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PRICE FORMATION AT THE PALMERSTON NORTH

FRESH VEGETABLE AUCTION MARKET

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A thesis

presented in partial fulfilments of  
the requirements for the Degree

of

Master of Horticultural Science

in

Horticultural Economics and Marketing

at

Massey University

by

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Massey University

October 1973

ABSTRACT

The aim was to analyse the short term price fluctuation of fresh vegetables at the Palmerston North auction market. A brief review of the theoretical and methodological aspects in relation to this topic is outlined.

An econometric recursive model was developed in the "inductive phase" to represent the past behaviour of the industry. The simulation model was developed in the "deductive phase" for testing the sensitivity of the model and policy assessment.

The results indicated that :

- 1) The wholesale demand for cabbages and cauliflowers is relatively inelastic (-0.5034 and -0.8142 respectively) while that of lettuces (-1.434) was elastic. Carrots showed non-significant positive relationship between quantity purchased and price (+1.935).
- 2) The simulation model was relatively insensitive to changes in its parameters. It was proved that the supply of fresh vegetables was mainly governed by the seasonal factor.
- 3) The policy of supply rationalisation could reduce price variance and supply variance by 18% and 45% respectively, while the gross income and unweighted mean price could be increased by 8.7% and 0.3% respectively.

ACKNOWLEDGEMENTS

I would first like to record my sincere thanks to my supervisor, Dr W.R.Schroder, Reader in Agricultural Marketing, of the Department of Agricultural Economics and Farm Management, Massey University, for his guidance, advice and encouragement during this study.

Mr I.J.Bourke, Lecturer in Marketing, of the Department has also contributed with considerable helpful discussion during the progress of the thesis.

Special mention should be made of the assistance received from the staff of the Computer Science Centre during the running of the various computer programs.

Special thanks are given to Professor A.R.Frampton, Head of the Department, and Mr J.M.Clifford of Palmerston North, for financial assistance and encouragement.

Finally, I am indebted to Mrs M.Clifford for the typing of this thesis.

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## CHAPTER 1

### INTRODUCTION

The fresh vegetable industry in New Zealand faces many problems, of which price instability is one. The analysis of this problem cannot be completed without full knowledge of the industry's production features and marketing structure.

This chapter discusses the organisation of vegetable production and marketing in New Zealand. The objectives of this study and its scope are outlined. Finally, the thesis guide provides a general outline of the contents of this thesis.

#### 1.1 The New Zealand Fresh Vegetable Industry

##### 1.1.1 Geographic distribution

There are three major vegetable production areas:

(a) Auckland, (b) Wellington, and (c) South Island [77, p.39].

Vegetable growing areas in the North Island are mostly concentrated at Auckland, Northland, Franklin, Manawatu and Horowhenua, while those of the South Island are scattered around Nelson, Oamaru and Christchurch.

The Pukekohe district provides the Auckland area with a considerable amount of its vegetable requirement, as well as being the main onion-growing area of the North Island. The Manawatu/Horowhenua districts send most of the vegetables they grow to Wellington City, while Ohakune supplies both Auckland and Wellington with cabbages, carrots and broccoli [76].

In the South Island, market gardening is mainly carried out near Christchurch, Oamaru, Dunedin and Nelson cities. Nelson also produces considerable quantities of fresh and processed vegetables, most of which are marketed in Wellington.

### 1.1.2 Trends in grower numbers, acreages and production

A field survey by Philpott and others [20] in 1964 indicated that there were approximately 2,600 growers engaged in the vegetable industry [26, p.1].

The New Zealand Department of Statistics 1966 Census showed that approximately 2,200 growers were engaged in the industry [78], while the New Zealand Official Year Book, 1972, stated that approximately 2,700 growers cultivated 18,211 hectares in 1964 [76]. The discrepancies in the statistics in the different reports cannot indicate the trend of the growers in the industry. These differences may be partly due to the inclusion of process vegetable growers or potato growers.

The Department of Agriculture estimated that in 1970 approximately 17,623 acres of vegetables (excluding potatoes) were grown for the fresh market, and 30,280 acres for processed production. Based on these acreages 179,540 tons of vegetables were produced for the fresh market and 85,500 tons for processing. These levels were both lower than the figures for 1969, but still considerably higher than those for 1968<sup>1</sup>.

Most of the fresh vegetable production is consumed within New Zealand, only 20,542 tons, or 11%, being exported<sup>2</sup>.

### 1.1.3 Types of production

The vegetable production in New Zealand may be divided into three types:

- 1) Outdoor production,
- 2) Hothouse (glasshouse) production,
- 3) Production for processing (mostly outdoor).

The first two groups provide for domestic fresh vegetable consumption, while the process production is canned or frozen.

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1. See Appendix A.1

2. See Appendix A.2

Glasshouse production is scattered over both Islands. Most glasshouse production is a monoculture, though some growers do cultivate a second crop. Tomatoes and cucumbers are the two crops grown in the glasshouse.

Vegetables for processing are beans, peas, outdoor tomatoes and sweet corn. All the produce is sent to canners on a contract basis.

Outdoor growers are less specialised, growing from six to ten of the twentyfive vegetables, mainly cabbages, carrots, cauliflowers, lettuces, tomatoes and onions.

The 1964 Survey showed that outdoor production accounts for 57% of total growers as compared with 26% for glasshouse production and 17% engaged in both types of growing (26, p.17).

#### 1.1.4. The consumption of vegetables

The vegetable industry is a comparatively small part of New Zealand's primary industry, but it is the third largest producer for the domestic food market.

In household expenditure only 3% of the total income is allocated to vegetables [26, p.37]. The trend is for consumption of fresh vegetables to decline, while that of processed vegetables is increasing, the main reason probably being the "convenience" of using the processed vegetables. It is found that New Zealanders consume more of the cheaper vegetables, such as root crops, cabbages, pumpkins, and so on, than the "luxury vegetables" (tomatoes, lettuces, and sweet corn).

#### 1.1.5. The grower's income

Some of the vegetable growers complain that their income is unsatisfactory as compared with that of other primary producers. The recent Report on Economic Trends in the Industry [81] showed that incomes in market gardening were low, but there was no evidence of seriously declining trends. Instead the Report found that the production of vegetables has markedly increased by about 5% per annum [81, p.117].

## 1.2 The Marketing System for Fresh Vegetables

### 1.2.1 The marketing channel

Several channels are available for distributing the fresh vegetables from producers to consumers:

- 1) Direct sale through or to wholesaler,
- 2) Direct sale to retailers,
- 3) Direct sale to consumers (road stall or "over the gate" method),
- 4) Direct sale to institutional users (hotels and restaurants),
- 5) Direct sale through a grower market.

All these relationships are shown in Figure 1.1. No recent data is available to indicate the actual volume of vegetables going through these channels. However, most fresh vegetables are handled by the wholesalers. The 1964 Survey [26, p.89] showed that two-thirds of the growers moved their produce through wholesalers, the remaining one-third using other channels.

By and large, the wholesale market is the most important channel for cabbages, cauliflowers and lettuces, but Bourke [10, p.8] in a detailed survey of Auckland city found that only a limited range of vegetables was bought direct to any extent, these being bulk lines of carrots, cabbages, onions and tomatoes. The detailed values in his Survey for various fresh vegetables through different channels are shown in Table 1.1.

It is obvious that fresh vegetables distributed through the auction (including the Commission buyer) amount to 69.8%, while direct selling amounts to only 22.9% and other channels, such as "road stalls" and direct sales to institutional users, share the balance.

FIGURE 1.1 DISTRIBUTION OF COMMERCIALY GROWN VEGETABLES IN NEW ZEALAND

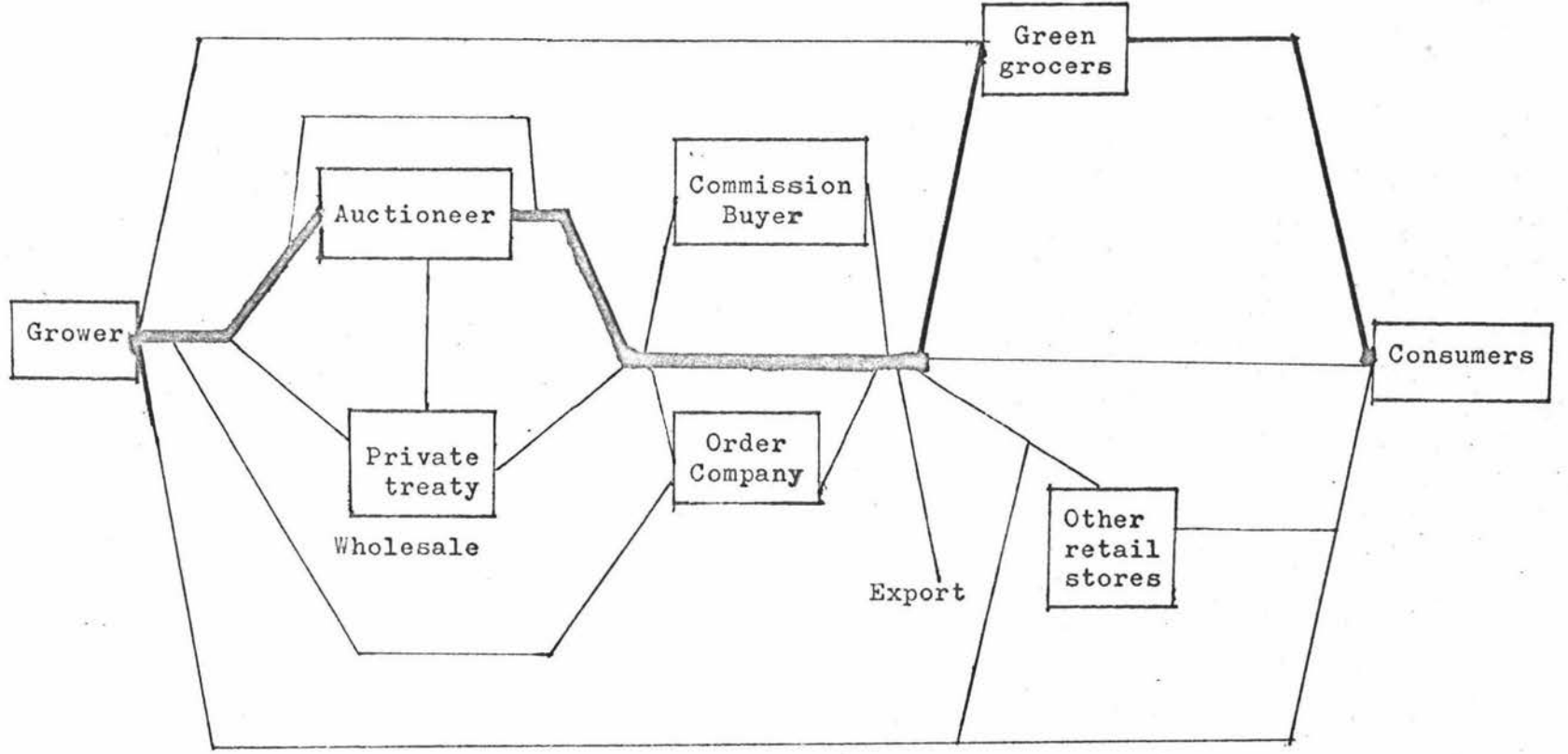




TABLE 1.1

SOURCE OF FRESH VEGETABLES

	<u>Auction</u>		<u>Private Treaty</u>		<u>Grower Direct</u>		<u>Commission Buyer</u>		<u>Other</u>	
	<u>R</u>	<u>S</u>	<u>R</u>	<u>S</u>	<u>R</u>	<u>S</u>	<u>R</u>	<u>S</u>	<u>R</u>	<u>S</u>
Asparagus	4	2	-	-	1	1	9	1	1	-
Beans - Broad	6	-	-	-	-	1	9	-	-	1
Green	6	-	-	-	-	-	9	1	2	-
Beetroot	6	-	-	-	-	-	10	-	2	-
Brussels Sprouts	6	-	-	-	-	-	9	1	2	-
Cabbage	-	3	-	-	16	2	-	4	-	-
Carrots	-	3	-	-	16	2	-	5	-	1
Cauliflower	5	1	-	-	1	5	9	1	2	-
Celery	6	-	-	-	1	1	10	-	2	-
Cucumber	5	1	-	-	2	6	10	-	2	-
Lettuce	3	2	-	-	2	10	9	1	2	-
Parsnip	6	-	-	-	-	-	10	-	2	-
Peas	6	-	-	-	-	1	9	1	1	-
Sweet Corn	6	-	-	-	-	3	10	-	2	-
Tomatoes	4	2	-	-	2	8	10	-	2	-
Kumara	6	-	-	-	1	-	10	-	2	-
Onions	4	2	-	-	4	10	9	1	1	-
Potatoes	3	3	-	-	1	6	10	-	1	-
Pumpkin	5	1	-	-	1	5	10	-	2	-
Spinach	6	-	-	-	-	-	9	-	1	-
Swedes	6	-	-	-	-	-	10	-	2	-
Silver Beet	6	-	-	-	-	-	10	-	2	-
<b>TOTAL</b>	125		0		109		208		35	
<b>Percentage</b>	26.2		0		22.9		43.6		7.3	

R = Regularly      S = Sometimes

Source: Bourke, I.J., "A Survey : The Direct Buying of Fresh Vegetables in New Zealand", Massey Occasional Paper No.2, Agricultural Economics and Farm Management Department, 1971, p.9.

### 1.2.2 Auction system and price formation

The auction system involves the consignment of fresh vegetables to the auction floor and the presence of buyers bidding on the produce which they hope to purchase.

Produce is transported to the wholesale firms usually on the evening before the next auction session commences, transport being carried out either by growers themselves or by transport firms. On arrival at the auction floor, the produce is stacked on various parts of the floor, in order of sequence of arrival. Most of the produce is grouped by the wholesalers in lines<sup>3</sup>, the grower's name being indicated on every line of produce. Before the auction commences at 7 to 8 a.m., the buyers gather on the auction floor to inspect the produce for quality and quantity. When the auctioning commences, the interested buyers bid against each other for a particular line as it is offered for sale by the auctioneer.

The method of auction is the "ascending type" (English auction) [14, chap.5]. The sale involves buyers bidding successively higher amounts until the top price is reached. The buyer is allowed to state the quantity that he will take (for example, he may specify to take 5 out of 20 cases in the whole line). Since there is no formal grading system, the successful bidder selects the best from the line. The remainder is then offered to the second highest bidder, and the rest of the bidders at the same price. Should the line not sell at that price, it is offered to the bidders at successively lower prices, until the whole line is disposed of.

Possible limitations of this system are:

If the number of bidders is not numerous, some unethical practices can exist, such as "ring buying" [26, p.98] - where one buyer bids for a group of, say, four or five buyers, and they split the line between them. In fact, this practice will

---

3. A line represents one grower's produce.

depress the price of that particular line of vegetables quite markedly as competitiveness in the price-making process is reduced [83, p.191].

The buyers are aware of each other's buying power. If a big buyer is present (such as a supermarket) the small buyers have to bid actively to acquire the produce, because - should the big buyer obtain that particular line - there may be none available for the small buyers. In this case, the price of produce is increased significantly.

On the other hand, where a top bidder is a small buyer, who is obviously not able to take the whole line, the remaining bidders may hold back in anticipation of acquiring the remainder of the line at a lower price. It is obvious that this practice will depress the price of the produce.

However, the quantities of supply definitely contribute some activity in bidding as varying supplies are scarce or plentiful.

After the line of produce has been sold, a document indicating the particulars of each line, including price, is handed to the office for processing. The produce can be taken out subject to a check by the storeman. The bills are sent to the buyers weekly.

The auction firm deducts 10% commission from the total value of the produce consigned by the growers.

### 1.2.3 Types of buyer

Several types of buyer are present at a vegetable auction:

- 1) Small retailers buying on their own account,
- 2) Commission buyers
- 3) Buyers employed by big retail firms (supermarkets)
- 4) Order company (in the wholesale firm).

Most of the buyers in attendance at the auction are small retailers buying for their own shops. The commission buyers buy on behalf of large users (institutions, hotels, restaurants and distant buyers).

Order companies act as wholesalers and are owned by the auction firm. It has been argued that auctioneers may use these to manipulate bidding [93, 76a].

Auctioneers deliver produce to buyers for a 10 percent surcharge.

#### 1.2.4 Retailers

A decade ago most of the produce was sold by fruit and vegetable stores. Nowadays, the structure of the retail selling of vegetables has significantly changed. Several retail outlets are available such as:

- 1) Greengrocers (fruit and vegetable stores)
- 2) Grocers
- 3) Dairies
- 4) Variety stores
- 5) Produce markets
- 6) Other stores.

Statistics show that the 5,577 stores handling fruit and vegetables in 1963 had declined to 4,928 stores by 1968, and the turnover and sales of the fruit and vegetable stores had declined from 62% to 57% during this period [79]. This reflects the change in the structure of the retail trade in that the number of traditional small fruiterers and green grocers is declining, while the large stores are gaining a greater share of the market.

#### 1.3 The Vegetable Industry in Manawatu

The number of vegetable growers in the Manawatu district was quite stable throughout the years under study, e.g. from 1969 to 1972 being about 300-330<sup>4</sup>. Nearly one-third of the growers have their properties within 15 miles of Palmerston North<sup>5</sup>, such as Longburn, Aokautere, Te Matai Road and Napier Road areas.

The total acreage of planting and production for fresh vegetables is shown in Table 1.2.

- 
4. N.Z. Horticultural Statistics, Manawatu district, unpublished.
  5. Names and addresses acquired from the wholesale markets in Palmerston North.

TABLE 1.2      ACREAGES AND PRODUCTION OF FRESH VEGETABLES  
FOR MARKET

	ACRES			TONS		
	1969	1970	1971	1969	1970	1971
Asparagus	1	1	1	1	1	1
Beans - green	15	20	15	45	65	45
Beetroot	15	20	15	75	80	80
Brussels sprouts	40	60	50	140	240	200
Cabbages	210	210	160	1680	1600	1280
Carrots	800	1000	800	9600	12000	8000
Cauliflower	400	450	375	3150	3200	2250
Celery	30	30	30	300	300	300
Lettuce	150	200	150	900	1100	750
Onions	180	190	110	1800	1900	1100
Parsnips	400	400	250	3200	3200	1500
Peas	15	15	5	22	22	10
Tomatoes (outdoor)	60	55	35	600	400	280
<b>TOTAL</b>	<b>2316</b>	<b>2641</b>	<b>1996</b>	<b>21513</b>	<b>24103</b>	<b>15796</b>

Source : Annual Statistics, N.Z.D.A., Manawatu District.

It can be seen that the total acreage of planting throughout the years 1969-1972 declined from 2,316 acres to 1,996 acres and production from 21,513 tons to 15,796 tons<sup>6</sup>. Since the numbers of growers has remained stable, the only explanation of this is that individual growers have reduced their acreage of planting.

Most of the produce is sent to the wholesale firms in Palmerston North. But, from personal discussions with different growers, some indicated that they do send produce out of the Palmerston North area to Auckland, Wellington and Wanganui districts. The volume of vegetables sent out of the local area is not available.

#### 1.3.2 The Wholesale Market in Palmerston North

There are two wholesale firms in Palmerston North. The procedures of auctioneering have been discussed in section 1.2.2 of this thesis.

The structure of the two firms is quite similar. They both provide marketing services and some loans to growers (under certain mutual agreement). That is, the growers under such contract must send agreed amounts of produce to the firm at each auction sale. Part of the proceeds is deducted from the credit of the grower to repay the loan as well as the interest.

The only differing feature between the two wholesalers is that one firm provides a market information service to the growers. A department was set up to inform the growers of the recent auction prices of different vegetables around the Central North Island (Auckland, Hamilton, Wanganui and Wellington). Sometimes they advise the growers to send produce to a particular centre where, owing to scarcity of supply, high prices are likely to be gained.

#### 1.4 The Main Problem of the Vegetable Industry

The most severe problem of the vegetable industry is "price instability". The term "price instability" in a price series data may, for analytical purposes, be divided into four categories of

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6. Refer to Table 1.2

variations, namely secular trends, the cyclical, the seasonal and the irregular.

A trend refers to long term persistent direct of changes in prices which may be due, for example, to income and population growth, technological changes, and taste. Price variations due to such trends are not considered "price instability". Rather, price instability is regarded as that part of variations which superimpose upon the trends caused by cyclical, seasonal and irregular variations. The cyclical variation is a more or less normal year to year variation. The seasonal variation is a more or less normal within year change, and the irregular variation is random variation due to changes in demand, supply and weather. In the context of this study we are interested in the short term price fluctuation - that is the irregular component in price instability.

The prices of vegetables exhibit a much greater short term price fluctuation than do the prices of some other agricultural primary products, when they encounter a period of glut and low prices, followed by a period of shortages and high prices [26, p.62]. In turn, this leads to social waste and prevents the efficient planning of production by growers.

Again, to examine the annual price fluctuations in the fresh vegetable industry, the recent Report states:

"Further evidence of cyclical instability in New Zealand is given by an updating of annual prices for a number of vegetables..... Cabbages retail prices varied widely, annual variations of 20% to 60% being common, the spring and winter crops showing greatest variation. Carrots and cauliflowers showed price variations also, but not to the same degree as cabbages." [81, p.33].

Since auction price is closely correlated with retail price, the extent of fluctuation in auction price was more severe than

in retail price. The Report [81, p.24] showed that cabbage prices at auction varied up to 280%. Therefore, the extent of variation in the grower's price would be much more severe than in either auction or retail price.

There is very little research on the short term price fluctuation in the fresh vegetable industry. This research void may have stemmed from the difficulty in obtaining and handling weekly time series data. However, this present study aims to give some indication of the short term price analysis in the fresh vegetable market.

The cause of price fluctuation will be discussed in more detail in Chapter 2.

The following section discusses the principles involved in supply manipulation to avoid price fluctuations and improve the grower's income.

## 1.5 The Principles of Supply Manipulation

There are two ways in which manipulation of supply can smooth out short term price fluctuations, namely marketing cooperatives (self help by the producers themselves) and marketing agreements and orders (government action strengthening the marketing organisation) [29, pp.22-23].

### 1.5.1 The Marketing Cooperative

When a group of growers market their produce together through their own organisation as one unit, this is the basis of cooperative marketing. Such cooperatives have been in existence throughout the nineteenth century and at present are important in the fresh produce market. They may carry out some important marketing functions such as classifying, assembling, packing, cold storage, shipping and selling. In addition "it will be possible for the association to perform an effective role in disseminating accurate price information or information regarding the actual behaviour of



the market which will enable the producers to adjust their production schedule to avoid either a glut or a shortage in the market". [94, p.118].

However, "..... by and large, marketing cooperation in the fresh fruits and vegetable industry centre their activities upon the handling and marketing of the produce of their members." [96, p.112].

But there are several limitations for cooperative marketing as a method of efficient marketing:

- 1) Cooperative marketing cannot eliminate the middleman's functions;
- 2) Cooperatives cannot reduce marketing costs to any great extent. Any small reduction results from economies of group action.
- 3) A cooperative marketing agency cannot guarantee its members a profit on sales because price is governed by demand and supply, and the cooperative has no control over demand and does not fully control supply.
- 4) Cooperatives cannot guarantee higher prices, or even fixed prices for its members, but it may be able to influence price to a certain degree by withdrawing supplies from the market. [36, p.19]

Therefore, probably the most difficult field for horticultural cooperatives is that of cooperation in supply and production. Since cooperatives need to market produce of uniformly high quality, they are achieving this to an increasing extent by exercising varying degrees of control over their members' production [62, p.16]. In this case, the above limitations will be relaxed to a certain extent.

Since technical advances in recent years have brought cold stores into wider use, the cold storage facilities in the marketing cooperatives of the fresh vegetable industry may be employed

to regulate supply in the short term - for example, to keep Friday's output for Monday's market. The aim is to extend the season and even-out the grower's day-to-day supply. It is particularly desirable when a crop matures more quickly than can be absorbed by the market. [62, p.187].

If further excesses of supply cannot be absorbed by local markets, the cooperatives can transfer the produce to other centres to avoid oversupply locally.

With powers of production control, cold storage facilities, and the manoeuvring of excess supplies, the objective of supply manipulation can be achieved by market cooperation.

#### 1.5.2 Marketing Agreements and Orders

These are the two methods by which the agricultural industry in the United States has attempted to increase producers' nett return. Various types of provisions include control of volume marketed; quality, size, grade, pack or container regulations; advertising and sales promotions; research and investigation; and prohibition of unfair trade practices. The aim is to improve the marketing of supplies produced.

A marketing agreement is a voluntary arrangement between the Secretary of Agriculture and the handler of the agricultural commodities, such as farmers' cooperatives, who sign the agreement. On the other hand, marketing orders are regulations which can be issued by the Secretary of Agriculture on the approval of two-thirds of the handlers, and which name the terms of the "agreement" compulsory upon all handlers of the products.

"Marketing orders and agreements differ from the major crop control programmes in that they do not include provisions for government payments to growers and they do not control directly the amount any farmer may produce.

This enables an industry to manipulate supply and demand in such a way as to bring about a balance at a level which yields a higher net return than would otherwise result." [33, p.17].

There are two problems in employing marketing orders. Firstly, the increase in price does not mean that producers' total returns are necessarily increased. If consumers respond to increases in price by buying relatively less of the produce, that is elastic in demand, the total return will be no greater - in fact, it will be less. [48, p.258].

Secondly, "marketing orders do not provide for control of production. Hence continued restriction to the volume marketed, if it does result in higher returns to producers, can lead over time to an expansion in production. This, in the long run, is apt to defeat the attempt to raise producers' total returns. Thus, if the excess supply problem that the industry faces, is temporary or seasonal, a marketing order can help. But marketing orders by themselves are not likely to solve chronic surplus problems." [87, p.147].

Since the chronic over production is not a major problem in the fresh vegetable industry in New Zealand, marketing agreements or orders may be possible to even-out the daily or seasonal price fluctuations to a certain degree. But, the usual procedure for initiating marketing agreements and orders commences with a request from some group or organisation (producers' cooperatives or handlers) for a program and for its consideration at a public hearing.

Therefore, the first task is to organise the producers' market. Then the marketing cooperative can be a basic means of

manipulating the supply.

#### 1.6 Objectives of this Thesis

The thesis has the following objectives:

1. To estimate short term supply and demand relationships for fresh vegetables at auction, with emphasis on the short term price elasticity of demand.
2. To determine the effects on prices of using various short term marketing policies by growers and retailers.
3. To determine the effect on prices of rationalising supply.

This embodies an econometric analysis of the market structure and the development of a simulation model to investigate the impact of various problems of supply on prices and growers' incomes.

#### 1.7 The Scope of The Study

Four fresh vegetables (cauliflowers, cabbages, lettuces and carrots) are chosen in this study because they are grown by most outdoor growers and are subject to seasonal influences. The area with which this study is concerned, is the Palmerston North wholesale market.

There are two aspects of the study:

1. An estimation of the supply and demand models by using econometric analysis to obtain the structural parameters and the estimated short term price elasticities of demand at the local wholesale level for the selected fresh vegetables.
2. A computer simulation model is used to duplicate the supply and demand patterns of the selected vegetables at the particular market. Experimenting on this model by changing the marketing policies of the growers and buyers to see the effects on prices and incomes is one of the aspects of this study.

## 1.8 Thesis Guide

This thesis comprises six chapters. Chapter 2 reviews theoretical causes of price fluctuations (the Cobweb Theorem) and some empirical studies in price elasticities of fresh vegetables. Chapter 3 outlines some previous approaches to evaluation of economic policy alternatives. The techniques of model building for this study are determined. Chapter 4 develops the econometric model for the selected fresh vegetables and the results of the short term price elasticities of demand are examined. Chapter 5 outlines the construction of a computer simulation model based on the existing econometric model, and experimentations on various short term marketing policies and the rationalisation of supply are conducted. The results are presented and discussed.

Finally, Chapter 6 presents the conclusions of the study.

## 1.9 Summary

The fresh vegetable industry in New Zealand produces a large range of vegetables. Production is carried out by some 2,700 growers in both Islands, the predominant areas being Auckland, Franklin, Manawatu and Horowhenua. Most of the production is for local consumption, very little being exported. More of the cheaper vegetables (cabbages, root crops) than of the luxury ones (tomatoes and lettuces) are consumed.

Owing to the instability of incomes and prices, many growers complain of their income being lower as compared with other primary industries.

Vegetables distributed from the growers to consumers go through several channels, but the main one is the wholesale market where the produce is sold by the auction method. The auction is conducted in the presence of buyers bidding against

each other. The price formation of the system may lack competitiveness if collusion in buying practices does occur. Prices can be depressed or increased, thus inducing more fluctuations in income for the growers.

Price instability of fresh vegetables is the main problem of the industry - especially short term price fluctuation, which could be smoothed out by means of supply manipulation. Two ways to even-out the short term supply are marketing cooperation and marketing agreements and orders, which have been discussed. The primary task is to organise the producer market (marketing cooperative) to achieve the objective.

The study was conducted to find a possibility of reducing the price instability for fresh vegetable growers. The method of doing so was in two steps : first, the supply and demand function needed to be estimated by econometric analysis. The estimated model can then be converted to a computer simulation model by which we can experiment on the various short term marketing policies on the effects of prices.