the cost of milkfat as a purchased input.

(2) Each season index number is the average of 4 quarters; October 1 to September 30.

SOURCE: Constructed from Department of Statistics data.

TABLE A.1.6

ENERGY INDEX

PRICES PAID FOR ELECTRICITY, COAL AND OIL INPUTS

SEASON	INDEX
1970/71	223
1971/72	230
1972/73	246
1973/74	280
1974/75	499
1975/76	589
1976/77	757
1977/78	854
1978/79	1000

INDEX CONSTRUCTION

The above index has been constructed using percentage weights based on the ratio of inputs used as provided by the Indirect Works Division. It was computed using the Laspeyres fixed quantity method using costs obtained from the Central Administration Division.

(1) Each season index number is the average of 4 quarters; October 1 to September 30.

SOURCE: Confidential.

TABLE A.1.7
CAPITAL EXPENDITURE INDEX
BUILDINGS, MACHINERY, LAND

SEASON	INDEX
1970/71	345
1971/72	368
1972/73	405
1973/74	446
1974/75	537
1975/76	656
1976/77	790
1977/78	886
1978/79	1000

INDEX CONSTRUCTION

(1) Each season index number is the average of 4 quarters; October 1 to September 30.

SOURCE: Farming Capital Expenditure Price Index; Department of Statistics.

TABLE A.1.8
INTEREST RATE INDEX
DEBENTURES AND OVERDRAFT RATES

SEASON	INDEX
1970/71	520
1971/72	503
1972/73	515
1973/74	655
1974/75	655
1975/76	748
1976/77	812
1977/78	886
1978/79	1000

INDEX CONSTRUCTION

The above interest rate index has been constructed using percentage weights based on the ratio of debenture issues and overdraft requirements as provided by the Central Administration Division.

(1) Each season index number is the average of 4 quarters; October 1 to September 30.

SOURCE: Confidential

APPENDIX 2

TABLE A.2.1

SUMMARY OF TEST STATISTICS FOR (Y=a+b/X)

Division	Test Statistics			
	t(b)	AdjR2	F	D.W.
Killing and Processing	-9.506	.9178	90.395	1.8599
Killing-Dressing	-8.2432	.8932	67.95	1.432
By Products	-12.0036	.9470	114.087	1.9382
Rendering	-1.95641	.26144	3.827	.7568
Indirect Works	-10.7087	.93425	114.675	1.5469
Central Administration	6.1608	.82204	37.95	3.266