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A PRICE ANALYSIS OF VEGETABLES
ON THE EAST LONDON MUNICIPAL MARKET

Dissertation

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CHAPTER 1INTRODUCTION1.1 Aim of the study

Much of the information available on the prices of vegetables marketed through the fresh produce markets is of limited use to producers. This information contains the actual prices for individual years. This can obviously be taken as a guide to future prices but it does not necessarily mean that those prices are a true reflection of the general pattern.

In this study an attempt will be made, firstly, to establish whether a general pattern exists in the prices of selected vegetables on the East London municipal market. This will be attempted by studying the prices obtained over the 1964-1979 period. Information of this nature can be used as a basis for the planning of future crops. Secondly, to determine the months which obtain the "best" prices for the selected vegetables taking into account the quantities supplied to the market.

1.2 Agricultural marketing in South Africa

The major share (86 percent) of the agricultural produce in South Africa is marketed under one or other statutory control measure, while the remaining 14 percent is not bound by any form of control. The purpose of this section is to outline the different marketing

channels and to consider the relative importance of the fresh produce markets in South African agriculture.

1.2.1 Controlled marketing

The Marketing Act was first placed on the Statute Book in 1937 after agricultural prices failed to recover to the same extent as industrial prices after the depression in the early thirties. Lombard and Stadler (1967, p149) point out that "... Voor 1937 was daar reeds beheerrade in die lewe geroep (in die geval van mielies, koring, tabak, vleis en melk) maar hierdie beheervorm was ongekoördineerd en was nie 'n sukses nie." The Marketing Act of 1937, which incorporated these previous control boards, was superseded in 1968 by a consolidated Act, namely the Marketing Act (Act 59 of 1968).

The main aim of the Marketing Act, as it was seen at the time of its introduction, is stated by Gregory (1962, pp293-294) as follows :

1. "Die ontwikkeling van 'n georganiseerde stelsel van distribusie wat, in die belang is van sowel produsent en verbruiker, na groter bestendigheid van pryse, en
2. beter koördineering tussen die belange van die verskillende landbouvertakkings en van produsente en verbruikers in die algemeen".

He also shows that these aims come down more specifically to a pricing policy with the emphasis on price stability, production

with the attention on increased productivity, and rationalization of marketing with the emphasis on narrowing the price gap between the producer price and the consumer price. The secondary aim of control, according to Gregory (1962, p301) is as follows :

"...die aanmoediging van landbouproduksie in die algemeen of van 'n bepaalde bedryf teneinde die las van landbou-invoere te lig, of uitvoere uit te brei, of die voedings peil te verhoog, of om strategiese redes."

According to the Report of the Commission of Inquiry into the Marketing Act (1972, p17), 22 marketing schemes have been established since the passing of the Marketing Act, although the milk and the dairy schemes were consolidated in 1977. The 21 marketing schemes are subdivided into five general classes which vary with regard to the type and extent of the control imposed. the following is a brief description of the types of control schemes applied in South Africa as described in the Report of the Commission of Inquiry into the Marketing Act (1976, pp17-18).

1.2.1.1 Single-channel fixed-price schemes

This type of scheme applies to maize, winter cereals, and dairy produce. The producers of the primary products, with the exception of dairy produce, where single-channel marketing does not apply to the primary product, but to creamery butter and Gouda and Cheddar, cheese, may sell only to the control boards concerned. Every year the producer prices are fixed for the primary products according to class and grade. The

control boards also fix the domestic selling prices for the products they control, and in some cases fix the price right through to the retail level.

1.2.1.2 Single-channel pool schemes

Oilseeds, leaf tobacco, chicory, lucerne seed, rooibos tea, buckwheat, deciduous fruit, citrus fruit, bananas, wool, mohair and fresh milk fall under this type of scheme. These marketing schemes require that producers sell the primary product only to, or in accordance with arrangements by, the control board concerned. An advance payment is made to the producers when the product is delivered and then a pool is conducted for the sale of the product. The producers are possibly made an interim payment as well as a deferred payment when the pool accounts are closed. The selling prices are in most cases fixed by the control board concerned.

1.2.1.3 Surplus removal schemes

These schemes apply to potatoes, grain sorghum, dry beans, meat and eggs. The products controlled under these schemes are sold on the open market and the control boards apply measures, where necessary, to support the prices by setting a floor price and acting as buyers if the market price drops below that floor price. The control boards are, in some cases, prepared to sell on the local markets the produce they have bought if the prices reach a certain level. However,

most of the produce bought up to support prices is exported.

1.2.1.4 Supervisory schemes

Only two products are controlled under this type of scheme, namely, cotton and canning fruit. The main aim of these schemes is orderly marketing with a limited amount of price protection. There is no physical control over the marketing of cotton but a minimum price that ginners must pay to producers is set. This also applies in the case of canning fruit. Cannery may only purchase from a producer under written agreement which makes provision for certain grades.

1.2.1.5 Publicity scheme

The purpose of this scheme is solely to promote the demand for karakul pelts.

1.2.1.6 Commodities controlled under other legislation

A small number of agricultural commodities are controlled by other legislation but do not have control boards established for this purpose. These include ostrich products which are controlled by the Klein Karoo Landboukoöperasie Beperk, wine by the K.W.V. (Ko-operatiewe Wijnbouwers Vereeniging van Zuid-Afrika Beperkt) and sugar by the South African Sugar Association.

1.2.2 The marketing of non-controlled agricultural products

The most important products which are not controlled by some statutory stabilization measures are vegetables and sub-tropical fruit (excluding bananas).

Du Toit (1973, p13) states that "...Munisipale marke is verreweg die belangrikste afsetkanaal vir varsprodukte, hoewel 'n groeiende volume jaarliks deur verwerkingsbedrywe geabsorbeer word." The non-controlled agricultural products are not the only agricultural products sold on the municipal markets. Products such as citrus, bananas, potatoes, grapes, peaches, apricots, apples and pears, which are controlled products, are also traded on the municipal markets. This is the case because the extent of the control measures varies according to the season, the region where the product is produced and the type of control imposed. As quoted in the Report of the Commission of Enquiry into Agriculture (1972, p145), "...so far as the domestic marketing of the above-mentioned regulated products is concerned, the same marketing problems are encountered as with non-regulated fresh produce."

1.2.2.1 The relative importance of fresh produce

The production of vegetables and fruit makes a significant contribution to the total gross value of agricultural production in South Africa. Table 1.1 shows, in value terms, the contribution to total agricultural production made by the

production of vegetables and fruit (excluding wine grapes). The average contribution for the period 1966/67 to 1979/80 was 13 percent. The variation from year to year was not very large with the smallest proportion of 10,8 percent of total production being made in 1972/73 of 14 percent. Thus the contribution is relatively stable.

These figures do not represent the value of vegetables and fruit sold on the fresh produce markets because they include products which fall under single-channel pool schemes and are

Table 1.1: Contribution of vegetables and fruit to total agricultural production.

Year	Total Agricul- tural Production	Vegetables and Fruit	Vegetables and Fruit as % of Total Produc- tion
	R millions		
1966/67	1331,5	157,8	11,9
1967/68	1200,5	158,4	13,2
1968/69	1301,2	182,8	14,0
1969/70	1322,7	177,6	13,4
1970/71	1520,9	206,2	13,6
1971/72	1737,8	225,2	13,0
1972/73	1827,1	264,8	14,5
1973/74	2663,7	287,2	10,8
1974/75	2772,8	372,0	13,4
1975/76	2972,8	404,7	13,6
1976/77	3656,1	451,0	12,3
1977/78	3956,9	511,2	12,9
1978/79	4345,2	567,7	13,1
1979/80	5711,8	702,0	12,3

Source: Abstract of Agricultural Statistics, 1981.

fruit sold on the fresh produce markets because they include products which fall under single-channel pool schemes and are

not sold on markets. These are only sold on the markets under certain circumstances. The value of vegetables and fruit that flow through the fresh produce markets is a much smaller percentage of the total production but remains a sizeable amount. This can be seen in Table 1.2 which shows the value of vegetables, fruit and the total value of produce sold on the major produce markets, as well as the percentage contribution to the gross value of all agricultural produce. The median of the value of produce sold on the major fresh produce markets as a proportion of the gross value of agricultural production was 4,71 percent. This percentage also remained fairly constant over the period in question.

In terms of quantity, the amount of produce that has been traded on the fresh produce markets has been increasing. According to the figures published in the Abstract of Agricultural Statistics, the quantity of vegetables sold on the fresh produce markets has increased from about 708 000 tonnes in the year 1966/67 to over 1,1 million tonnes in 1979 which is an average annual increase over the 1966/67 quantity of approximately 4,3 percent (Table 1.3). Over the same period there was an average annual increase of 4,1 percent from 237 700 tonnes to 371 700 tonnes of fruit sold on fresh produce markets.

Of the total production of vegetables, an average of about 51 percent is marketed through the fresh produce markets. The Report of the Commission of Enquiry into Agriculture (1972,

Table 1.2: Value of vegetables and fruit sold on the major fresh produce markets.

Year	Vege- tables Sold	Fruit Sold	Total Sold	Total Sold as % of Total Agri- cultural Produc- tion
	R millions			
1966/67	38,2	17,7	55,9	4,21
1967/68	37,7	18,8	56,5	4,71
1968/69	56,4	20,9	77,3	5,95
1969/70	70,1	22,7	92,8	7,02
1970/71	71,3	25,0	96,3	6,34
1971/72	68,9	27,3	96,2	5,54
1972/73	69,7	29,8	99,5	5,45
1973/74	75,9	36,0	111,9	4,20
1974	85,2	39,9	125,1	4,51
1975	115,7	47,1	162,8	5,47
1976	116,3	54,3	170,6	4,67
1977	117,2	60,6	177,8	4,49
1978	130,7	65,7	196,4	4,52
1979	166,2	79,1	254,3	4,30

Source: Abstract of Agricultural Statistics, 1981.

pp145-146) gives the figures for the marketing of vegetables through various channels for the five years ending 1969/70 as being, by mass, 53 percent sold by municipal markets, 8 percent processed, 2 percent exported and 37 percent marketed locally through other channels or kept by the producers for their own use. In separate calculation, however, the writer found that the annual average for municipal markets for the same period was 48,7 percent. This difference must be put down to discrepancies in the figures published between the various issues of the Abstract of Agricultural Statistics. Only a relatively small proportion of the total production of

Table 1.3: Quantities of vegetables and fruit sold on the major fresh produce markets.

Year	Vege- tables Sold	Total Vege- Produc- tion	Fruit Sold	Total Fruit Produc- tion	Veg. sold as % of Total Pro- duction	Fruit sold as % of Total Produc- tion
	1 000 tonnes					
1966/67	708,2	1457	236,7	1434,6	48,6	16,5
1967/68	769,2	1587	277,1	1499,8	48,0	18,5
1968/69	752,7	1524	278,8	1517,3	49,4	18,4
1969/70	854,6	1695	277,2	1560,5	50,4	17,8
1970/71	829,0	1680	291,8	1650,6	49,3	17,7
1971/72	894,7	1728	354,9	1699,2	51,8	20,9
1972/73	820,3	1706	331,7	1736,5	48,1	19,1
1973/74	986,0	1818	336,4	1808,1	54,2	18,6
1974	1014,6	1915	356,6	1795,0	53,0	19,9
1975	1015,6	2028	356,7	1888,2	50,1	18,9
1976	1097,5	2177	361,8	1787,0	50,4	20,2
1977	1160,1	2110	350,6	1908,0	55,0	18,4
1978	1198,8	2155	365,3	1996,8	55,6	18,3
1979	1130,6	2129	371,7	2092,1	53,1	17,8

Source: Abstract of Agricultural Statistics, 1981.

fruit is sold on the fresh produce markets (18,6 percent), because the largest proportion is marketed through the control boards. This figure is much the same as that published in the Report of the Commission of Enquiry into Agriculture (1972, p146) which put the figure for the amount of the total production that is marketed through the municipal markets at 19 percent and of the rest of the production, by mass, 38 percent was exported, 31 percent processed and 12 percent marketed through other channels or kept by producers for their own consumption.

These figures indicate the importance of fresh produce in the agricultural production of South Africa and the importance of the fresh produce markets as an outlet for this produce.

1.2.2.2 Municipal marketing system

The most important domestic outlets for fresh produce, especially fresh vegetables, in South Africa are the municipal markets. In most cases these markets are owned and run by the municipalities concerned. According to the Report of the Commission of Enquiry into Agriculture (1972, p149) there were about 100 municipal markets in the Republic, of which most, on the basis of turnover, were relatively small. The Report goes on to note that the 23 larger markets handled about 98 percent of the total turnover of all the municipal markets, while the four largest handled about 80 percent of the total turnover. Of the municipal markets certain ones are regarded as national markets. Up to 1972/73 there were nine national markets, after which the number was increased to fourteen.

In view of the large number of relatively small consignments of produce from scattered production areas, there are various problems involving the orderly distribution of fresh produce. With the decision as to where to market the produce in the hands of the individual producer, who acts on his own judgement, certain markets are likely to be oversupplied at times while others will experience shortages. These malallocations between the markets give rise to speculation

between the markets and increase the cost to the industry.

In order to assist the individual farmer in deciding on the allocation of produce between markets, the Department of Agriculture and Fisheries announces to the press and radio the prices and quantities supplied to the national markets on a daily basis and reviews the demand and supply position of some of the more important products on some of the larger markets every week. In addition to the daily and weekly reports, the Department distributes a monthly publication "Crops and Markets", which provides some of the processed information for that month, and an annual report "Statistics on Fresh Produce Markets", giving the monthly quantities, value and average prices for each of the products sold on the national markets. The problem with "Crops and Markets" is that it only becomes available between three and four months after the month end.

The Report of the Commission of Enquiry into Agriculture (1972, p150) also noted that the market facilities in South Africa had become so antiquated that official bodies and Organised Agriculture had made strong representations to municipalities to modernise their facilities. Many of the old markets were situated near the centre of town where land for expansion was either expensive or unobtainable. The location of the markets led to traffic problems to and from the markets for both the producer and the buyer. The lack of space for expansion led to overcrowding at the markets which made efficient control and management very difficult. The old East

London municipal market was a case in point, as it was situated in the centre of town without room for expansion.

The Municipal Markets Committee was appointed to investigate all aspects affecting the erection and control of municipal markets. As a result of the report of the Committee, Parliament passed the Commission for Fresh Produce Markets Act (Act 82 of 1970). This Act determines relations between the Central Government, the Provincial Administrations, and the Local Authorities in regard to the erection, control and management of national markets. The main objectives of the Act are to provide for properly equipped markets and to ensure that they are run on a sound economic basis.

As far as the control and management of the municipal markets is concerned, this lies with the respective municipalities. They provide the site and buildings for the market operations. In addition, they provide the necessary sanitary, cleaning and other essential services and license the market agents and their employees, where private agents are allowed to operate on the market. The market master manages the affairs of the market on behalf of the municipality and advises the town or city council on market matters.

Until recently, virtually all produce received on municipal markets was sold by public auction, municipal officers being responsible for the auctioning. This method of selling produce had certain advantages, the most important being

public price formation, but it also had certain shortfalls which became more noticeable as the turnover of the larger markets increased. These disadvantages include the time-consuming nature of auctions, the producer having virtually no say in the price formation, except that he could put a reserve on his products, and that the big buyers could form "rings" and in that way manipulate the prices in their favour (Report of the Commission of Enquiry into Agriculture, 1972, p151).

When auctioning produce, only consignments under the hammer were offered for sale at a particular time which resulted in the municipalities having to use increasing numbers of auctioneers at the same time, as the turnovers of their markets expanded. The buying power was thus split between various auctioning points which had a detrimental effect on the prices. Buyers also had to spend hours on the market in order to secure their requirements which resulted in many smaller buyers avoiding the markets and buying from wholesalers. This also weakened the competition at the auctions.

The Report of the Commission of Enquiry into Agriculture (1972, p151) states that "...Ringing is asserted to have been fairly widespread among bulk buyers - all the more so where the auctions are held simultaneously in different sections of the market, which obviously made it impossible for a single buyer to attend the various auctions." The result was that often the smaller buyers had to obtain their requirements from

the bulk buyers.

The Cape Town market was the first to allow out-of-hand sales as well as auctioning to overcome the defects in the auctioning system. Other markets subsequently also adopted the system of out-of-hand sales and it has now become the main method of selling on the larger markets. Out-of-hand sales were commenced on the East London market in 1974 and is the method used in selling all produce except that which is not containerized. The uncontainerized produce is still sold by means of auctioning. The main difference between the two systems is that, with the out-of-hand system all products are on sale at any particular time so that the buyer can purchase a consignment or part of it at any time during the business hours. The market agent and the buyer formulate a price by means of personal negotiation. This makes ringing more difficult and the market agent has more say in the price formation.

The market agent is the person that brings the producer and the buyer together (Kohls and Uhl, 1980, p30). On the smaller municipal markets, the market master acts as the sole agent. On the larger markets this function is performed by private firms registered as commission agents with the Department of Agriculture and Fisheries and licensed by the municipality concerned. The market master also has an agency on some of the larger markets which competes with the private agents.

The need arose for some control to be exercised over the manner in which sales were conducted and payments made to producers because sales on the markets take place in the absence of the producers. The Perishable Agricultural Produce Sales Act (Act 2 of 1961) was passed in order to meet this need. The object of the Act is to control commission agents, brokers and certain dealers in vegetables and fruit so as to ensure a high standard of business and to ensure that the producer is protected. The Act makes provision for the registration of market agents and for the keeping of certain records of the produce handled, bought or sold by them.

Over and above their normal functions, market agents extend credit to buyers, provide packing materials, labels and stamps for producers, and even make short term loans to producers. It is common practice among most agents to inform producers daily of prices attained and to advise them on further consignments. In return for these services, market agents receive a commission calculated on the gross selling price of the products and which varies between 5 and 7,5 percent.

The producer has to pay the municipality concerned a market fee which can be regarded as payment for the use of the market facilities. The market fees are calculated on a percentage of the gross value of sales. On the East London market the market fee is 6,5 percent of the gross value of sales with a 1,25 percent rebate to any producer whose sales exceed R200 on any one day. For the use of other facilities such as ripening

and cold storage, separate tariffs are levied. The Commission for Fresh Produce Act (Act 82 of 1970) laid down that market fees for the national markets, established under the Act, are subject to the approval of the Minister of Agriculture, but the Administrator has the power to determine tariffs, in consultation with the Minister, for the other markets.

The Government has taken further steps in order to achieve greater stability in the fresh produce industry by the adoption of certain amendments to the Marketing Act. The Report of the Commission of Enquiry into Agriculture (1972, p153) listed the following measures to be adopted for products for which there is no control scheme in force:

(a) A levy to be paid into a special account may be imposed which can be used for the following purposes, among others:

1. The purchase of a quantity of a product on which a levy is paid;
2. the payment of costs in connection with such purchase and removal, diversion, storage, conveyance, distribution, or sale thereof;
3. the promotion of the production or marketing of such a product; and
4. the "fostering or stimulation" of the demand for such a product.

(b) Prices may be fixed for non-regulated products.

(c) The marketing of non-regulated products may be regulated through certain persons.

These changes to the Marketing Act have now made it possible to adopt stabilization measures for certain products without instituting fullscale and expensive marketing schemes under the Act.

1.3 The East London Market

1.3.1 The importance of East London as a fresh produce market

The East London municipal market does not rank very highly in comparison to the larger national markets in the Republic. From 1964 until 1970 the East London market was the seventh largest market in the country in terms of the mass of produce sold through the market and eighth in terms of the turnover of the market. The position of the East London market fell in the rankings with municipal markets such as those in Bloemfontein, Vereeniging and Springs registering larger turnovers and volumes of sales. In terms of the volume of sales, the East London market was responsible for 3,28 percent of the total volume of sales on all national markets in 1964/65. This figure decreased steadily until in 1979 it was slightly under 2 percent. Of the total turnover of the national markets, the East London market was responsible for 2,85 percent in 1964/65 and only 2,00 percent in 1979.

As a percentage of the total volume of sales and turnover in the Republic, the East London market does not make a major contribution. In the Eastern Cape, the East London market is an important link in the marketing of fresh produce. It was responsible for 37,1 percent of the sales in 1964/65 but decreased to 32,5 percent in 1973/74. In 1974 the Uitenhage market was given national market status and the contribution by the East London market fell rather sharply in 1974 to 27,7 percent. In 1979 the contribution was in the region of 25 percent. The decrease in the percentage of the turnover of the Eastern Cape markets contributed by the East London market was not as large as that of the decrease in the percentage volume of sales. Even with the inclusion of Uitenhage as a national market there was not significant change. In 1964/65 the East London market was responsible for 35,4 of the turnover and 28,4 percent in 1979. In addition to the three national markets in the region there are three non-national fresh produce markets, namely King William's Town, Grahamstown and Queenstown. In terms of their importance in the marketing of fresh produce in the Eastern Cape, they serve a purpose to their communities but only make up a relatively small percentage of the volume of sales and turnover in the region. The largest of these non-national markets is the one in King William's Town which is fairly close to East London. The mass of produce sold on the King William's Town market was 20 percent of that on the East London market. But the turnover is only 14,1 percent of the turnover on the East London market. This means that the average price obtained on the East London market are higher than those obtained on the King William's Town

market. The King William's Town market must, however, have some affect on the supply of produce to the East London market since a large proportion of the produce delivered to King William's Town is grown in the same area that supplies East London.

The fresh produce market at Mdantsane in Ciskei is even closer to the East London market than the King William's Town market but obtains most of its produce from the East London market. This market is therefore not a drain on the supplies delivered to the East London market.

1.3.2 Market operations in East London

The East London market is one of the fresh produce markets declared a national market in terms of the Commission for Fresh Produce Markets Acts (Act 82 of 1970). Until September 1978, the market was situated in Oxford Street, which is in the central business district of East London, a building it had occupied since 1954. The lack of space for expansion of the market led to managerial problems. According to the annual reports of the Director of Markets for East London, great difficulty was experienced in accommodating and displaying the products that and that on certain days it was necessary to request the South African Railways to withhold deliveries to the market until after the sales when the floor space would again be available. In the annual report of 1973 (p4) the observation was made that because of the demand for additional space and fear that the supplies could not be accommodated, producers were arriving at the market

with goods intended for the next day's sales during the period when the sales for that day were still in progress. This resulted in their having to wait until entry could be given, a practice which caused much inconvenience to normal traffic in the vicinity of the market, and often required attention of the Traffic Department. The Director of Markets was also of the opinion that these circumstances encouraged producers to find other outlets for their products, a practice which not only meant a loss of income to the market on such sales, but seriously affected by the buying demand on the market.

On 25 September 1978 the new market was opened at Wilsonia, which is an industrial area on the outskirts of East London. The new location of the market alleviated the traffic problem by being out of the centre of town and also by having spacious delivery facilities. Another factor that is a great asset in the delivery of produce to the market is the availability of a railway siding at the market. This reduces the amount of handling of the produce in getting it to the market and has resulted in a reduction in the number of claims for shortages and damages. Other facilities at the new market include ripening chambers, which will eventually be used for all products, are now only available for bananas which are sent to the market by the Banana Control Board. Green bananas are sent to these chambers and are ripened on behalf of the Board at a fee of 30 cents per 20 kilogram container. The cold rooms are used mainly for fruit delivered to the market. The cost of storing produce in the cold rooms varies according to the size of the container. It varies

from 2 cents per week for a container of up to 15 000 cubic centimetres to R1,25 per week for a container of greater than 500 000 cubic centimetres.

The market master's agency on the East London market handles the largest proportion of the annual market turnover. Between 1973 and 1978, this agency handled an average of around 56 percent of the total market turnover. It has been handling an increasing proportion of the produce delivered from distant producers. This has increased from 38,3 percent of such sales in 1973 to 63,6 percent in 1978. Apart from the market master's agency there are three private commission agents who operate on the East London market.

Four control boards are operative on the East London market. The South African Co-operative Citrus Exchange channels all citrus supplies, during the period that distribution control applies, through the market master's agency. The Deciduous Fruit Board, which is responsible for the distribution of certain deciduous fruits grown in various controlled production areas, also supplies the market. Prior to the opening of the new market, the market was not always able to attract the desired quantities of the better quality fruit marketed by the Board because of the congestion at the market and the lack of the required cold storage facilities. The market master's agency handles all consignments received from the Deciduous Fruit Control Board. Before March 1975 the market master's agency received regular supplies of good, half-ripe bananas from the

Banana Control Board. As already mentioned the market now receives green bananas from the Control Board which are ripened in the ripening chambers at the market.

The Potato Control Board is the other control board that operates on the East London market. This board does not have the same powers as other boards operating on the market through distribution control of the commodity they represent. The main functions of the Potato Control Board are to stabilise the price of potatoes particularly through purchases. In order to achieve this objective the Board administers a Stabilization, a Redistribution and a Market Support Scheme. In times of surpluses, potatoes are bought up and sold in the National States, Black residential areas and in towns and cities where prices are out of proportion with those realized on the surplus market. The funds for these schemes is obtained through the imposition of a 3 percent levy on the sales per producer who supplies the market. Most of the potato requirements sold at the Black Market in Duncan Village near East London were obtained through the Stabilization Scheme operated by the Potato Control Board. The Black Market in Duncan Village has subsequently been closed. The report of the Director of Markets (1973, p8) states that the Potato Control Board is "... of great value to this market by way of information and statistical services they render." The information supplied includes the areas where potatoes can be obtained if needed and the quality of the potatoes. The statistics refer to the supply and demand for potatoes and the prices obtained.

1.3.3 Vegetables studied on the East London market

A choice was made of six of the more important vegetables on value and quantity basis supplied to the East London market, namely, cabbages, carrots, onions, potatoes, pumpkins and tomatoes.

These vegetables have constituted an increasing proportion of the total quantity of vegetables supplied to the East London market. The proportion these six vegetables have contributed to the total amount of vegetables sold on the market has increased from 65,8 percent in 1965 to 91 percent in 1979. The increase in the importance of these particular vegetables may be the result of a movement toward a greater degree of specialization on the part of the producers. The increase is even more significant because the quantities of pumpkins and carrots supplied to the market have declined over the same period. The decrease in the supply of these two products could be the result of a decrease in their demand for various reasons. A decrease in the demand for carrots may have come about due to the ready availability of frozen carrots which from the housewives point of view are more convenient. In the case of pumpkins, consumers may consider this an inferior good and so with increased incomes have substituted some other vegetable for pumpkins.

The contribution of the six vegetables chosen in this study to the total value of vegetables sold on the East London market over

the same period has increased from 84 percent to 92,2 percent. Thus their contribution toward the total value of vegetables sold on the market has increased at a slower rate than has their contribution to the total quantity sold on the market. A proportionate increase in the contribution to the total value would have meant that the vegetables in question would have had to make up 95,7 percent of the total vegetables sold on the East London market. This probably resulted from the smaller supply of the other vegetables to the market which caused their prices to increase at a relatively faster rate to the prices than the vegetables being studied.

CHAPTER 2ECONOMIC MODEL

The formulation of hypotheses is one of the steps Groenewald (1973, p7) considers important for an orderly pattern of research because the theoretical solutions "... should give direction to all that follows." This chapter will therefore consist of a discussion of time series and the price-quantity relationship that is an operation in a perfectly competitive market.

2.1 Time series

Time series are a series of successive observations of the same phenomenon over a period of time. They are of particular importance in economics and business studies. Ordinarily, the observed values of the variable being studied, such as the price of a commodity, are the results of various influences. Discovering and measuring the effects of these influences are the primary purposes of a time series analysis. Although the effects cannot always be determined exactly, they can often be approximated if observations have been made over a sufficiently long period.

It is convenient to think of variations in the original data as being the result of four influences: secular trend, seasonal variation, cyclic variation, and random or irregular variation (Alder and Roessler, 1972, p256). These are explained in more detail below.

2.1.1 Secular trend

The secular trend is that characteristic of a time series which extends consistently throughout the entire period of time under consideration. It is the basic long-term tendency of a particular activity to increase or decrease. Under present day conditions it is the tendency for prices to increase in the long-run. This would, for example, be the result of inflation.

In the case of the price of vegetables on municipal markets the upward trend in prices, which is predominantly the case, will be due to an increase in demand, a reduction in the supply of vegetables to the markets, or to inflation. Vegetables on municipal markets are sold either by auction or out-of-hand. This means that prices generally reflect supply and demand and do not necessarily reflect the costs of production of the vegetables.

An increase in the demand will result in the prices of vegetables on the markets, provided that the quantity of vegetables supplied to the market remains constant over time. The increase in the demand could be the result of a number of factors, the most important ones being an increase in the income of the population and an increase in the population itself. Decreases in the supply of vegetables to the market may not necessarily be a result of reduced production but of the availability of alternative markets for produce. There is an increasing tendency for

producers of vegetables to sell their produce directly to large retailers, such as large chain stores, and there is an increasing number of producers who are growing vegetables under contract for processing industries, such as frozen food firms.

2.1.2 Seasonal variations

Seasonal variations are variations that occur in regular sequence at specific intervals of time. The term "seasonal" is meant to include any kind of variation which is of a periodic nature and whose repeating cycle is relatively short. Seasonal variations in the prices of perishable agricultural commodities are the result of climatic conditions and show pronounced seasonal variation, being high early in the season, then declining sharply at the peak of the season and finally rising again as the supply diminishes.

Not all vegetables have specific seasons and so with these the price variations are not as marked. Another factor that influences seasonal variations is the production of vegetables under artificial conditions out of season. These factors tend to reduce the seasonal variations.

2.1.3 Cyclic variations

Cyclic variations are long-term movements that represent consistently recurring rises and falls in activity. Agricultural price cycles are caused, inter alia, by the tendency of farmers to base future production plans on current prices, rather than on future prices. A good example of cyclic variation is the hog cycle in the United States where the hog prices move in characteristic cycles averaging four years in length, the cycles in the hog prices being caused by opposite cycles in hog production.

According to Kohls and Uhl (1980, p212) the length of the hog cycle is a combination of both the psychological attitude of the farmer in changing his level of production because some time may be needed in order to obtain information and to make a decision to alter the level of production, and the physiology of the hogs in that it takes a given period of time to increase the number of hogs. Most of the cycles are longer than the biological lag, the remainder of the cycle being made up by the psychological lag. Kohls and Uhl (1980, p213) put forward the following necessary conditions for the development of identifiable price cycles: "First, there must be a time lapse between the change in price and the producers' response to that change. Second, producers must gear production to current prices rather than to expected future prices. Third, producers must have reasonably good control over output. Finally, price cycles are more likely to develop in almost perfectly competitive industries, where each

producer believes that his output decision will not influence prices." They also add that there are no well-defined price cycles in crops, as there are in livestock, because producer decisions are only partially responsible for crop size.

2.1.4 Random or irregular variations

These variations occur in a completely unpredictable fashion. Random variations are due to unforeseeable factors and in agricultural production, they are usually the result of unusual weather conditions. In other terms, random or irregular variations in a time series are variations which cannot be accounted for by secular trend, seasonal variations or cyclic variations.

The time series data is therefore influenced by these four forces acting simultaneously. This can be shown by the following equation:

$$O = T \times S \times C \times I, \text{ where}$$

O = the original data,

T = the secular trend,

S = the seasonal variation,

C = the cyclic variations, and

I = the random or irregular variations.

The factors are multiplied so as to make it possible to divide the original data by one or more of the factors in order to produce a new series from which the effect of the factor is

removed (Lewis, 1963, p339).

2.2 Price relationship

In order to ascertain the market price level it is necessary to consider the forces in the economy that will be at work in this process. A combination of the market demand for, and the market supply of a particular product will determine the market price. The interaction of the demand and supply to the market also determines the volume of the transactions that take place on the market. Before considering the determination of the market price it will be useful to have a look at the market demand and supply functions individually.

2.2.1 Market demand function

Dahl and Hammond (1977, p71) define demand as "... a behavioural relationship that describes how much of the product will be purchased at different prices under a carefully defined set of conditions." The consumers whose tastes are given will attempt to purchase the most preferred combination of commodities according to their budget constraint. The problem that confronts the individual is how to allocate his limited resources in such a way so as to maximize his satisfaction.

This idea of maximum consumer satisfaction implies that the consumers know the relative amounts of utility they can derive from the consumption of all the items available to them.

According to Du Toit (1973, p21), the rational consumer will in his efforts to achieve maximum satisfaction allocate his money in such a way that the marginal utility of the goods and services that he purchases will be equal in relation to their prices. In other words, the marginal utility per unit of money must be equal for all the goods and services consumed. If this condition is not fulfilled, the consumer would be able to increase his total utility by allocating his expenditure in some other manner. Therefore, if the consumer was consuming goods a, b and c, expenditure would be allocated in such a way that

$$M.U.a/P.a = M.U.b/P.b = M.U.c/P.c = k, \text{ where}$$

M.U. = marginal utility of commodities a, b and c,

P = price of commodities, and

k = marginal utility of money.

Under the assumptions that the marginal utility of money remains constant and that the consumer is subject to diminishing marginal utility, that is, he acquires less utility from each additional unit of commodity consumed, he will be prepared to pay less for the last unit consumed than for the previous unit. Therefore, the larger the quantity of a commodity an individual consumes, the less he is willing to pay for an additional unit of that commodity. The inverse is also true in that the higher the price the less the consumer is prepared to consume. This results in there being a negative relationship between the quantity demanded by the consumer and the price of the commodity.

This price-quantity relationship is formulated under the

assumption that all other factors affecting demand are held constant. These factors are the consumer's disposable income, the prices of substitute commodities, the prices of complementary commodities, expectations of future prices and income, and tastes and preferences of the customers (Dahl and Hammond, 1977, p73). This consumer demand function can be written in the general form

$$Q_d = (P, Y, P_s, P_c, E, T), \text{ where}$$

Q_d = quantity demanded,
 P = price of commodity,
 Y = consumer's disposable income,
 P_s = price of substitutes,
 P_c = price of complements,
 E = expectations, and
 T = tastes and preferences.

Changes in any of the factors affecting the demand for the product, with the exception of the price of the product, will result in a shift in the demand curve. An increase will be a shift of the curve away from the origin, and a decrease in demand an opposite shift. A change in the price of the product ceteris paribus will bring about a movement along the demand curve because the conditions under which the price-quantity relationship is defined have remained constant. Therefore, if any of the other factors change, a new set of conditions will be established which will mean a different price-quantity relationship.

The consumer demand curve specifies the quantities an individual

will demand at specific prices. The market demand schedule can be derived by adding the quantities of the product that each consumer is prepared to purchase at each specific price level. Thus, according to Goodwin (1977, p186), the market demand is the horizontal summation of all demand curves for all the consumers who are purchasing on a given market at a given time.

In the case of market demand functions, the factors that influence the consumer demand are still held constant but there are a number of other ceteris paribus factors that need to be specified. Goodwin (1977, pp187-188) describes the following additional factors that must be held constant as follows:

1. Population. If the population increases there will be an increase in the demand for a commodity. This can be held constant by either deflating the quantity demanded by the population growth rate or by measuring demand in terms of per capita quantity. In this case it is the demand per person that is being studied, immaterial of the number of people involved.
2. Distribution of income. If the distribution of income is uneven, the types of products with the heaviest demand will be different to when there is a more even distribution.
3. The general price level. If the general price level is increasing or decreasing it will lead to an inflation or deflation of the monetary unit. But since some commodities will tend to inflate or deflate more rapidly than others, the quantities of individual commodities demanded at various prices are likely to be changed.

4. International trade agreements. Because of international and governmental trade arrangements, many products that are available, or potentially available, face market demand schedules different from those that might be faced under a different set of arrangements. For example, tariff structures and import quotas could change the demand patterns.

Ritson (1977,p45) makes the point that "... investigating the relationship between population size and the demand for food products it is not a particularly useful exercise." If there had been no changes in any of the other factors affecting the demand, an increase in the size of the population would result in a pro rata increase in the demand for all products. Ritson (1977, p45) goes on to state that "...it is extremely likely that there will be changes in some of the factors affecting demand associated with changes in population size. For example, a change in the size of the population may imply a change in average income and/or a different distribution of income. A growing population will almost certainly be associated with a shift in the taste factor because of alterations in the composition of the population."

Using figures published in the Population Census of 1960 and 1970 and assuming a linear increase in population, the population of East London increased from 121 304 in January 1966 to 132 473 in December 1978. This is an increase in the population of 9,45 percent over the 13 years or 0,73 percent per year. Therefore, if all the other factors affecting demand remained constant,

demand should have increased by a similar amount over that period.

Distribution of income is not studied in the same way as other factors because, according to Ritson (1977, p38), it is one of those factors which it is reasonable to assume remains constant over fairly long periods of time, and because there is a lack of a single acceptable method of measuring it. The conventional method is by means of the Lorenz curve and the Gini coefficient, which can be used to show the result of different income distributions on demand.

The Lorenz curve relates the cumulative percentage of aggregate income to the cumulative percentage of the population receiving that income. If there was a completely equal distribution of income, the Lorenz curve would coincide with the diagonal line OC, shown in figure 2.1, which would result in 50 percent of the population receiving a proportional share of the income. As the distribution of income becomes more unequal, the further below the diagonal line would lie the Lorenz curve.

The Lorenz curve, although it does show the degree of inequality, does not provide a precise value that can be used for comparative purposes. The Gini coefficient, or inequality coefficient, does fulfil this need and is defined as the ratio of the area between the diagonal and the Lorenz curve to the total area under the diagonal. In figure 2.1 this is $\text{area A}/(\text{area A+B})$. A completely equal distribution of income will give an inequality coefficient

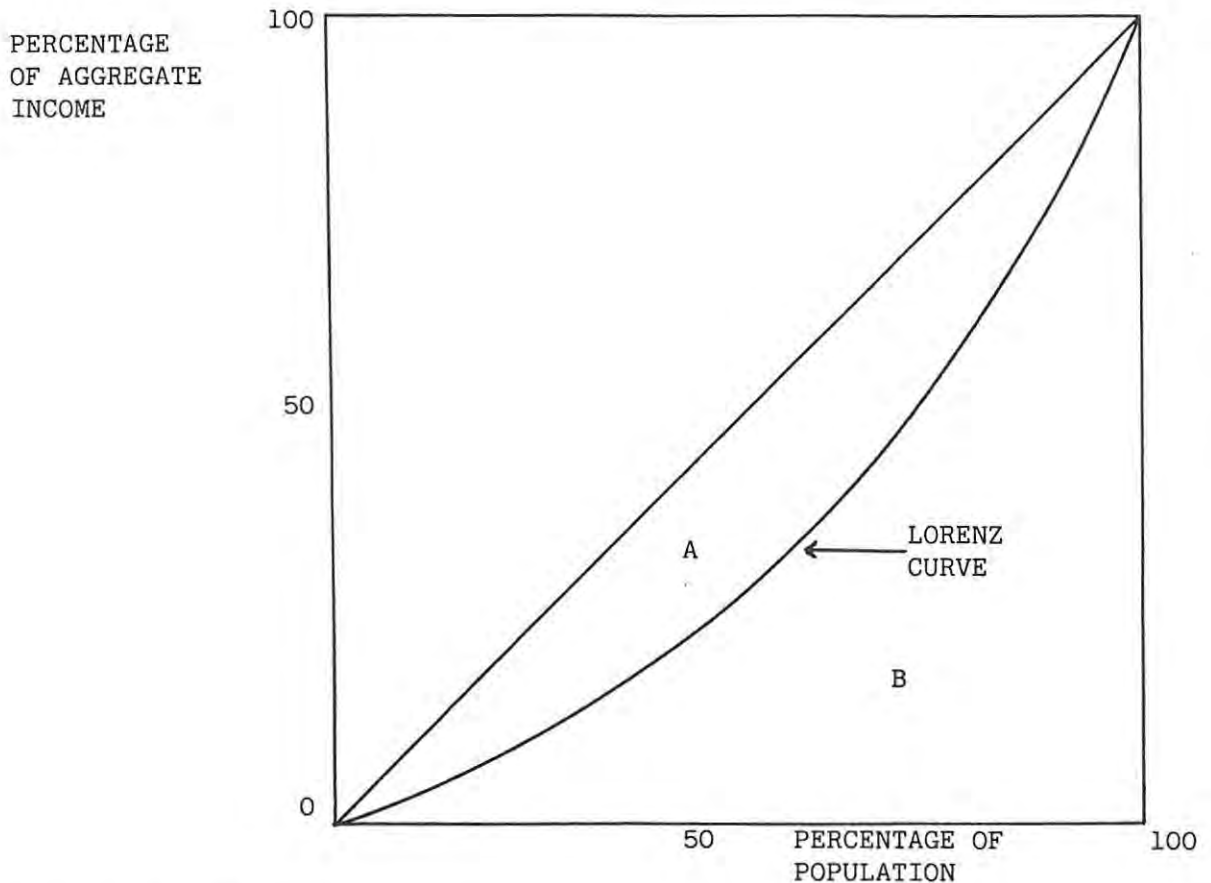


Figure 2.1 Lorenz curve

of zero and complete inequality will be denoted by one.

In order to relate a series of different income distributions to the demand for food it is important to study the conditions that will result in a change in demand due to a changing distribution of income. If everybody in the population had the same purchasing patterns, the result would be a linear income-consumption relationship, such as line AB in figure 2.2. In this case the increase in consumption, due to the increase in one individual's income, would be the same as the reduction in consumption which results from a decrease in another's income. Ritson (1977, p40) states that "... most available evidence

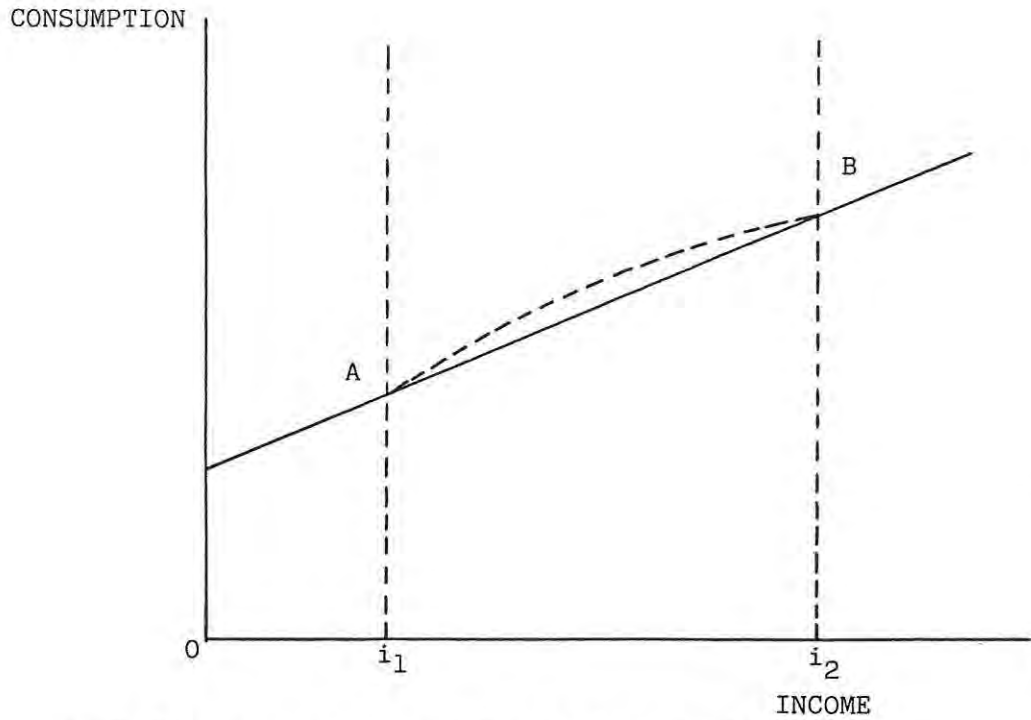


Figure 2.2 Income-consumption relationship

suggests, however, that for most food products, the individual's income-consumption curve is most likely to take the form of a curve, the slope of which is declining", as shown by the broken line in figure 2.2. Under these conditions the increase in consumption would be larger than the decrease in consumption resulting from a given redistribution of income. Therefore, the larger the inequality coefficient, or the more unequal the distribution of income, the lower will be the demand for food products.

2.2.2 Market supply function

Goodwin (1977, p152) defines the supply of an individual firm as the "... schedule of quantities that a producer is able and willing to make available at a specific series of prices, in a given market, at a given time, other things being equal." In order to establish the quantities an individual firm is able and willing to supply it is necessary to study the cost structure of the firm. When studying the cost structure of the firm it will be assumed that the producer will produce at a point within the rational stage of production, that is, where the marginal cost of the production is greater than the average variable cost.

If the price of a commodity were to fall below the minimum point of the average variable cost, the producer would not be able to recover the costs of the variable resources. The producer would, therefore, not operate at prices below OA in figure 2.3 and would rather utilize those resources in some other manner.

Should the price be at a level above the minimum point of the average variable cost curve, that is, in the rational stage of production, for example OB, the producer would produce at a level where the price of the commodity is equal to the marginal cost of producing that commodity and produce OY units of the commodity. By doing this the producer would be maximizing profit. The higher the price (OC), the larger the quantity the firm would be willing to produce (OZ). Since the marginal cost curve associated with a particular production function also denotes the

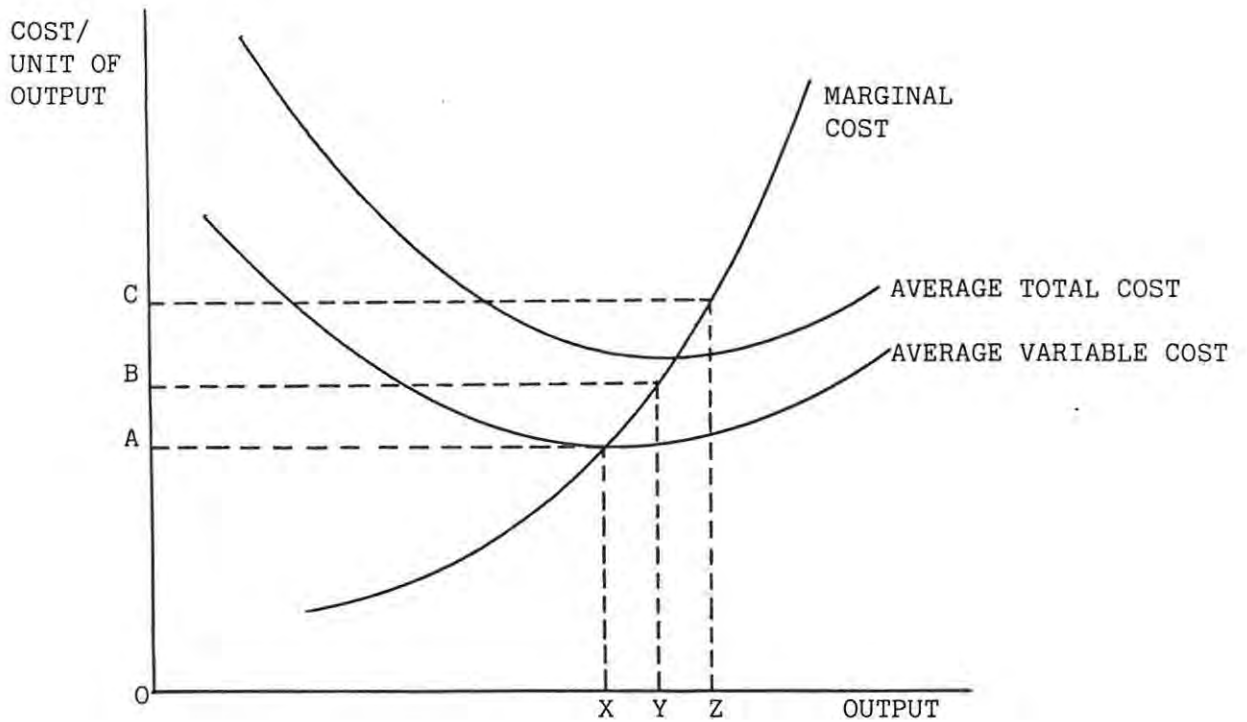


Figure 2.3 Cost structure related to concept of supply quantities that will be offered for sale at various prices, it will be the equivalent of a supply curve in terms of the law of supply (Goodwin, 1977, p152).

As with the demand function, the relationship between the price and the quantity supplied is expressed under the assumption that all the other factors are held constant. The more important of these factors are the price of inputs, the prices of the other commodities that can be produced, and the level of technology. The supply relationship can be written in the following form:

$$Q_s = (P, P_i, P_o, T_e), \text{ where}$$

Q_s = quantity supplied,

P = price of the commodity

P_i = price of inputs

P_o = price of all other commodities, and
 T_e = level of technology.

The time factor plays an important role in the definition of the supply function of a firm. The difference between the short run and the long run is the number of factors of production that can be varied. The production period for vegetables is several months and therefore a price change sometime in that production period will not to any great extent influence the quantity to be supplied, since the resources have already been committed to production (Goodwin, 1977, p153). As the time period is lengthened the fixed factors of production can change which will lead to a completely new production function. The result of this is that a different price-quantity relationship will be established, which means a shift in the supply curve for that commodity.

The supply curve of a particular firm specifies the quantities that firm will supply at specific prices. In the same way as the market demand function is derived, the market supply function is the "... horizontal summation of individual firms' supply curves" (Dahl and Hammond, 1977, p97). Therefore the aggregate supply of a commodity to the market will be influenced by the number of firms producing that commodity.

Ritson (1977, p108) states that for most agricultural products the fixed costs are considered to be high relative to the variable costs, and this has an important influence upon the

short run response of agricultural supply to price changes. Firstly, in the short run, output can respond only to changes in the quantities of variable resources employed, and so in the short run the supply curve for agricultural products tends to be less elastic than the supply curve for a product for which the variable costs represent a high proportion of total costs. Secondly, because of the assumption that firms will only produce in the rational stage of the production function, prices have to fall to very low levels before individual firms will terminate production.

2.2.3 Market price determination

If the market demand curve and the market supply curve are shown on the same set of axes, as illustrated in figure 2.4, the intersection of the curve will determine the price at which the market will be cleared. At this price (P_e), the quantity that the producers are willing to sell (Q_e) is equal to the quantity consumers are willing to purchase. If the market is operating under conditions of perfect competition, this will be the only price that can be maintained. Ritson (1977, p121) states the following conditions are required for attainment of perfectly competitive market:

1. There are many buyers and sellers such that the action of no one individual buyer or seller can have a perceptible influence upon market price;
2. Producers and consumers have perfect knowledge of events on the market and act on this knowledge;

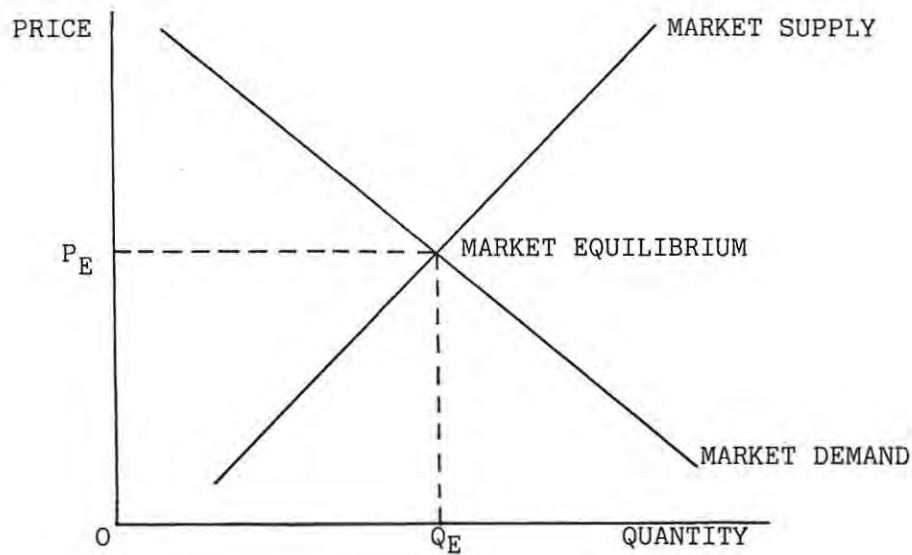


Figure 2.4 Market equilibrium

3. The product is homogeneous so that consumers are indifferent between the produce of alternative suppliers;
4. Firms act independently of each other in such a way as to maximize their individual profits and each consumer acts similarly so as to maximize utility from consumption; and
5. There are no barriers to the movement of goods or factors of production. Firms are therefore free to enter or leave the production of the product and are able to supply the market whatever quantity they wish.

Hill (1980, p87) makes the point that "... The agricultural industry, consisting of many farmers whose individual outputs form an insignificantly small proportion of total output and whose products are virtually identical to those of other farmers, approximates to the perfect competition model". The individual farmers' total production, therefore, is insufficient to affect

the market price and so the farmer is a "price-taker" irrespective of the quantity supplied to the market.

Any price which is higher than the equilibrium price on the market will result in the producers supplying a quantity greater than that which the consumers are prepared to purchase. If this price were to continue, the producers would begin to accumulate stocks of the product. Each producer finds that if the price is lowered a larger quantity will be sold and the price ruling on the market will decline. This process will continue until a price is reached where the quantity demanded and the quantity supplied are equal. Alternatively, if the price is below the equilibrium price, consumers will not be able to obtain the quantity they would like at that price. This will result in the individual consumers bidding the price up, so as to obtain the quantity they desire. This forces the market price up to the equilibrium level.

In the course of one season the demand for agricultural products is not likely to change to any significant extent and can, therefore, be considered to be constant. As previously stated, the supply of vegetables to a market is not constant throughout the year, being low out of season and high in season. The result is that out of season, with the short supply, the price rises until a price is reached where the quantity supplied equals the quantity demanded. During the season for a particular vegetable, the supply increases, and in order to clear this quantity from the market the prices will have to fall so as to

match supply and demand (Hill, 1980, p83). Therefore, in the short run, prices will vary on that market in accordance with the quantity supplied at that time.

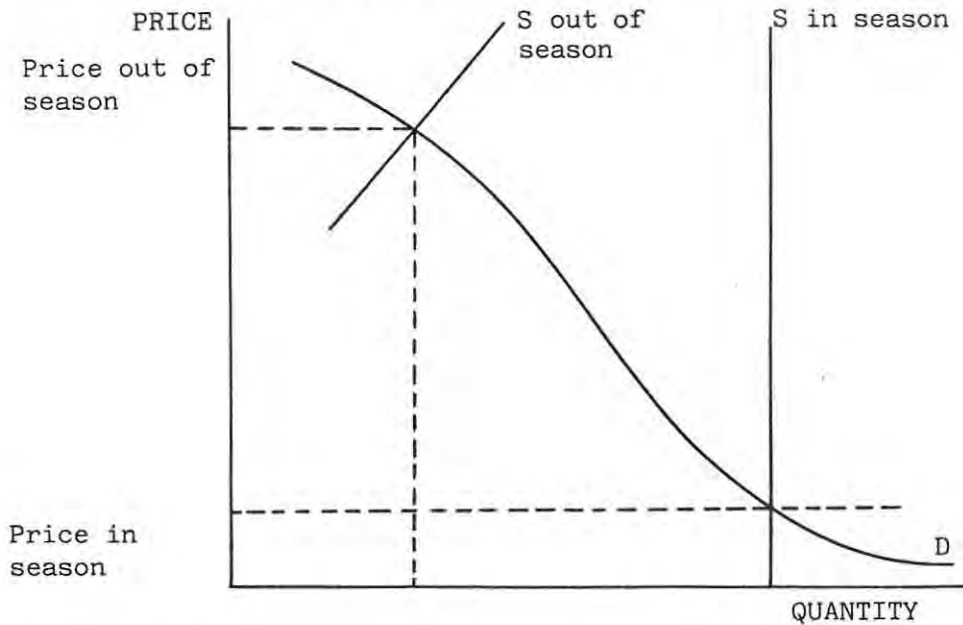


Figure 2.5 Demand and seasonal supply of vegetables

Strydom (1980) notes that "... A distinctive feature of the South African situation is that vegetables are usually in good supply throughout the year without the necessity of protected cultivation, importation or storage over prolonged periods. This advantage is derived from the diversity of climatic regions and subregions including the subtropical areas with a relatively frost-free winter. The composition of the spectrum of available vegetables will vary considerably from month to month but it is true that the ten most important vegetables will be found on all markets every month of the year". This fact will tend to reduce the variation in the quantities supplied from month to month, but will not be sufficient to overcome the problem completely.

The position in the long run is rather different because all the factors affecting both demand and supply can change. Assume the cost structure of a representative firm in the market, as well as a market demand curve D_1 and a market supply curve S_1 . If the demand increases to D_2 , because of an increase in income or population or in a change in taste, the short run result is an increase in the market price from P_1 to P_2 where the demand and supply are again equated. At the higher price the individual firms will maximize their profits by producing a larger quantity q_2 , and therefore the quantity supplied to the market will increase to Q_2 .

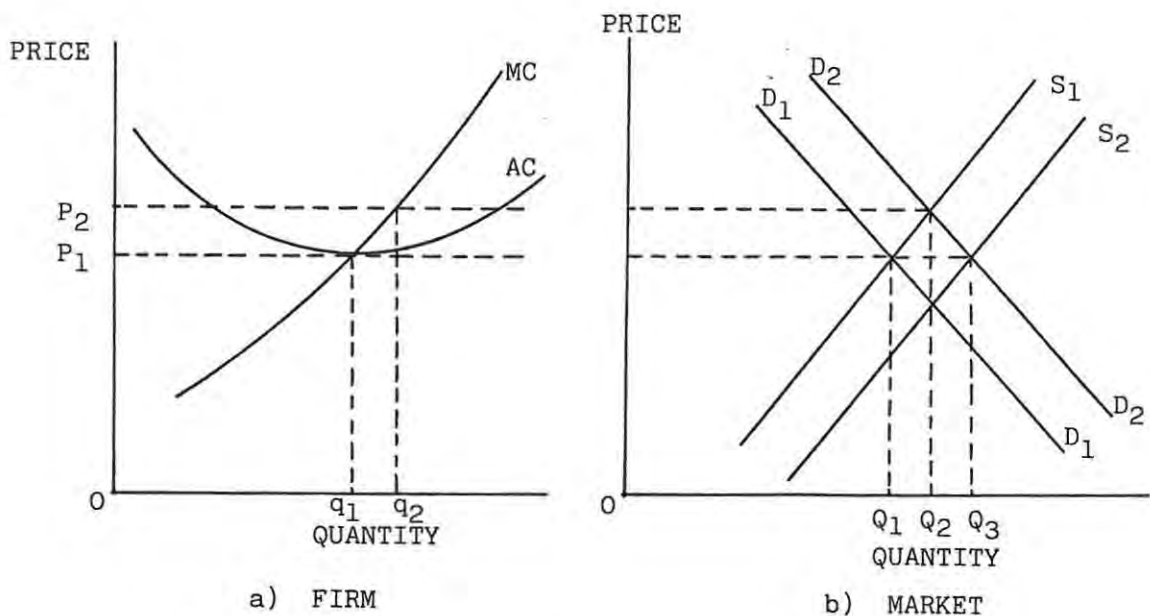


Figure 2.6 Process of long-run adjustment

The increase in market price means that the typical firms in the market would be making an excess profit on each unit of the product, equal to the difference between the market price and the

average total cost at output q_2 . If this increase in demand persists, this equilibrium price would not hold. The excess profits being made by the firms will attract other firms into the market which will shift the supply curve to the right, and result in the price of the product being forced down. Firms will continue to enter the market until the excess profits have been eliminated. If the costs of producing the product remain constant, the long run equilibrium price will be P_1 , with a total market quantity of Q_3 . Each firm is again operating at an output of q_1 , where the price is just covering the average total costs (Dahl and Hammond, 1977, p117).

The long run adjustment due to a decrease in demand or an increase in production costs can be explained in a similar manner. As assumed previously, if the market price is at a level below the minimum point of the average variable cost curve, the firms will not operate. A price which is in the region between the average variable cost and the average total cost will result in the firms minimizing their losses by operating where the price is equal to the marginal cost. These firms will leave industry in the long run because they will not be covering their fixed costs. The result of these firms leaving the industry is that the market price will rise until the price and the average total cost are equal.

The demand and supply curves of a particular commodity over a period of time are not static but shift continuously as other factors (ceteris paribus factors) change. Dockel and Groenewald

(1970, p15) make the point that "... When a statistical function is fitted to price-quantity combinations over time, two sets of factors play a role - demand and supply. Without a thorough knowledge of the underlying data and phenomena, it is possible to calculate demand relationships, a supply relationship or a combination of demand and supply relationships by means of an ordinary regression equation."

Price-quantity data represents points where the demand and supply are approximately equal. The relative shifts of the demand and supply curves will result in three possible series of equilibrium points. If it is accepted that the slopes of demand and supply remain constant over time, Dockel and Groenewald (1970, p16) show, graphically, the three possibilities as follows:

1. The case where the demand and supply curves shift equally (Figure 2.7).

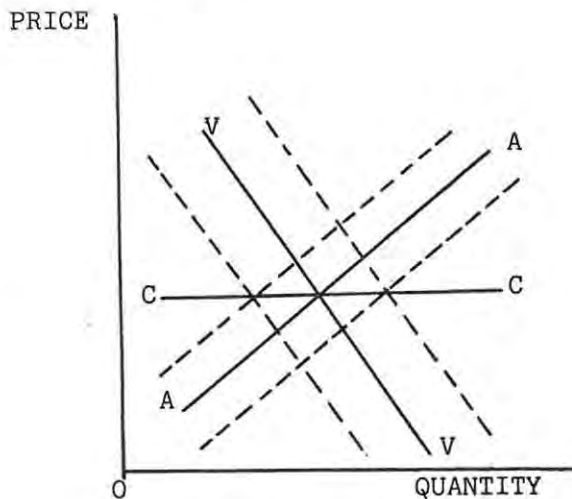


Figure 2.7 Equal shift in supply and demand

If a regression is fitted to the price-quantity data, a line CC may be obtained. Such a regression line will represent

neither demand nor supply.

2. The supply curve may shift relatively more than the demand curve, as in figure 2.8.

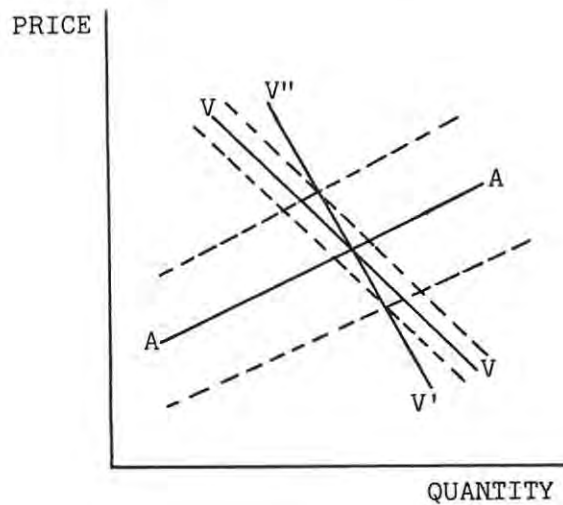


Figure 2.8 Supply shifts more than demand

In this case, a regression line such as $V''V'''$ may be described, which gives a reasonable approximation of the theoretical demand curve VV .

3. The demand curve may shift relatively further than the supply curve, as in figure 2.9. In this case, a regression line will describe a line such as $A'A''$ - a reasonable approximation of the supply curve AA .

Therefore, on the basis of price-quantity alone, it is impossible to differentiate between demand and supply. Neither of these economic structures can be identified in this way and Du Toit (1973, p26) states that for this reason certain exogenous shift variables are included in econometric models. By including the shift variables an attempt is made to eliminate the movement of demand and supply curves, thereby obtaining a closer approxi-

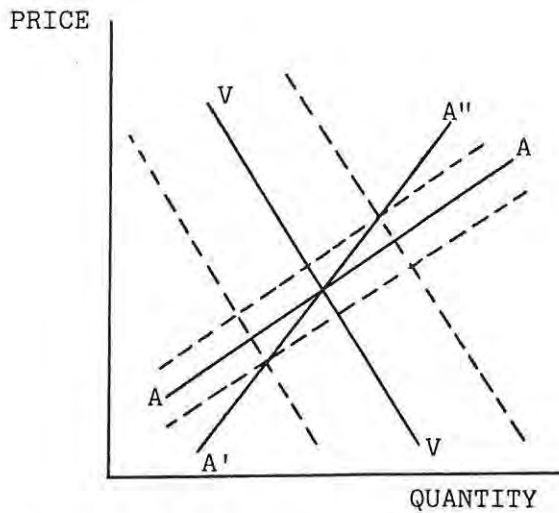


Figure 2.9 Demand shifts more than supply

mation of the desired economic structure.

2.2.4 Cobweb theorem

The price-quantity relationship as described in the previous section shows how the equilibrium price is attained by means of a comparative static equilibrium analysis. This technique is not able to predict the path the market follows from one equilibrium to another, or to predict whether or not a given equilibrium position will ever be attained. A dynamic analysis is required to explain the behaviour of the market in disequilibrium situations.

By adding the production time lag characteristic of agricultural supply, it is possible to construct a simple model for the agricultural market. This model, first described by Ezekiel (1938, pp262-272), is known as the cobweb theorem, and predicts

the development of a market cycle. The cobweb theorem takes into account the conditions of perfect competition as well as the assumption that there is a time lag between the decision to produce a certain level of output and the produce becoming available for supply to the market. The quantity supplied is therefore a function of the price in the previous time period. Ritson (1977, p134) calls these supply curves "... lagged output curves." Dahl and Hammond (1977, p125) describe this supply equation for time period t and the price determination as follows:

$$Q_s = e + fP_{t-1}$$

In time period t , this quantity is marketed, and it yields a price given the demand relation. Since the quantity has already been determined, the price is determined uniquely by the demand function

$$P_t = g - hQ_t$$

This price in period t will result in another quantity being supplied in the following period, $t+1$, which in turn will result in another price. Dahl and Hammond (1977, p125) state that this price and quantity determination "... is a sequential or recursive process rather than a simultaneous process." In order for this process to take place the market must be moved out of equilibrium in some way, such as a crop failure or a sudden change in demand.

In period 1 the quantity supplied to the market is Q_1 , which is

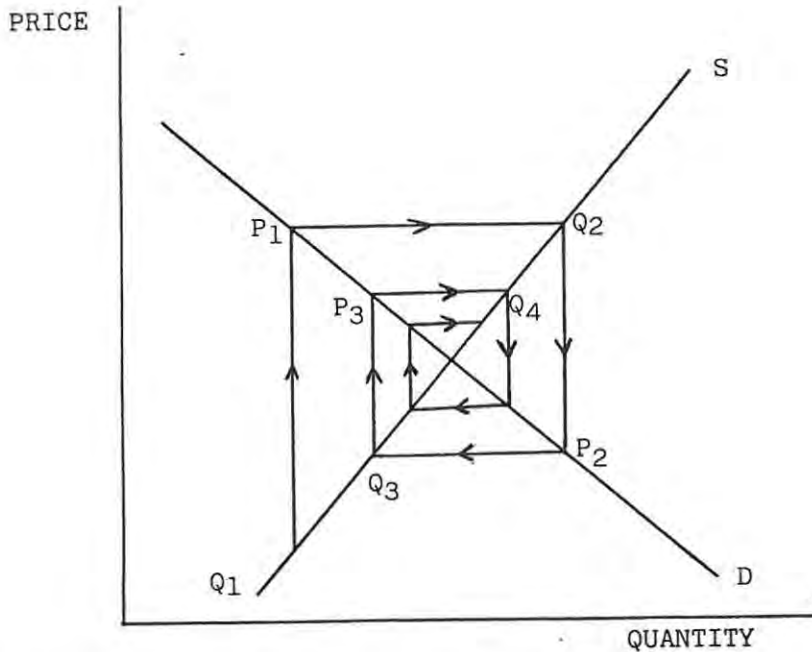


Figure 2.10 Converging cobweb

short of the equilibrium quantity and results in a price of P_1 (Figure 2.10). Because of this high price in period 1, producers base their production decisions for period 2 on this price. When the quantity Q_2 is supplied to the market in period 2 a price of P_2 will be obtained. The low price in period 2 will result in a low level of output in period 3. The prices will continue to oscillate in opposite directions.

There are three basic cases of the cobweb theorem. The first is the converging cobweb, as depicted in figure 2.10, where the price and quantity oscillations move closer to the equilibrium. This will result when the demand curve is more elastic than the supply curve. The second case is the diverging or explosive cobweb which results in the price and quantity oscillations expanding in size. The conditions for this type of cobweb are the opposite to those for a converging cobweb, as shown in figure

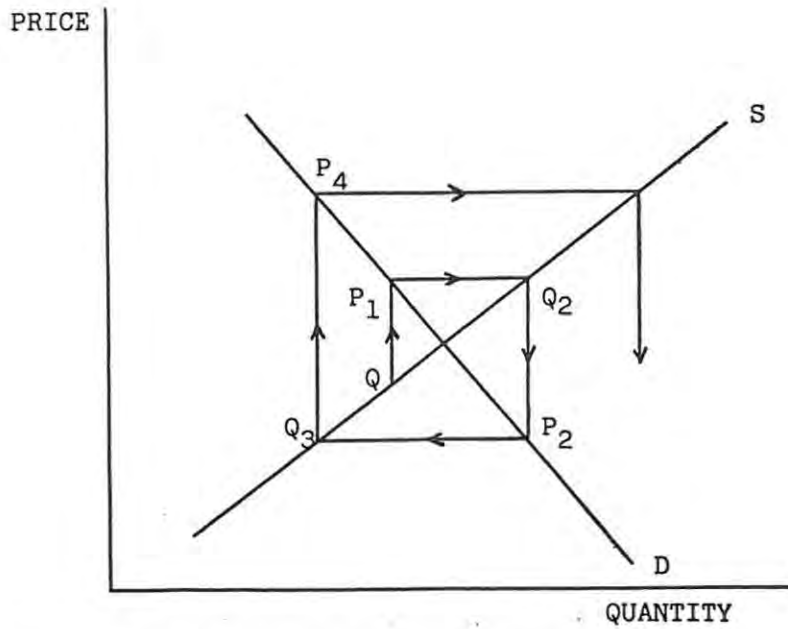


Figure 2.11 Diverging cobweb

2.11. Shepherd (1963, p37) points out that the oscillations will

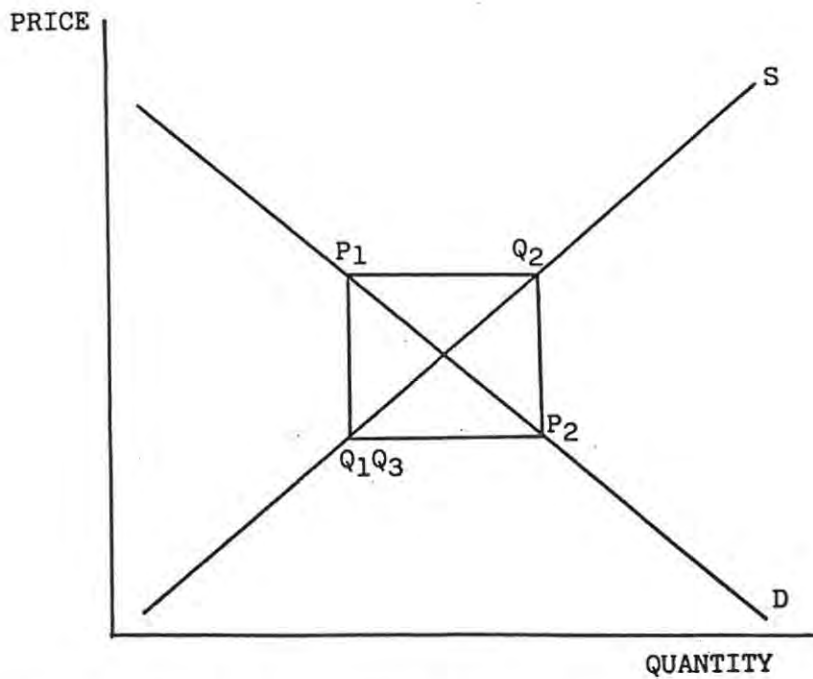


Figure 2.12 Continuous cobweb

continue to expand "... until the price fell to absolute zero,

or production was abandoned completely", but Dahl and Hammond (1977, p126) make the observation that this does not occur in observed cycles because "... other factors must come into play that prevent the cycles from exploding." The final cobweb occurs when the elasticity of demand and supply are the same, and therefore, after the initial disturbance, the fluctuation in price and quantity will continue in this unchanged pattern indefinitely, without equilibrium being approached or reached (Shepherd, 1963, p37). This is the continuous cobweb as shown in figure 2.12.

CHAPTER 3EMPIRICAL PROCEDURE

Having reviewed the factors that influence a time series and the manner in which prices and quantities interact, necessary statistical methods must be used in order to evaluate these factors. This chapter will deal with the methodology applied in evaluating the data.

3.1 Methodology for isolating factors affecting a time series

When faced with a large mass of figures it is not always possible to extract meaningful information from the data at face value, and so use is made of statistical analysis. One of the most important functions of statistical analysis is that it substitutes a few figures which display a recognisable and meaningful portion of the information contained in the data for the mass of data. By doing this a part of the information may be sacrificed, but in return a real grasp of the vital parts of the information is obtained.

Statistical procedures have been developed to aid in unravelling the confusing variations in an extensive time series, so that it is possible to see through these variations to the "relatively simple rules governing them" (Lewis, 1963, p335). These rules will often describe most of the variations observed in the past, leaving only a small portion "unexplained". If these rules are consistent with a reasonable explanation of the facts, then they can be extended with

confidence into the future so as to make forecasts in which a reasonably high degree of confidence can be placed. If, on the other hand, it is not successful in reducing the unexplained portion of the variation, this fact itself will act as a warning as to the reliability of the forecast.

Before all the individual influences that affect the time series can be isolated, certain adjustments have to be made to the original data. The trend value, one of the factors affecting the time series, and the moving average, must first be calculated.

3.1.1 Moving average

The moving average is an average of successive observations taken over the period of the expected seasonal movement. In the case of vegetables the seasonal movement is expected to be a period of 12 months. One method is to take a twelve-month moving average, but this requires the values to be centred on one particular month. Rather than going through the whole process of determining the twelve-month moving average and then centring it on the seventh month, the same result will be achieved by calculating a thirteen-month moving average with the months weighted 1,2,2,2,2,2,2,2,2,2,2,1 (Croxtan and Cowden, 1962, p330). Instead of dividing the sum of the 12 successive observations by 12, with the thirteen-month moving average the total of the 13 weighted successive observations is divided by 24 to achieve the same result.

Symbolically, if the observations in the same time series are denoted by Y_1, Y_2, \dots, Y_n , then a 13-month weighted moving average is the series of successive means of 13 consecutive observations weighted as already mentioned and divided by 24. That is, the series of moving averages is

$$Y_1 = Y_1 + 2(Y_2) + 2(Y_3) + \dots + 2(Y_{11}) + 2(Y_{12}) + Y_{13} / 24$$

$$Y_2 = Y_2 + 2(Y_3) + 2(Y_4) + \dots + 2(Y_{12}) + 2(Y_{13}) + Y_{14} / 24$$

The logic of the procedure is that the moving average is an estimate of the secular trend and cyclic variation influencing the time series, i.e. $T \times C$. The moving average smoothes out seasonal movements as it is an average taken over the period of the seasonal variation. It also reduces the irregular movements since they are mainly of a short duration.

3.1.2 Secular trend (T)

"Since the trend is the long-term tendency of a time series (disregarding the usual minor seasonal variations and the major cyclical and random variations), we may think of the secular trend as being the main tendency of a time series. It is natural, therefore, to represent a time series graphically by a scatter diagram and find a curve, preferably a line, which best fits the points of a scattergram" (Alder and Roessler, 1972, p257). In the case of a straight line trend, the method used of fitting the data is by means of the least squares method. In as much as the observations, Y , of the time series are usually measured at set

intervals, the following formula is applicable

$$Y_x = a + bX, \text{ where}$$

Y_x = the trend value in period X ,

a = intercept,

b = the slope of the line, and

X = the number of the time period

The trend value for the consecutive time periods will increase or decrease by the amount of the slope of the line of regression. A test can be done on the slope of the regression line in order to ascertain whether the slope is statistically significant. This can be done by means of the null hypothesis test which will determine whether the slope is significantly different from zero. A slope of zero would mean that there is no change in the dependent variable over time. A t -statistic for the data which is greater than the t -statistic for $(n-2)$ degrees of freedom would show that the regression line is significantly different from zero which would mean that the increase in the dependent variable is significant.

When the moving averages and the trend values have been calculated, it is possible to isolate the seasonal variation and the cyclic variation.

3.1.3 Seasonal variation (S)

The method employed to isolate the seasonal variation is to divide the original data by the corresponding centred moving average. The original data is assumed to be composed of trend, cyclical, seasonal and irregular influences. The moving average is an approximation of the trend and cycle because the moving average smoothes out seasonal movements and, to a large extent, irregular movements, since these are generally movements of a small amplitude and short duration. Therefore, by dividing the original data by the moving average, a figure is obtained which is an estimate of the seasonal and irregular movements.

$$T \times C \times S \times I / T \times C = S \times I$$

The problem now arises of eliminating the irregular influences still present. In order to achieve this a mean for each month is calculated. The averages of the seasonal indexes for each month will provide an indication of the average seasonal pattern for that particular time series. The less the dispersion of the individual monthly indexes the more uniform is the seasonal movement from year to year and the more confidence can be placed in the seasonal index.

When calculating the mean seasonal index for each month a standard deviation must also be calculated. With this information it is possible to compute a coefficient of variation for each month. The coefficient of variation will give an indication of the dispersion of the seasonal index figures for

that month. The lower the coefficient of variation the smaller will be the dispersion. Eliminating values in individual months which appear to be usually high or low will possibly result in a more realistic indication of the seasonal pattern and dispersion of the monthly values. The time period can also be divided into smaller groups or even individual years, and the mean of the groups or the values of the individual years can be compared so as to discover any change in the seasonal pattern over the time period.

3.1.4 Cyclic variation (C)

The method of isolating the cyclical variation, which is a movement in the series that usually lasts longer than one year, is very similar to that of calculating the seasonal variation. The variation being that different factors have to be isolated.

Having calculated the moving average, which is an estimate of the trend, cyclical and probably some irregular influences affecting the series, the data has been deseasonalised and most of the irregular influences will have been eliminated. According to Croxton and Cowden (1962, p368), it may frequently be desired to study economic and business series adjusted only for seasonal variation. In this case the consideration may not be so much whether the series is increasing relative to a hidden combination of trend and seasonal movements, but by only eliminating the seasonal movement the cycle will become evident.

The elimination of trend from the moving average will produce a value representing the cyclical movement in the series.

$$\text{Moving Average} = T \times C$$

$$(T \times C) / T = C$$

The values achieved are indexes and are not in the original units. The deseasonalised data are in the same units as the original data. The trend values, however, are in terms of the original units, so that when the trend of the series is eliminated by dividing, the resultant figures are percentages.

Once the cyclical variation has been isolated, the figures must be studied in order to ascertain whether there are any recurring movements in the series. This can be done by plotting the values for the cyclical variation on the graph. By means of visual inspection of the graph, any recurring cycles will become evident.

3.2 Analysis of covariance

The analysis of the time series data gives an indication of the secular trend, seasonal variation and cyclic variation of the prices and quantities of the particular vegetables over time. The time series will indicate, for example, the months with the highest seasonal price index, but will not be a reliable guide as to which month will have the highest prices in relation to the quantities supplied to the market. In order to ascertain which months had the highest prices and whether there was any difference, an analysis of

covariance was conducted on the prices and quantities of the vegetable studied.

3.2.1 Theory of analysis of covariance

Uncontrolled environmental conditions may affect both experimental error and estimates of treatment effects. If the condition can be measured even approximately, some adjustments can be made, often increasing the information in the experiment (Snedecor, 1956, p394). An appropriate statistical method is analysis of covariance. This technique combines the features of analysis of variance and regression (Bolch and Huang, 1974, p185). Hays (1973, p654) sees the combination of the two techniques in the following manner "... Whereas the analysis of variance deals with experimental factors treated qualitatively, and regression analysis deals with quantitative factors, the analysis of covariance represents a link between two approaches. In the analysis of covariance, some of the experimental factors are qualitative and others quantitative. The theory of the analysis of covariance thus has elements both of analysis of variance and of regression analysis."

Analysis of covariance is a means of reducing experimental error where a variable Y in an experiment is adjusted for variations in a variable X by means of linear regression, the latter variable being measured for each plot and being considered likely to be correlated with Y in such a way that some of the otherwise unaccountable variation in Y may be associated with variations in

X (Rayner, 1969, p400). It will therefore be possible, if the hypothesis proves reliable, to correct for these variations in X by reducing the error variance and by adjusting the treatment means.

In these circumstances X, the quantity of a particular vegetable bought on the market, is known as a concomitant variable, and the analysis of covariance amounts to an analysis of variance with a regression adjustment. It is conventional to denote the dependent variable, the price paid for a particular vegetable on the market, as Y, and the independent variable as X, and in expressing Y in terms of X, Y is regarded as dependent on X. The regression used is that of Y (the dependent variable) on X (independent variable), and although in this application it may possibly be true that X causes Y to vary, it is not necessary for the relationship to be a causative one.

3.2.2 Statistical model

When making use of the analysis of covariance the error component of the ordinary statistical model for the design is replaced by two terms, one involving X and the other residual error. This is on the assumption that part of what would otherwise have been regarded as error variation can be accounted for by variation in X.

Using a randomised blocks type of design, the model will be

$$Y_{ij} = \mu + \beta (X_{ij} - \bar{X}_{..}) + \epsilon_{ij}, \text{ where}$$

Y_{ij} is the dependent variable for the j^{th} treatment in the i^{th} replication

μ is a component of the dependent variable common to all the blocks and is taken as the grand mean of the dependent variable,

β is the regression co-efficient of Y on X,

X_{ij} is the independent variable for the j^{th} treatment in the i^{th} replication,

$\bar{X}_{..}$ is the grand mean of the concomitant variable, and

ϵ_{ij} is the residual error component which has a zero mean and represents the variance of Y which cannot be regarded as attributable to variations in X.

Therefore, in the model, apart from the error term, each Y_{ij} observation is represented by its grand mean, μ , plus an effect stemming from the fact that the associated concomitant variable, X_{ij} , differs from the grand mean of the concomitant variable, $\bar{X}_{..}$. The regression co-efficient, β , indicates the importance of the influence of the concomitant variable upon Y_{ij} . Bearing in mind that the main objective is to compare the price of various months, it would seem reasonable to adjust for the quantity variable. Therefore it is necessary to do an analysis of variance using the price column means after they have been "adjusted" for the effect of quantity. The adjusted price means, \bar{Y}_j^* , are defined as:

$$\bar{Y}_j^* = \bar{Y}_j - \hat{\beta} (\bar{X}_j - \bar{X}_{..})$$

In the event of $\hat{\beta}$ being positive, it would mean that X is positively associated with Y. Then, if a given value of \bar{X}_j is

greater than the grand mean $\bar{X}_{..}$, the adjusted column mean \bar{Y}_j^* will be smaller than the unadjusted column mean \bar{Y}_j . Therefore the equation will adjust the column mean of Y downward to take into account the fact that the column mean is associated with a large column mean for each concomitant variable. The opposite argument can be made for a negative β or for a column mean \bar{X}_j which is smaller than $\bar{X}_{..}$.

In the above section it has been demonstrated that the analysis of covariance combines regression analysis and analysis of variance. The estimated slope, β , will be provided by the regression analysis. An analysis of variance on the adjusted Y variables is done after adjusting for the effect of the concomitant variable. The final F ratios will be of the form:

$$F = \frac{(\text{adjusted column variation}) / (K - 1)}{(\text{adjusted error variation}) / (N - K - 1)}$$

The F ratios provide an indication of whether the adjusted means for the months are significantly different from one another. If the F ratio of the analysis is greater than the F values for the required degrees of freedom at a particular level of significance, then there is a significant difference. A significant difference between the adjusted means of the dependent variable will mean that the analysis can continue, and the adjusted means for the individual months can be investigated. An investigation of the individual months will necessitate the average least significant differences for the months being calculated. Adjusted means with differences between individual

months greater than the average least significant differences, will mean that they are significantly different from one another.

The model that explains the dependent variable implicitly assumes that the co-efficient β is constant for all treatments. That is, the effect of quantity upon the price is the same regardless of the month. Bolch and Huang (1974, p187-188) maintain that this lack of interaction between concomitant variable and the month is vital for the analysis to follow. If it is found that interaction is present, the reasons for the interaction are generally explored, but the analysis of variance terminates. Rayner (1969, p401) makes mention of this assumption but states that when using randomised blocks type of design "... this assumption is unlikely to be true in all circumstances, especially as regards treatments, but a lack of significance for homogeneity of the regression co-efficients for separate treatments cannot easily be applied, except in the case of simple random design". As this is not a simple random design, Rayner feels that the test need not be included and it will simply be assumed that the regression co-efficient is the same for all treatments.

3.3 Data sources

The prices and quantities of the selected vegetables used in the study were obtained from Statistics on Fresh Produce Markets for the period from 1964 to 1979. This is issued by the Division of Economic Services of the Department of Agriculture and Fisheries.

It contains the monthly statistics of the sales of vegetables and fruit on the national fresh produce markets in South Africa.

For the analysis of covariance the prices of vegetables were deflated by the consumer price index for vegetables to allow for the increases in price due to inflation. This was obtained from Crops and Markets which is also issued by the Division of Economic Services of the Department of Agriculture and Fisheries.

CHAPTER 4EMPIRICAL RESULTS

The results of the statistical methods described previously are presented in this chapter. The results were obtained by carrying out the procedures described with the assistance of the Prime 750 computer of the University of Fort Hare.

4.1 Results of analysis of time series

The time series analysis was carried out on the monthly prices and quantities of the six vegetables being studied. The secular trend, seasonal variation and cyclical variation analyses will be presented individually for the six vegetables.

4.1.1 Secular trend

The linear regression was fitted to the prices of each of the vegetables for the period 1965 to 1978. The results of the fitting of a trend line to the data for each month are shown in table 4.1.

The positive value for the slope of the regression lines indicate that the prices of the vegetables have been increasing over time, which was expected. The slopes of the trend lines were then tested to establish whether the slopes were significantly different from zero, which would mean that there would be no

Table 4.1: Secular trend equations and statistical test results. Equation $Y_x = a + bX$.

	a	b	r	r ²	t-test	z-test
Cabbages	15,45	0,25	0,62	0,38	0,60	9,64
Carrots	36,17	1,04	0,68	0,46	0,72	11,03
Onions	48,70	0,69	0,50	0,25	0,55	7,31
Potatoes	33,75	0,52	0,70	0,49	0,66	11,54
Pumpkins	5,70	0,52	0,65	0,42	0,82	10,31
Tomatoes	45,44	1,02	0,70	0,49	0,69	11,54

increase over time. To be in a position to reject the hypothesis that the slope of the trend line is equal to zero with a 5 percent degree of confidence, the calculated t-statistic for the slope of the line must be greater than the t-statistic for 178, that is, (n-2) degrees of freedom. Therefore the values would have to be greater than approximately 1,96. The calculated t-statistics for the slopes of the trend lines vary from 0,55 for onions to 0,82 for pumpkins. The values, therefore, fall far short of the required amount to reject the hypothesis that the slope is equal to zero. The increase in the prices of the vegetables from month to month was therefore not significant.

In order to ascertain whether there was any significant correlation between the time period and the price, a test was conducted on the correlation coefficients of the trend lines. The hypothesis that there is no correlation between the time period and the price was tested. In order to achieve this the correlation coefficient, r, was transformed to give a value for

Z. From the value of Z, z was calculated and this value was read off the tables showing the distribution of z which will display the probability of the hypothesis being true. The z values for the vegetables varied from 7,31 for onions to 11,54 for potatoes and tomatoes. Any value for z greater than 3,9 gives a probability of zero of the occurrence of that event. Therefore, the chances of there being no correlation between the time period and the price is zero, that is, the correlation is highly significant.

The coefficient of determination (r^2) which is the proportion of the total variation in the trend values that can be explained by the linear relationship for each of the vegetables is rather low. The reasons for this could be the seasonal, cyclical and irregular variations still present in the data or that the data does not follow a linear pattern. The moving averages for the vegetables, which will remove the seasonal variations and some of the irregular influences from the data but will still contain the cyclical and trend influences, was plotted on a graph. The prices of all the vegetables, with the exception of cabbages which showed no noticeable change in the slope over the 15 year period, displayed distinct increases in the trend of the prices at a point during the period. The changes in the trend of the prices occurred in the vegetables between the middle of 1971 and the middle of 1972 and were therefore probably influenced by the same factors.

4.1.2 Seasonal variations

The monthly seasonal indexes for the years 1966 to 1978 are shown in the tables. From the seasonal indexes for the individual months the mean is calculated so as to arrive at an average value for that month. In order to ascertain the reliability of the monthly average indexes a coefficient of variation for each month is calculated. The coefficient of variation is the standard deviation as a percentage of the mean. The higher the coefficient of variation the more unreliable will be the average for that month. A high coefficient of variation may be the result of certain years having exceptionally high or low prices which are completely out of character with the seasonal pattern. The variation in the indexes may thus be reduced by eliminating the highest and lowest seasonal indexes for each month and thus obtaining a more reliable average index for that month.

The seasonal price indexes will also be compared with three previous studies. The first was done by Behrmann and Kassier (1959) who calculated the seasonal price indexes on the Cape Town, Johannesburg and Durban markets for a number of vegetables over the period 1938-1954. They also calculated the seasonal indexes for potatoes on all the national markets except Kimberley. Mostert (1966) calculated the seasonal indexes for the same vegetables as did Behrmann and Kassier but for the 1954-1964 period. Nieuwoudt computed the seasonal price index for cabbages on the Johannesburg market for the period 1966-1975.

Table 4.2: Cabbages: Seasonal price indexes.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	0,31*	0,37*	1,17	1,77*	1,91	1,36	1,41	1,26	0,53	0,66	0,60	0,72
1967	0,93	1,00	0,72	0,72*	1,50	1,66*	1,48	1,15	0,68	0,49*	0,46	0,58
1968	0,96	1,42*	1,49*	1,58	1,75	0,99*	0,85*	0,77*	0,48*	0,53	0,58	0,75
1969	1,18*	1,01	1,10	1,27	1,50	1,32	1,30	1,10	0,76	0,58	0,35*	0,41*
1970	0,87	0,80	1,36	1,45	1,17	1,56	1,36	1,34	0,99	0,64	0,65	0,78
1971	0,49	0,59	0,56*	1,38	1,24	1,52	1,41	1,09	1,42*	0,66	0,55	0,79
1972	0,67	0,62	1,21	1,54	1,28	1,02	1,13	1,13	0,90	0,86	0,53	0,84
1973	1,05	1,19	1,44	1,16	0,94	1,00	1,17	1,07	0,95	0,95	0,53	0,65
1974	0,49	0,63	0,92	1,16	1,98*	1,65	1,30	1,87	0,89	0,59	0,77	0,69
1975	0,89	0,98	0,92	1,11	1,24	1,21	1,35	1,61*	0,84	0,75	0,87*	0,68
1976	0,54	0,51	0,80	1,33	1,55	1,39	1,43	1,27	0,93	0,50	0,50	1,01*
1977	0,99	0,90	1,12	0,81	0,91*	1,24	1,63*	1,32	1,25	1,36*	0,46	0,46
1978	0,33	0,72	1,16	1,26	1,53	1,56	1,22	0,82	0,84	0,72	0,54	0,67
Mean 13	0,73	0,83	1,07	1,27	1,42	1,34	1,31	1,14	0,88	0,71	0,59	0,69
CV	39,73	36,14	26,17	23,62	23,24	17,91	15,27	19,30	29,55	33,80	23,73	24,64
Mean 11	0,74	0,81	1,08	1,27	1,41	1,34	1,32	1,12	0,86	0,67	0,56	0,69
CV	32,43	25,92	20,37	17,32	19,15	15,67	8,33	14,28	20,93	19,40	14,28	14,49

Table 4.3: Carrots: Seasonal price indexes

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	0,57	0,44	0,75*	1,57	1,08	1,29	1,16	0,79*	0,59*	0,86	1,16*	1,09*
1967	1,46*	1,45	1,16	1,03*	1,17	0,79*	1,02	0,82	0,79	0,67	0,43*	0,59
1968	1,07	2,03*	1,42	1,15	0,77*	0,85	0,91	1,08	0,81	0,66	0,74	0,67
1969	0,83	1,18	1,24	2,08*	1,36	0,90	0,78*	0,89	0,71	0,63	0,63	0,60
1970	0,69	0,76	1,07	1,65	1,09	1,42	1,33	1,19	1,13*	1,03*	0,79	0,74
1971	0,56	0,66	1,08	1,25	1,20	1,05	1,16	0,93	0,74	0,62	0,56	0,53
1972	0,86	0,92	1,58	1,89	1,37	0,84	1,06	1,32	0,88	0,70	0,52	0,69
1973	0,78	1,05	1,40	1,33	0,93	1,15	1,21	1,30*	0,77	0,75	0,50	0,56
1974	0,39*	0,64	1,37	1,58	1,61*	1,95*	1,30	0,89	0,77	0,55*	0,45	0,53
1975	0,55	0,46*	1,29	1,80	1,36	1,38	1,24	0,99	0,88	0,91	0,74	0,71
1976	0,72	0,97	1,04	1,50	1,55	1,17	0,97	1,11	0,78	0,59	0,65	0,79
1977	0,78	0,84	1,73*	1,49	1,00	0,95	1,23	1,23	0,87	0,74	0,59	0,53
1978	0,72	0,81	1,09	1,41	1,45	1,60	1,33*	0,99	0,80	0,56	0,55	0,43*
Mean ₁₃	0,77	0,94	1,25	1,52	1,23	1,18	1,13	1,03	0,81	0,71	0,64	0,65
CV	33,77	46,81	20,80	19,74	19,51	29,66	15,04	16,50	17,28	19,72	31,25	26,15
Mean ₁₁	0,73	0,88	1,24	1,51	1,23	1,14	1,14	1,03	0,80	0,69	0,61	0,63
CV	20,54	30,68	13,71	14,56	15,45	21,92	11,40	13,59	6,25	14,49	16,39	14,28

Table 4.4: Onions: Seasonal price indexes

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	0,58	0,78	0,93	1,06	1,14	0,99	0,92	1,11	0,87	1,13	0,79	0,69
1967	0,65	0,66	0,85	0,67	1,27	1,29	2,33*	2,49*	1,23	0,41*	0,37*	0,36*
1968	0,31*	0,57	0,88	1,16	1,28	1,38	1,10	1,28	1,32	0,88	0,69	0,89
1969	0,87	0,81	0,83	0,82	0,95	0,97	1,04	1,37	1,32	1,07	0,82	0,81
1970	0,50	0,68	0,77	1,12	0,87	1,74*	1,62	1,34	1,25	0,90	0,84	0,75
1971	0,74	0,68	0,76	0,93	0,74	0,74*	0,96	1,41	1,76*	1,05	0,96	0,79
1972	0,54	0,51*	0,64	0,65*	1,05	1,32	1,78	1,80	1,24	0,61	0,54	0,61
1973	0,75	1,08*	1,19*	1,29*	1,48*	1,56	1,38	1,19	0,57*	0,66	0,42	0,55
1974	0,53	0,79	0,68	0,77	0,72	1,19	0,69*	1,09*	1,40	1,02	1,18*	1,22*
1975	1,09*	0,67	0,59*	0,69	0,93	1,09	1,85	2,28	1,18	0,78	0,63	0,58
1976	0,47	0,59	0,91	1,17	1,30	1,37	1,35	1,54	0,95	0,86	0,59	0,65
1977	0,62	0,86	0,99	1,09	1,02	1,23	1,18	1,53	0,95	1,12	0,75	0,83
1978	0,75	0,68	0,72	0,78	0,63*	0,90	1,26	1,59	1,75	1,15*	0,91	0,82
Mean ₁₃	0,65	0,72	0,83	0,94	1,03	1,21	1,34	1,54	1,21	0,90	0,73	0,73
CV	30,53	20,45	19,40	23,42	24,92	22,81	33,63	27,70	27,39	25,41	27,40	28,77
Mean ₁₁	0,64	0,71	0,81	0,93	1,12	1,21	1,31	1,49	1,21	0,92	0,72	0,72
CV	15,62	14,08	12,32	21,50	21,43	16,53	24,43	22,15	21,49	15,22	23,61	19,44

The average seasonal pattern of the prices of cabbages (Table 4.1) shows that the prices are high between March and August, that is, they have an index of greater than one. When each years monthly index was included, the coefficient of variation was rather high. The month with the most consistent seasonal index was July with a coefficient of variation of 15,27 percent and the month with the greatest variation was January (37,33 percent). After eliminating the upper and lower extremes from each month the average seasonal pattern remained the same but the coefficients of variation were of a more acceptable range. The months with the most reliable indexes were June, July and August with coefficients of 15,7 percent, 8,3 percent and 14,3 percent respectively, and November and December, 14,3 percent and 14,5 percent.

In comparison with the seasonal price indexes for cabbages calculated in the other studies the seasonal index reaches a peak later in the year on the East London market. In the calculations of Nieuwoudt (1977, p29) and Behrmann and Kassier (1959, p7) the seasonal price indexes for Johannesburg reached a maximum in March and in April in the calculations of Mostert (1966, p56). The indexes for Cape Town and Durban are even earlier reaching a peak in February. In each of the studies a minimum point was reached in November. The height of the peaks are much the same in each of the studies with the exception of Durban which had a higher seasonal peak. The seasonal price index for East London dropped to a lower level in November than was the case on the other markets. The reason for the seasonal high in the price of

cabbages coming later in the year on the East London market must be climatic since the cabbages marketed in East London are almost entirely grown in the Eastern Cape area.

The seasonal pattern of prices for carrots shows a similar pattern to that of cabbages. The seasonal index is also high between March and August. The variation in the indexes of each month are the smallest between July and October. The variations in January and February are exceedingly high being 33,7 and 46,8 percent respectively. The variation in the seasonal price indexes dropped significantly when the extreme values were omitted. Only three of the months had a coefficient of variation in excess of 17 percent as opposed to ten when all the indexes were considered. The month which now had the lowest coefficient of variation was September (6,25 percent) and the month with the most unreliable seasonal price index was February for which the coefficient of variation was 30,7 percent. The exclusion of the extreme seasonal indexes for each month resulted in the coefficients in February, January and November decreasing by 16, 13 and 15 percent respectively. This shows the effect that the extreme values can have on the variation of the mean. The other values in the series may be relatively consistent but the variation is upset by a small number of exceptional values. The seasonal price indexes in each of the studies show much the same pattern. The peak seasonal prices were also obtained in April on the Johannesburg and Cape Town markets and in May on the Durban market (Mostert, 1966, p57). In the earlier study by Behrmann and Kassier (1959, p6) the peaks occurred in the same month except

for Cape Town which peaked in July. The lowest levels in the studies were reached during October and November. The range of the seasonal movements in East London are much the same as those on the Johannesburg and Durban markets but larger than on the Cape Town market.

The average seasonal price index for onions is above average from May to September before dropping below one. The seasonal index during August is approximately twice that of the summer months. This signifies that the price is sensitive to changes in the quantity of onions because the seasonal quantity indexes do not vary greatly. The seasonal indexes for each of the months have a relatively high degree of variation from the mean. Only March has a coefficient of variation of under 20 percent (19,4) while the rest range from 20,5 to 33,6 percent. The coefficients of variation generally did not decrease by significant amounts when the extreme values were excluded. The only months that decreased by more than 10 percent were January and October which decreased by 14,9 and 10,2 percent respectively. The slight improvement in the coefficients of variation indicates that the wide variation is the result of general spread in the seasonal indexes of the individual months over the whole period.

The seasonal price indexes calculated by Behrmann and Kassier (1959, p10) indicated that for each of the markets a peak was reached during September. The lowest seasonal indexes were experienced between November and March. This is when harvesting takes place in the Western Cape which produces the majority of

the onions in the Republic. Mostert (1966, p56) found that the seasonal prices peaked at the same time in Cape Town and Durban but in July and August on the Johannesburg market because of onions produced in the Transvaal lowveld which ripen earlier. The peak of the seasonal prices on the East London market is reached during August. The supplies of onions to the East London market are obtained from the Orange Free State, Transvaal and mainly from the North-East Cape which probably harvest slightly earlier than in the Western Cape.

The seasonal price index of potatoes, as opposed to the previous vegetables, reached a maximum towards the end of the year. The prices were above average from September to December. With the exception of October which had an index of 1,33, the spread of the seasonal price indexes over the year was relatively small, ranging from 0,83 in March to 1,13 in November. This narrow variation is probably the result of information supplied by the Potato Control Board as to the areas where supplies of Potatoes can be obtained. The operation of the Potato Control Board is also likely to be the reason for the relatively small variation in the seasonal indexes of the particular months. Only three of the months displayed a coefficient of variation of greater than 20 percent. After discarding the outside values in each month four months had coefficients of variation of less than 10 percent and of the rest six had coefficients of under 17 percent.

The seasonal price indexes for other markets as calculated in the previous studies reach a maximum at around the same time of the

year with the East London market. A difference between the seasonal price index of this study and the other studies is that the prices are above average from much earlier in the year on the other markets. On the other markets the seasonal prices are above average from as early as April. This implies that the quantities to the other markets are in short supply from earlier in the year than is the case in East London.

The contrast to the relatively small range of the average seasonal pattern of potatoes, the range for pumpkins is exceedingly large. Pumpkins are mainly a summer crop which accounts for the low seasonal prices in January and February. They can be stored for a fairly long duration which will result in a flow to the markets for some time after harvest and will stabilize the prices while supplies last. Before the following harvest a shortage will result in a sharp increase in prices. The average monthly seasonal indexes vary from 0,56 and 0,58 in January and February to 1,44 and 1,91 in September and October. This demonstrates a pronounced seasonal tendency in pumpkins on the East London market. This distinct seasonal tendency is also accompanied by a large variation in the seasonal indexes in the individual months. Only August and September had coefficients of variation less than 20 percent. The exclusion of the extreme values did not reduce the majority of the coefficients of variation by significant amounts and it remained in excess of 20 percent for four months of the year. The coefficient of variation for August was the lowest at 10 percent while for the other seven months it varied from about 13 percent to 18 percent.

Table 4.5: Potatoes: Seasonal price indexes

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	1,03	1,14	0,87	1,25	0,92	0,93	0,95	1,14	1,67*	1,51	0,95	0,81
1967	0,69*	0,44*	0,70	0,94	0,80	0,67*	1,16	1,49*	1,21	0,98	0,94*	1,04
1968	0,93	0,81	0,94	0,89	0,79	1,06	0,95	1,01	1,03	1,10	1,21	1,33
1969	0,89	1,02	1,09*	0,89	0,87	0,96	1,01	0,90	1,12	1,49	1,19	0,88
1970	0,70	0,67	0,62	0,84	0,72*	1,17*	1,18*	1,06	1,17	1,50	1,09	1,06
1971	1,00	0,90	0,73	1,09	0,85	1,04	0,99	0,93	0,91	0,95	1,23	1,28
1972	0,83	0,74	0,71	0,67*	0,74	0,70	0,87	0,91	1,38	1,68	1,10	0,89
1973	0,90	0,96	0,94	1,37*	1,01	0,89	0,84	0,83	0,97	1,53	1,37*	1,34*
1974	0,86	0,55	0,57*	0,91	0,81	1,05	0,99	1,01	0,85*	0,87*	1,19	1,21
1975	1,00	1,21*	0,94	0,90	0,73	0,72	0,88	0,90	1,44	1,85*	1,16	1,16
1976	0,80	0,70	0,72	0,89	1,06*	1,01	1,11	1,00	0,97	1,18	1,07	0,89
1977	0,87	1,18	1,02	0,82	0,88	0,86	0,84*	0,74*	0,86	1,29	1,25	1,21
1978	1,21*	1,03	0,93	1,05	0,96	0,84	0,90	0,89	1,02	1,30	0,99	0,78*
Mean ₁₃	0,90	0,87	0,83	0,96	0,86	0,92	0,97	0,99	1,12	1,33	1,13	1,07
CV	15,56	27,59	16,87	17,71	11,63	15,22	10,31	17,17	21,43	22,56	12,39	18,69
Mean ₁₁	0,89	0,88	0,82	0,95	0,85	0,91	0,96	0,96	1,09	1,31	1,13	1,06
CV	10,11	22,72	15,85	12,63	9,41	13,19	9,38	9,38	16,51	18,32	7,96	16,98

Table 4.6: Pumpkins: Seasonal price indexes

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	0,70	0,87*	0,83	0,89	0,89	1,15	0,74*	0,77*	1,04	1,64	1,56*	1,01*
1967	0,90*	0,71	0,81	0,72	0,59*	0,92	1,20	1,21	1,54	2,34	0,74	0,62
1968	0,50	0,59	0,78	0,98	0,73	1,24	1,14	1,34	1,25	1,74	1,13	0,63
1969	0,58	0,68	0,92	0,81	0,89	0,98	1,06	1,19	0,94*	1,28*	1,28	0,92
1970	0,62	0,53	0,51	0,70	0,64	1,10	1,10	1,44	2,19	2,19	1,18	0,56
1971	0,44	0,39	0,44*	0,67	0,74	0,88	0,99	1,37	1,02	1,49	1,55	0,83
1972	0,69	0,61	0,73	0,34*	0,69	0,71*	2,54*	1,29	1,29	1,79	0,96	0,51
1973	0,45	0,60	0,93	0,80	0,70	0,93	1,45	1,39	1,18	1,88	1,15	0,66
1974	0,50	0,39	0,55	0,71	0,87	1,00	1,14	1,79*	1,25	2,61*	0,84	0,46
1975	0,41*	0,38*	0,50	0,54	1,06	1,42*	1,15	1,54	1,33	1,92	0,90	0,73
1976	0,57	0,49	0,57	0,59	1,16*	0,79	1,46	1,32	1,75	2,08	0,72*	0,44*
1977	0,43	0,68	0,82	1,09*	0,94	0,80	1,11	1,08	1,58	1,78	1,00	0,48
1978	0,49	0,56	0,98*	0,68	0,84	0,71	0,89	1,17	2,36*	2,09	0,74	0,66
Mean ₁₃	0,56	0,58	0,72	0,73	0,83	0,97	1,23	1,30	1,44	1,91	1,06	0,65
CV	25,00	24,14	23,61	27,40	20,48	20,62	35,77	18,46	30,56	18,85	26,42	26,15
Mean ₁₁	0,54	0,56	0,72	0,73	0,81	0,95	1,20	1,30	1,40	1,90	1,04	0,64
CV	16,67	17,86	22,22	16,44	14,81	16,84	18,33	10,00	24,29	13,16	23,08	21,88

Table 4.7: Tomatoes: Seasonal price indexes

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	0,70	0,82	0,55	1,19	1,00	0,92	1,18	0,95	1,12	1,28	1,10	0,66
1967	0,64	1,06	0,75	1,23	1,08	1,52*	1,09	1,11	1,61	0,70*	0,46*	0,50*
1968	0,71	1,16*	1,17	1,28	0,97	0,99	0,74	0,91	1,33	0,99	1,43	0,72
1969	0,54	0,83	1,35*	1,60*	1,41	0,82	0,63*	0,60*	0,78*	1,13	1,08	1,32*
1970	1,02*	0,65	0,98	1,22	0,70*	1,18	1,36*	0,73	1,31	0,91	0,98	1,29
1971	0,90	0,42*	0,54*	1,10	1,28	1,42	0,88	1,15	1,33	1,13	0,70	0,84
1972	0,66	0,46	1,20	1,35	1,27	0,89	1,14	0,98	1,40	1,17	1,73*	0,64
1973	0,48	0,75	1,30	1,45	1,53*	0,81	0,77	0,71	0,81	1,12	0,91	1,15
1974	0,68	0,66	1,12	1,13	1,19	1,18	0,97	1,37*	1,52	1,20	1,10	0,53
1975	0,35*	0,59	0,72	1,17	1,11	0,83	1,14	0,94	1,46	1,70*	1,00	0,90
1976	0,42	0,52	0,72	1,08	1,41	1,22	0,93	0,89	1,67	1,17	0,59	1,28
1977	0,85	0,99	0,80	0,79*	0,94	0,59*	0,90	1,12	1,61	1,42	0,81	0,75
1978	0,48	0,90	0,92	1,17	1,15	1,06	1,27	0,84	1,95*	0,99	0,75	0,90
Mean ₁₃	0,65	0,75	0,93	1,21	1,16	1,03	1,00	0,95	1,38	1,15	0,97	0,88
CV	30,77	29,33	30,11	16,53	18,97	25,24	22,00	21,05	23,91	20,87	36,08	31,82
Mean ₁₁	0,64	0,74	0,93	1,21	1,16	1,02	1,00	0,93	1,37	1,14	0,95	0,87
CV	23,44	25,67	25,08	9,09	13,79	18,62	17,00	15,05	17,52	12,28	24,21	28,73

The average seasonal price index pattern for tomatoes exhibited a pattern not common to any of the other vegetables studied. The seasonal pattern for tomatoes reached two peaks during the course of the year. The index was above average between April and July after which the index fell below one for August and then rose above average again for September and October. The low seasonal prices from November through to March occur when the local crop is harvested. The relatively low seasonal prices during July and August occur when the tomatoes from the Transvaal Lowveld are supplied to the market. The seasonal indexes are not very consistent as can be seen by the relatively high coefficients of variation. Four of the months had coefficients of variation in excess of 30 percent. When the extreme values omitted the coefficients of variation dropped to fairly acceptable levels in some cases but remained rather high in others. The coefficients of variation for the months of April to October varied from 9,1 percent in April to 18,6 percent in June while for the other months the coefficients were in excess of 23 percent.

The seasonal index of prices of tomatoes on the East London market as calculated in the study reveals a far larger range than was the case for tomatoes calculated in the other studies. In the study by Behrmann and Kassier (1959,p4) on the Durban and Johannesburg markets there were similar peaks between March and May as on the East London market. The seasonal price on the Cape Town market was relatively low in May but was at its maximum at the end of the year when the other markets' indexes were

relatively low. The seasonal pattern of prices on the Johannesburg and Durban markets in the study conducted by Mostert (1966,p57) more closely resembled the pattern on the East London market. The pattern of prices on the Cape Town market were completely different to those of the other markets being above average from March to December. The change in the seasonal pattern of prices between the early study and the two later ones is possibly due to a change in the methods of producing tomatoes.

In order to ascertain whether the seasonal pattern of prices for the vegetables has changed over the period studied, the time period question was divided into three periods of almost equal size, namely, 1966-1969, 1970-1973 and 1974-1978. An average value is calculated for each of the months in the particular periods which are then plotted on a graph which will expose any changes in the seasonal pattern between the different periods. The general pattern for each of the vegetables in the different time periods remained very much the same except for minor variations at certain times of the year. Even though the general patterns were very similar there were some wide variations between the values of the different periods for individual months. The vegetable that showed the most consistent pattern over the three periods was onions. The spread between the different periods was also relatively narrow for most months of the year. The coefficients of variation of the averages of the different periods ranged from 2,1 percent in February to 11,5 percent in May. Compared with the relatively narrow spread in the case of onions the spread in the case for the same months of

Figure 4.1: Cabbages: Seasonal price indexes of the different periods.

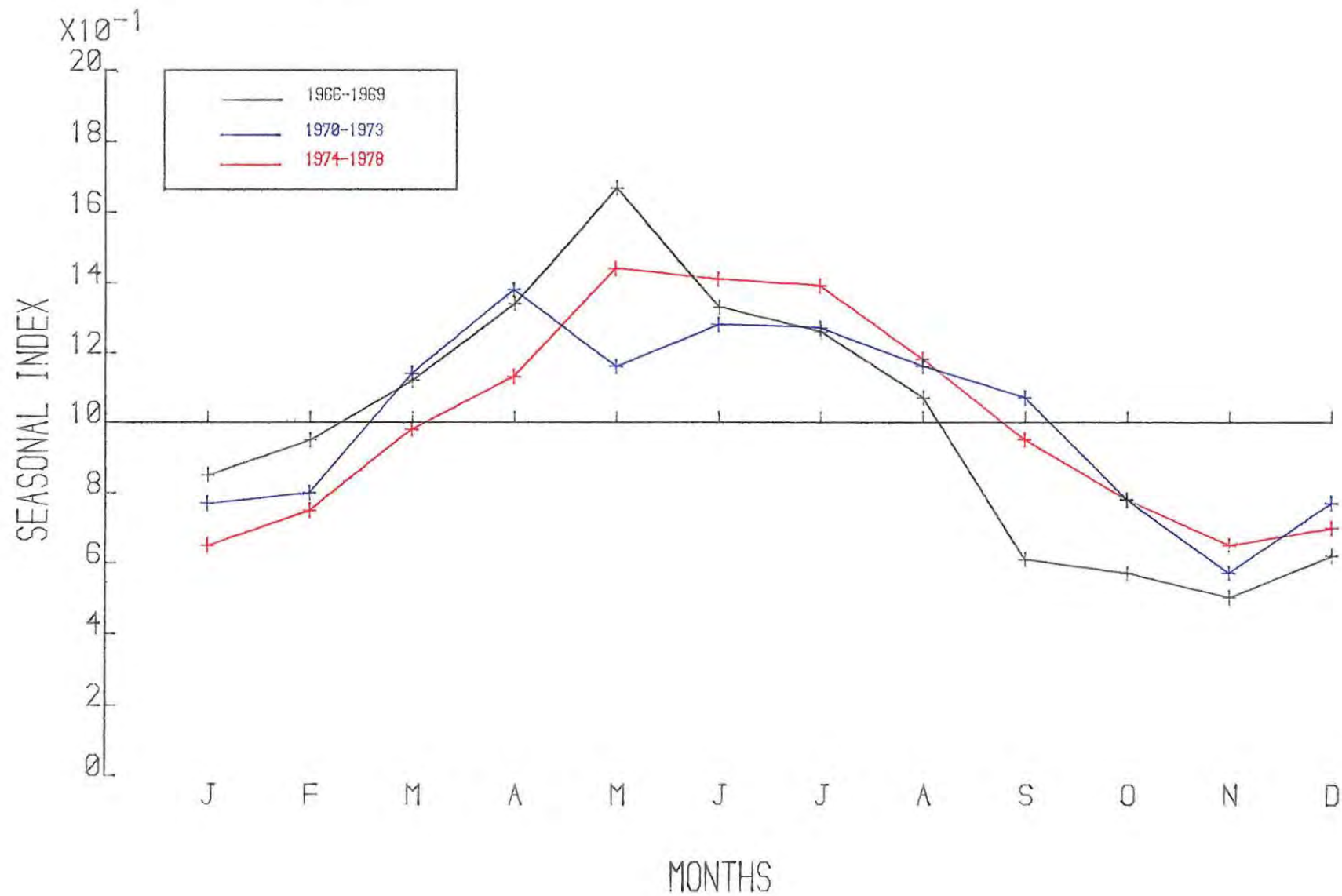


Figure 4.2: Carrots: Seasonal price indexes of the different periods.

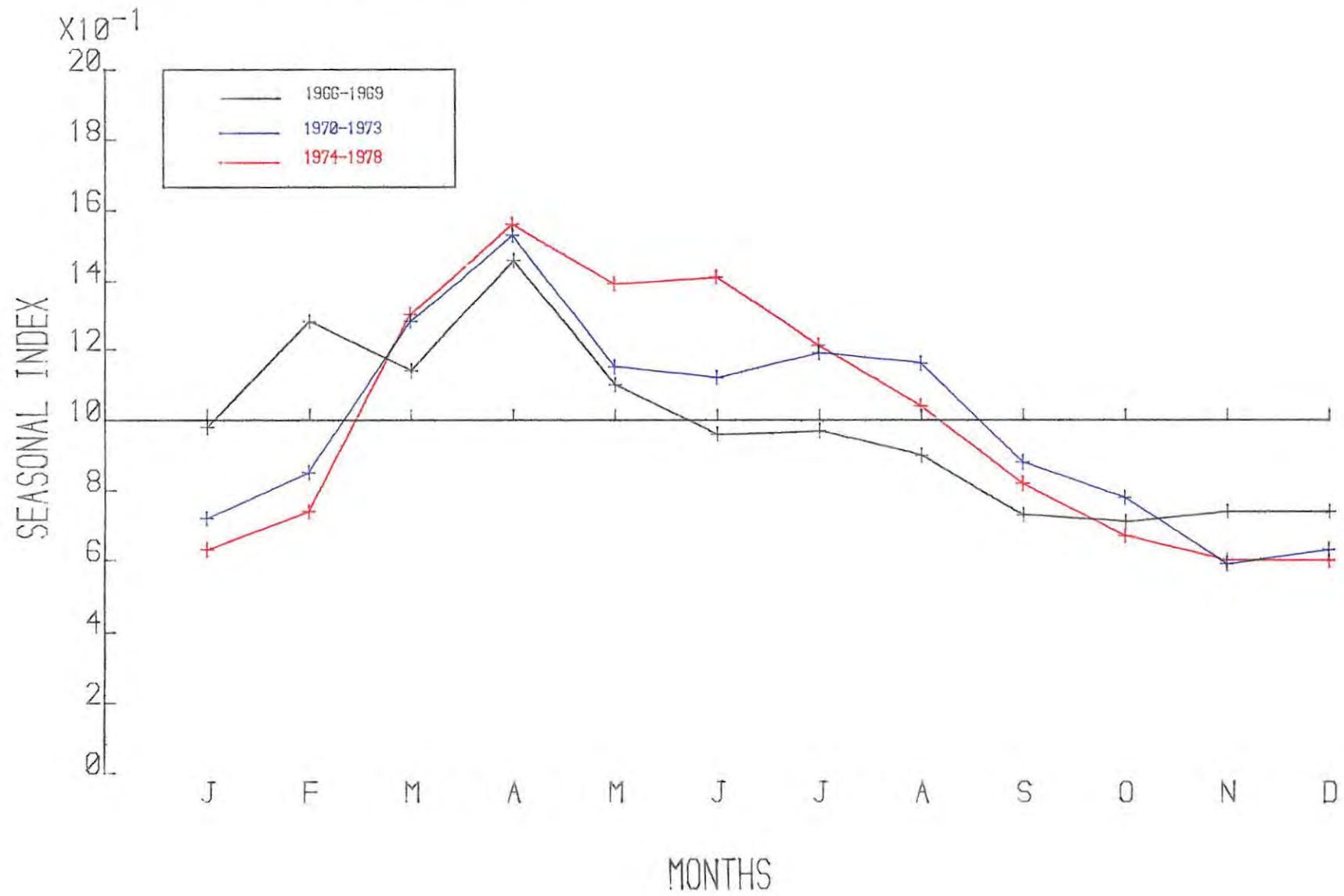


Figure 4.3: Onions: Seasonal price indexes of the different periods.

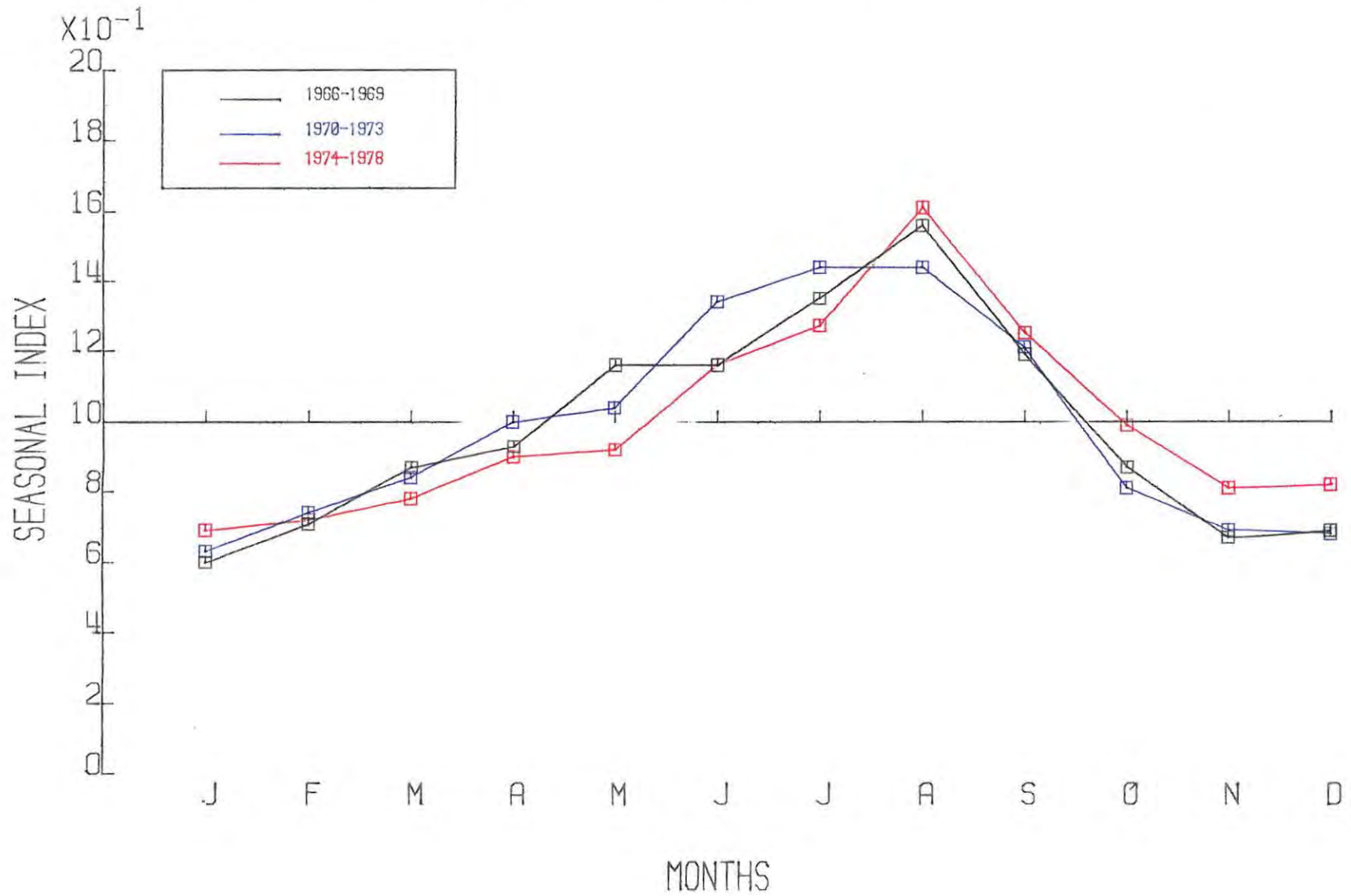


Figure 4.4: Potatoes: Seasonal price indexes of the different periods.

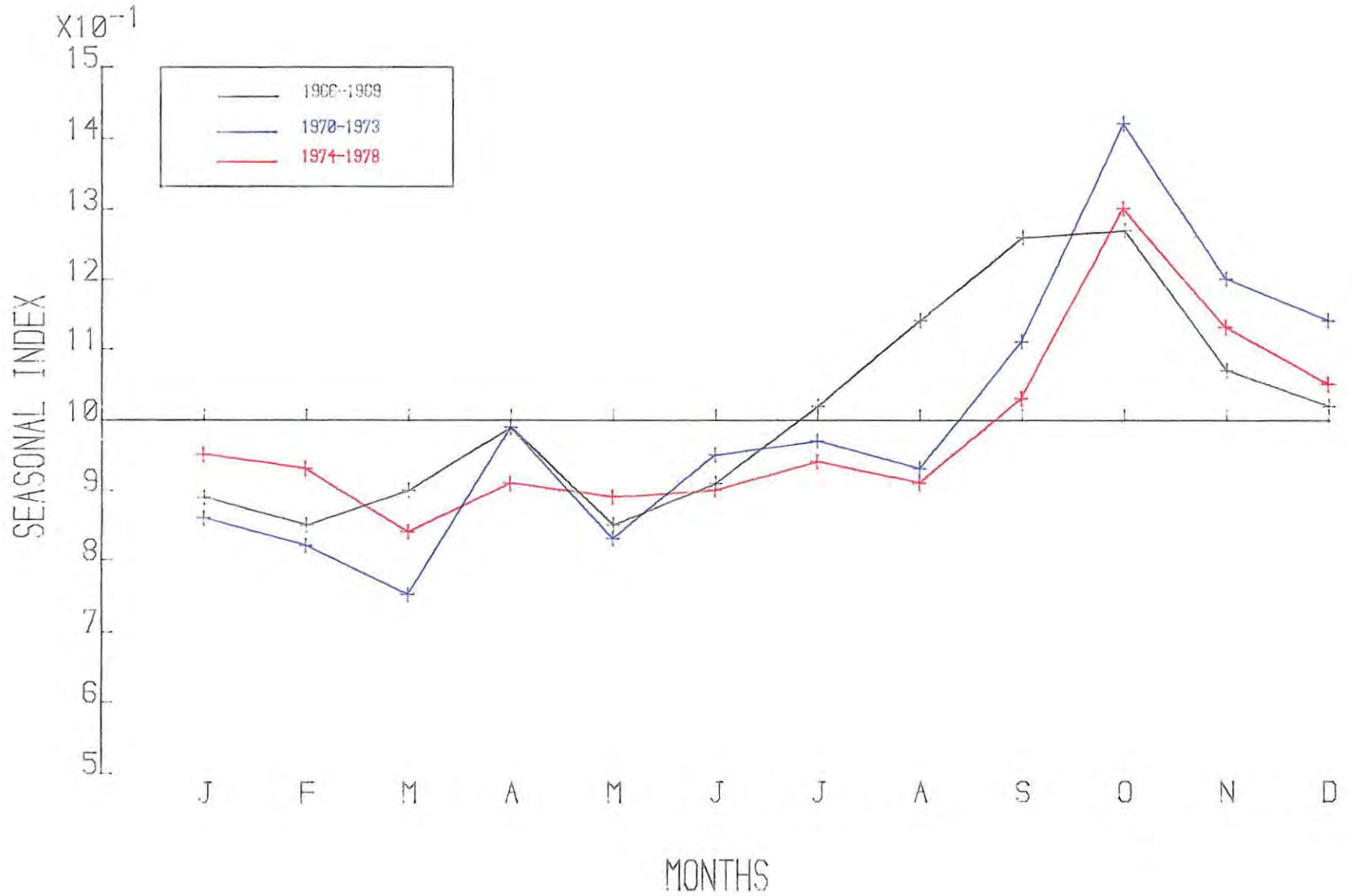


Figure 4.5: Pumpkins: Seasonal price indexes of the different periods.

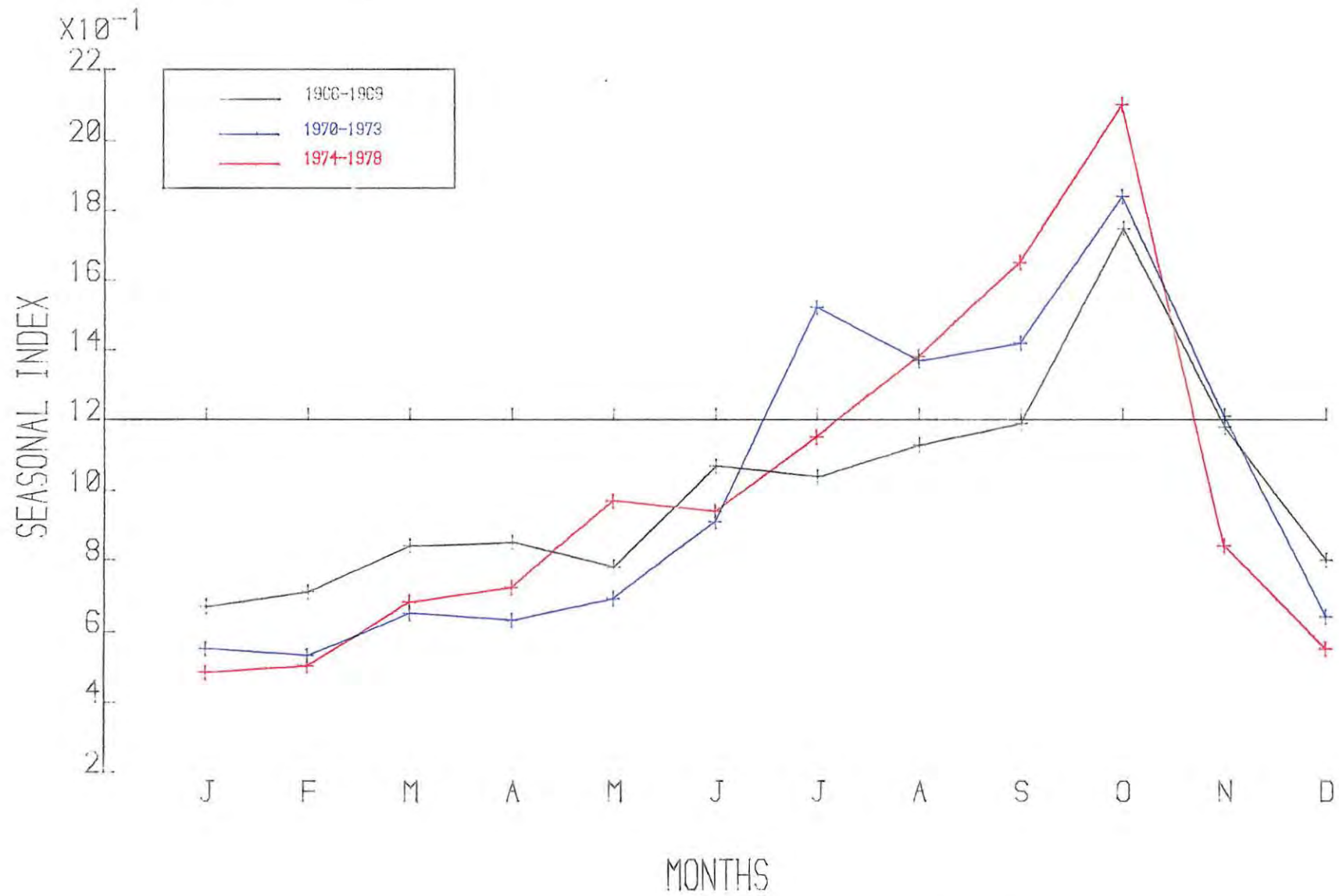
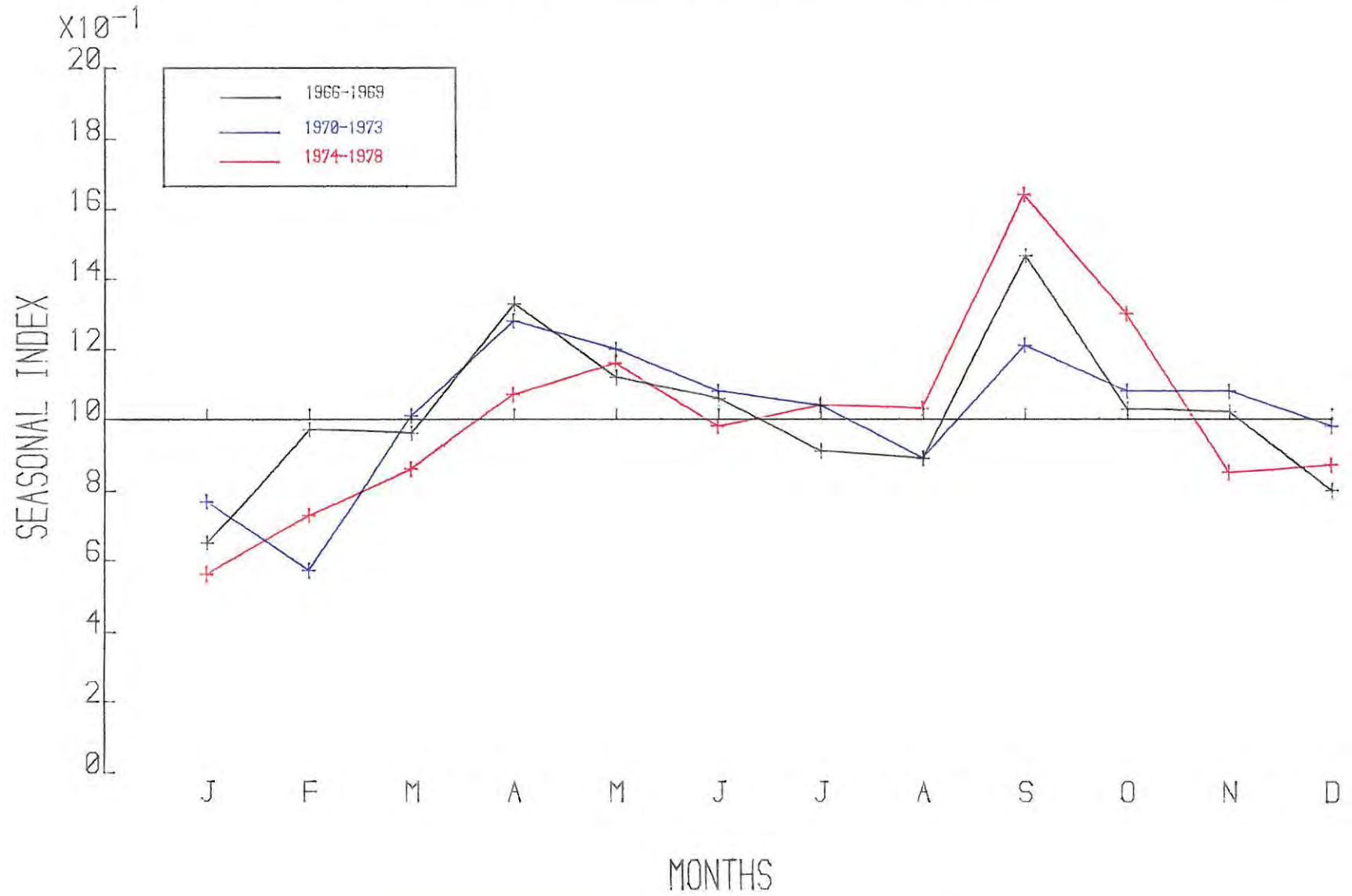


Figure 4.6: Tomatoes: Seasonal price indexes of the different periods.



the other vegetables is rather large. The coefficients of variation of the averages for the three periods for cabbages in September was 27 percent and for tomatoes in February was 26,7 percent.

The average seasonal index for cabbages in the 1970-1973 period showed a distinctly different pattern from the other two periods during May. In the other periods the seasonal index reached a maximum in May but the 1970-1973 period dropped off markedly in that month. The movement of the seasonal indexes for the latter periods from January through to April follow the same pattern. The earliest period rose to a minor peak in February, fell slightly in March and then followed the same pattern as the other periods. The seasonal price index for potatoes in the three time periods followed the same pattern except that the seasonal price index in the 1966-1969 period was above average from July whereas in the other periods this happened in September. The only other vegetable that did show any difference between the time periods was pumpkins. The 1970-1973 period climbed to a minor peak during July before reaching a maximum in October whereas in the case of the other time periods the indexes increased continuously to the maximum in October.

A comparison between the seasonal index of the prices of the vegetables and the seasonal index of the quantity supplied to the market reveals a strong inverse relationship between the two. As can be seen on the graphs displaying these (Figures 4.7-4.12), the price and the quantity supplied indexes of some of the

Figure 4.7: Cabbages: Seasonal price and quantity indexes.

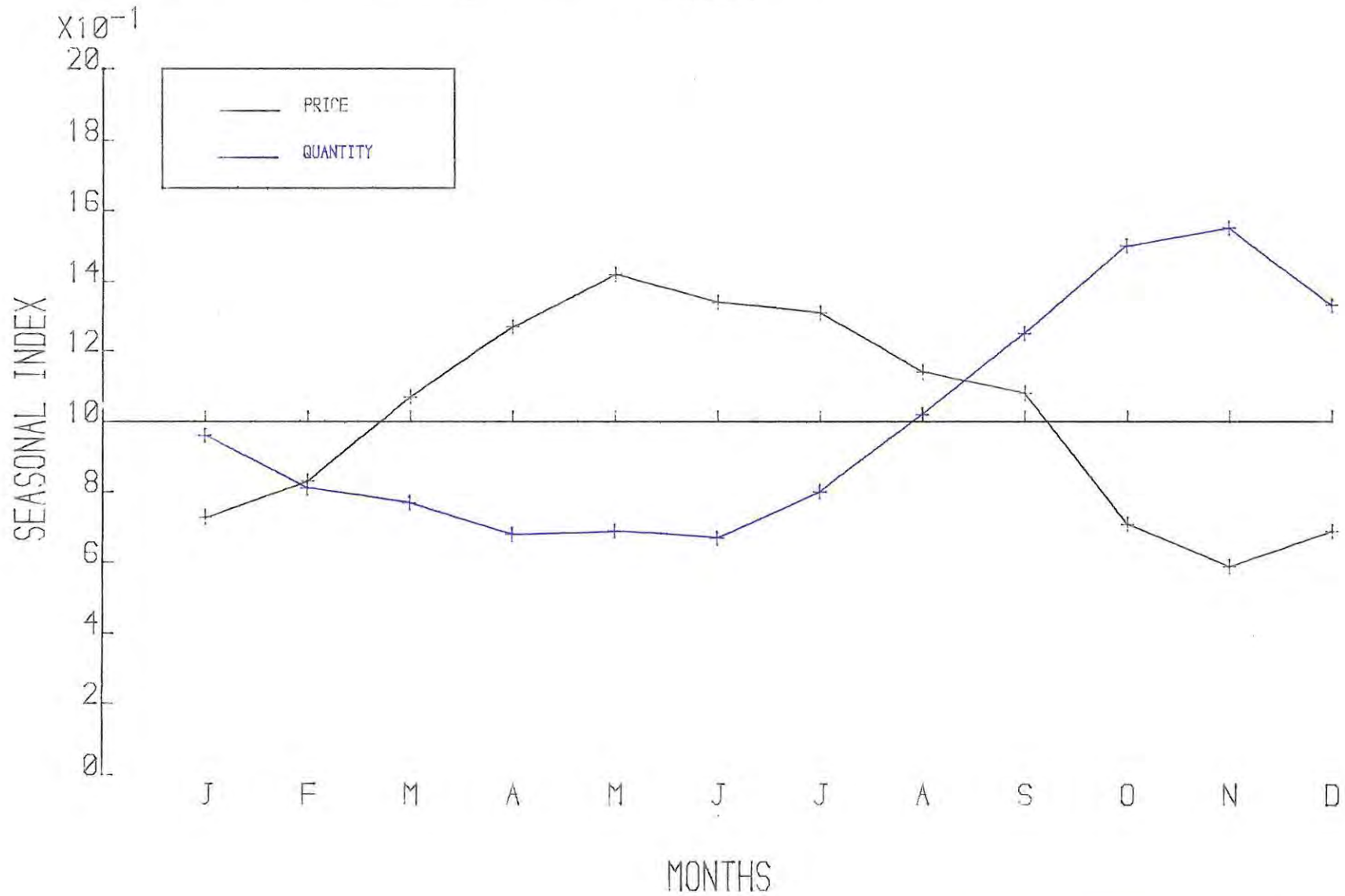


Figure 4.8: Carrots: Seasonal price and quantity indexes.

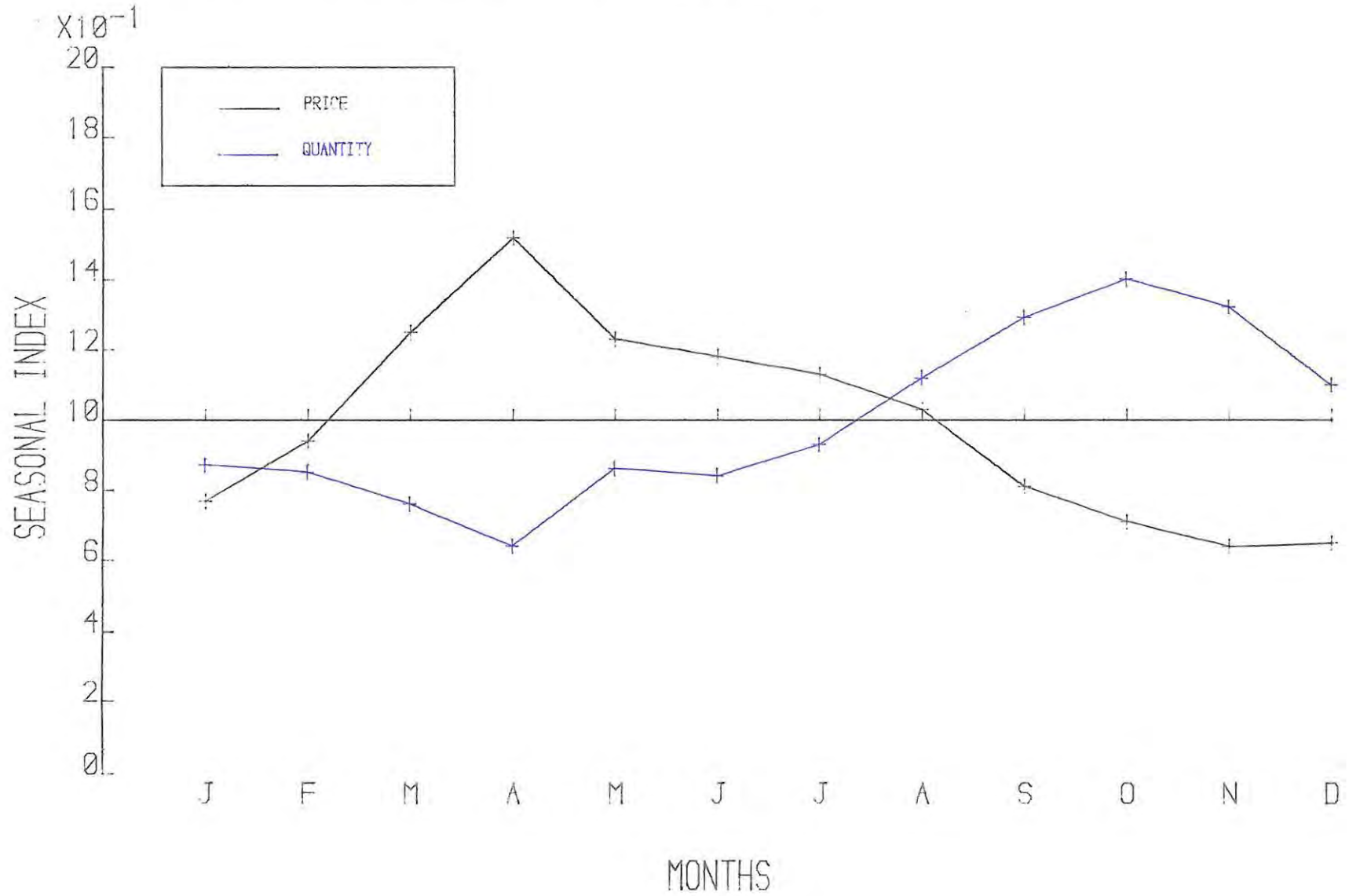


Figure 4.9: Onions: Seasonal price and quantity indexes.

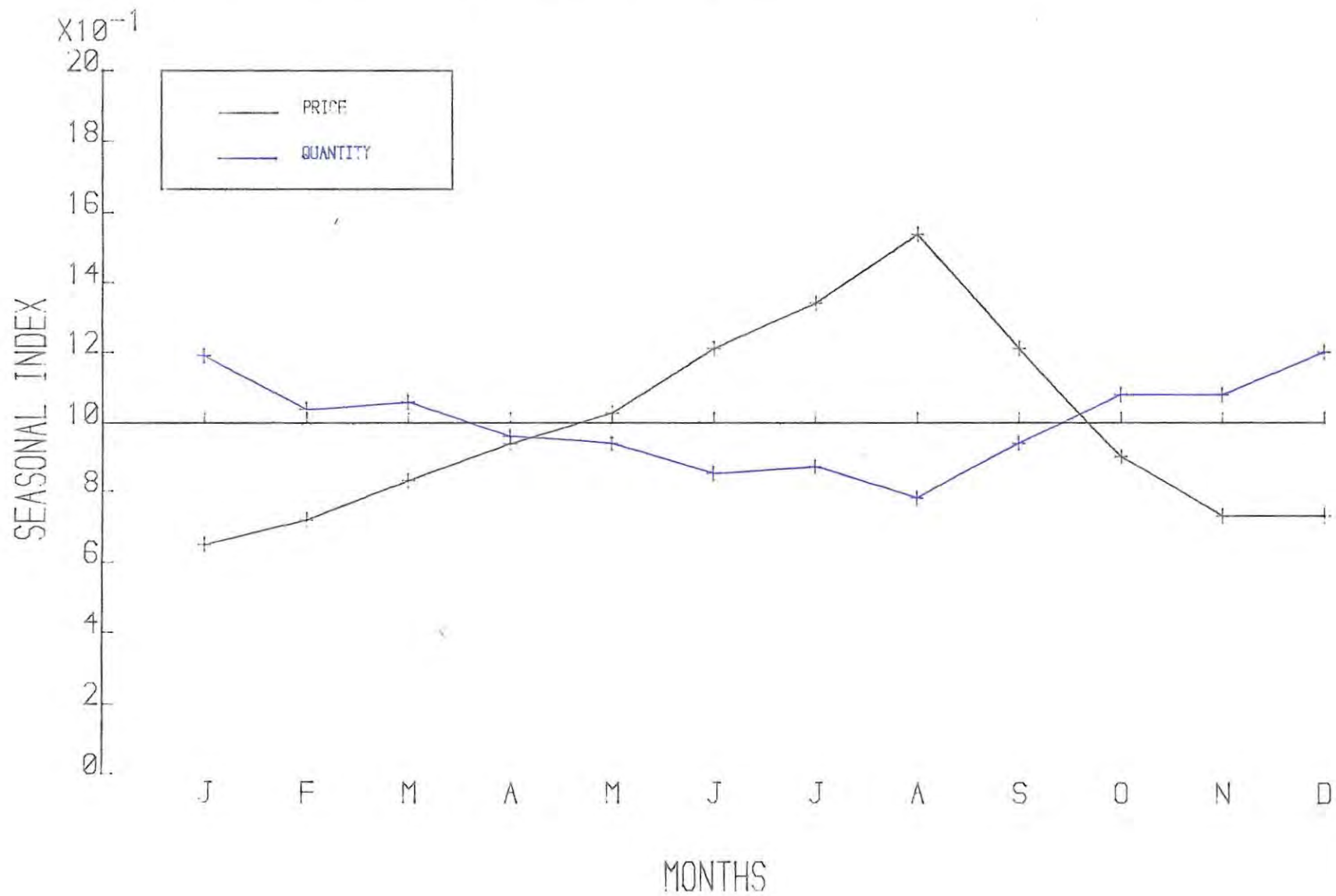


Figure 4.10: Potatoes: Seasonal price and quantity indexes.

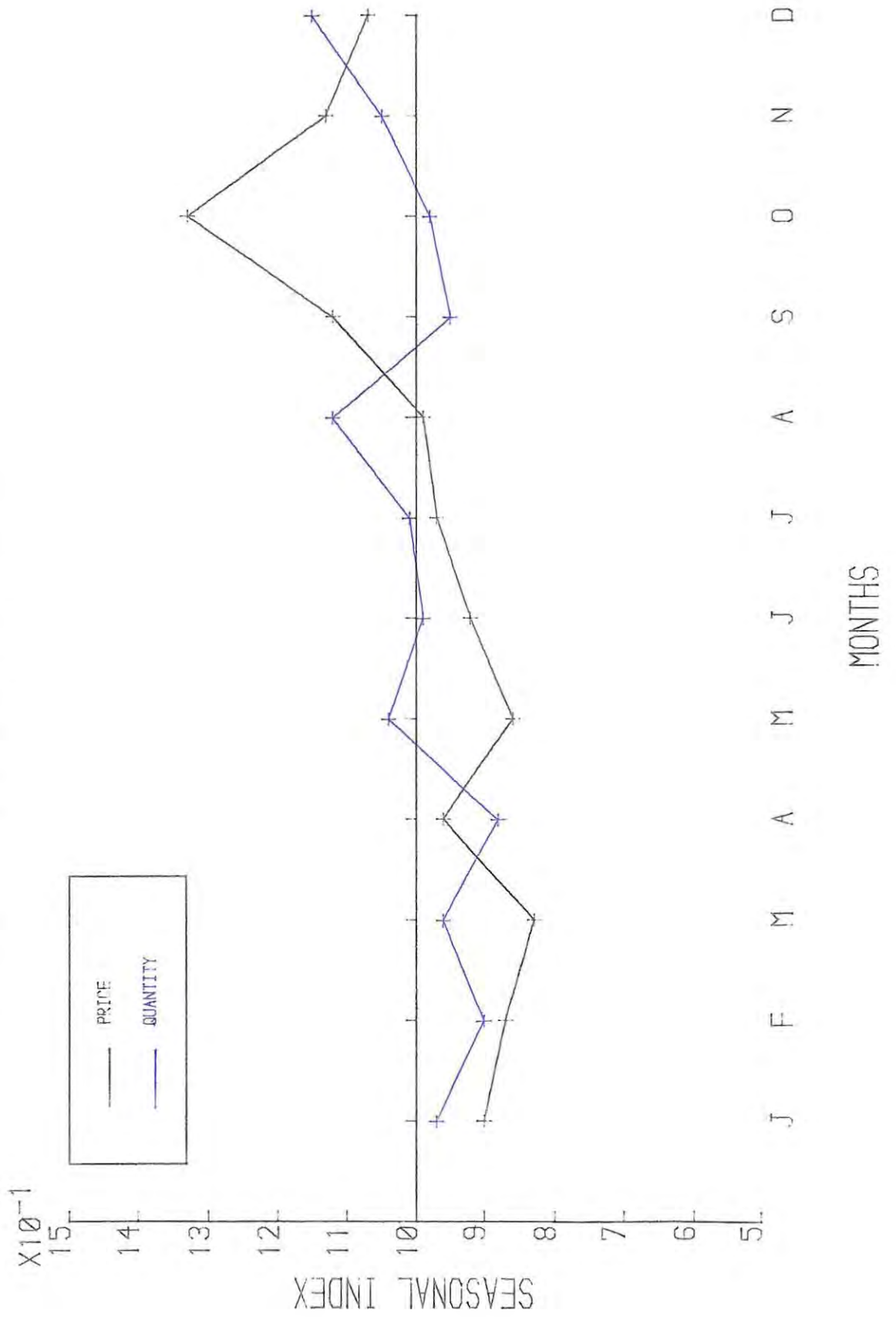


Figure 4.11: Pumpkins: Seasonal price and quantity indexes.

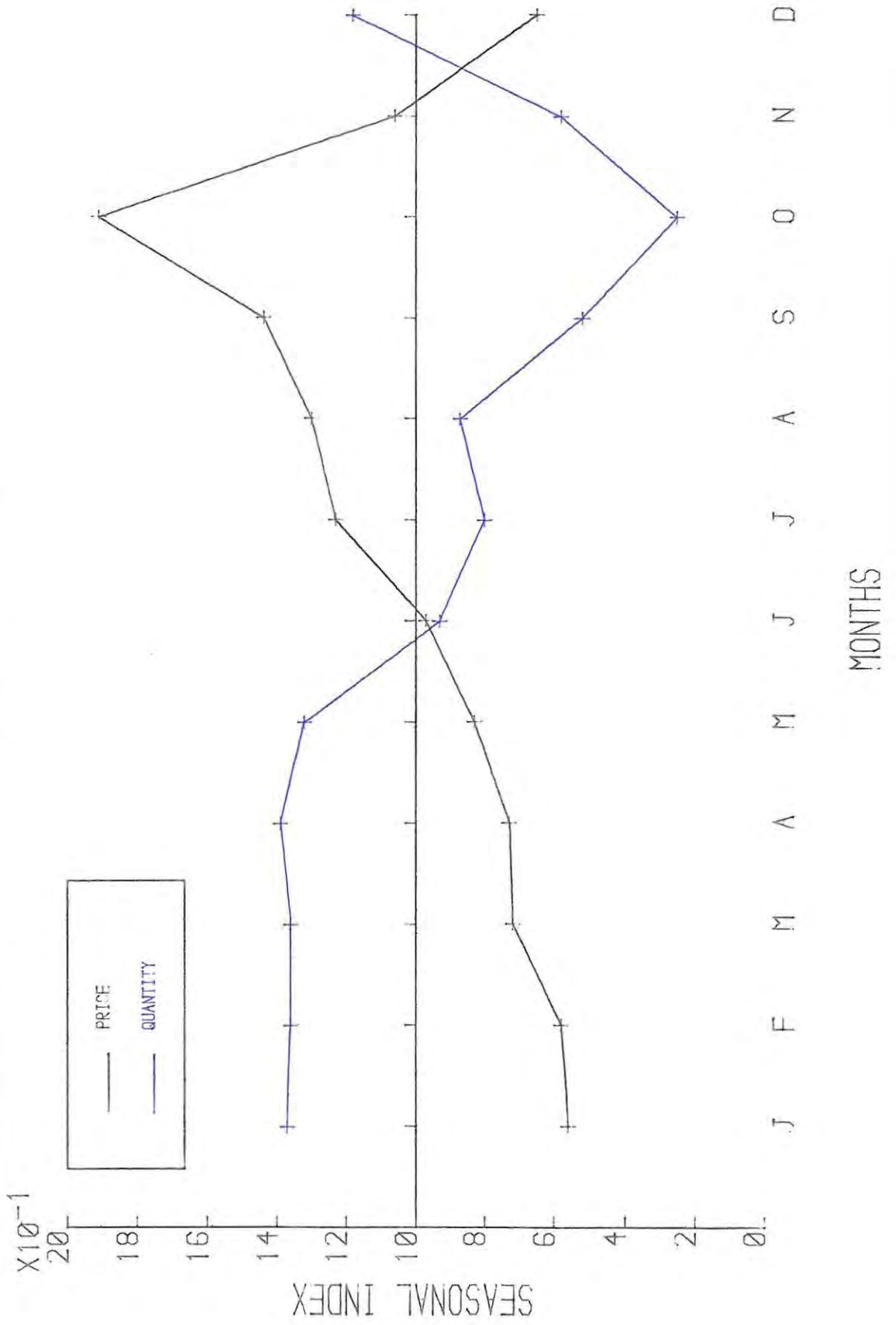
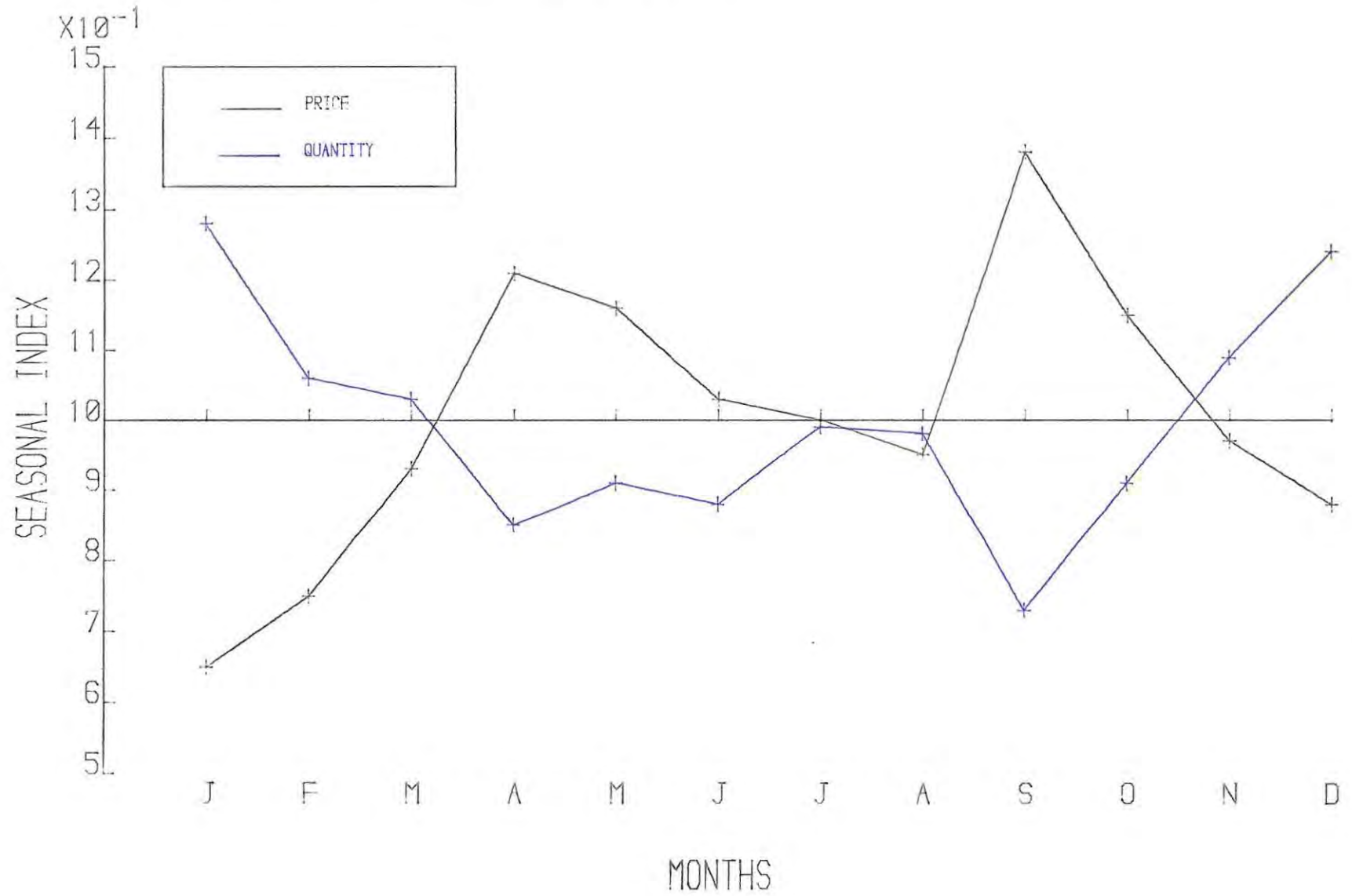


Figure 4.12: Tomatoes: Seasonal price and quantity indexes.



vegetables are almost mirror images of each other. There are occurrences where the seasonal price and quantity indexes do not display the theoretically correct negative relationship. These positive relationships between the price and the quantity indexes are not widespread and only extend for a month or two. The most noticeable incidence of this was in the case of potatoes (Figure 4.10) between June and August. Another point that becomes evident from the graphs is that the changes in the average seasonal price index are larger than those of the average quantity indexes. From a demand point of view, in most cases the vegetables under study are relatively price elastic meaning that a change in quantity will lead to a greater than proportional change in price.

4.1.3 Cyclical variations

Cyclical variations are defined as "long-term movements that represent consistently recurring rises and declines in activity" (Alder and Roessler, 1972,p256). In the case of the vegetables being studied the figures depicting the cyclical variations do show a certain amount of recurring movement. The cyclical movement of the prices of the vegetables however, do not occur consistently and the cycles that are present are not of equal length. A factor that tends to disguise any cyclical movements is the presence of minor fluctuations in the cyclical indexes. These minor fluctuations are probably the result of irregular influences still present in the data. They are particularly prevalent in the cyclical figures of cabbages, carrots and

tomatoes. By smoothing these out freehand it is possible to obtain a better idea of the cycles.

All the vegetables with the exception of pumpkins display four or five discernable cycles. Pumpkins only show one movement that resembles cyclical movement. For the rest the cyclical index for pumpkins consists of minor shifts that do not show any cyclical pattern. The movements displayed by the cyclical indexes of the vegetables do not only vary in length but also in amplitude. Some of the cycles show large differences in the cyclical indexes from the peaks to the troughs whereas for others the difference is rather minor. There are a number of possible reasons for this lack of recurring cyclical movement in the prices of vegetables. Firstly, the level of production of a crop can be altered with greater ease and speed than is the case with enterprices such as cattle and pigs which result in regular cycles in their prices. Another possible reason is that the producers growing the crops are widespread and do not always grow for a particular market but supply the market that has the highest price at that time.

4.2 Results of analysis of covariance

The prices obtained for the produce are determined by the quantity of produce supplied to the market. In order to determine for which months the best prices are obtained, independent of the quantity, the prices have to be adjusted according to the quantities supplied to the market. The analysis of covariance is therefore employed in this study to adjust the prices of the vegetables studied on the

East London municipal market for the variations in the quantities delivered to the market. This consists of a regression analysis, which is used to adjust the prices of the vegetables for differences in the quantities, and an analysis of variance, which indicates whether the adjusted means for the months are significantly different from each other. In the analysis of covariance a randomised blocks type of design is used with the dependent variable (Y) being the deflated prices of the vegetables and the independent variable (X) being the quantities supplied to the market. The treatments are taken as the months of the year and the replications are the individual years over which the study was conducted. This section will be studied by looking at the regression analysis and the analysis of variance separately.

4.2.1 Demand elasticities of selected vegetables

The regression equations generated by the analysis of covariance are shown in table 4.8. Theoretically there should be a negative relationship between the price of the vegetables and the quantity. This is the case with all the vegetables and can be seen by the negative value of β . The negative value of β has an effect on the adjustment of the prices due to differences in the quantities. If the average monthly quantity is greater than the grand mean quantity for that vegetable then the adjusted average price for that month will be lower than unadjusted average price for that month. The opposite is the case when the average monthly quantity is less than the grand mean.

The r-squared values for the regression show that quantity alone

Table 4.8: Regression coefficients and coefficients of determination. Equation $Y = A + \beta X$.

	a	β	r^2
Cabbages	44,41	-0,052	0,38
Carrots	169,61	-1,964	0,53
Onions	149,12	-0,533	0,45
Potatoes	106,26	-0,057	0,34
Pumpkins	53,65	-0,182	0,59
Tomatoes	177,00	-0,295	0,66

does not explain very much of the variation in the price of the vegetables. The coefficient of determination of the regression for tomatoes shows that 66 percent of the variation in the price is explained by the regression. Of the other vegetables the regression explains more than 50 percent of the price for pumpkins (59 percent), and carrots (52 percent) and the vegetable that has the smallest proportion of the variation in the price explained by the regression is potatoes (34 percent). The price of the vegetables are also influenced by many other factors such as the prices of other vegetables, income, population, tastes and preferences.

The regression equation is also useful in calculating the demand elasticity for the particular vegetables. The elasticity is the percentage change in the quantity due to a give percentage change in the price. This is calculated by using the following

equation:

$$\sum_D = \frac{\Delta q}{\Delta p} \times \frac{p}{q}$$

Because the price is the dependent variable in this equation, the elasticity has be taken as the reciprocal of the following equation (Vosloo and Groenewald, 1969, p25):

$$\frac{\Delta p}{\Delta q} \times \frac{q}{p}$$

An elasticity of greater than one means that a one percent change in the price will result in a greater than one percent change in the quantity demanded. If this is the case then a given decrease in the price will result in a proportionally greater quantity being demanded and therefore increasing the total revenue derived from the sale of that quantity of the produce. As this continues the elasticity at successive points will decrease. The total revenue will continue to increase at a decreasing rate and will reach a maximum at the point where the elasticity is equal to one (Shepherd, 1963, p87). The opposite argument may be used in the case where the elasticity is less than one where a one percent change in the price will lead to a one percent change in the quantity demanded.

The elasticity of the vegetables being studied vary from 1,17 for onions to 2,03 in the case of pumpkins. This means that proportionately more would be demanded at a lower price and that the total revenue could be increased by a greater quantity being supplied to a market. These elasticities are calculated for the average quantites that have been delivered to the East London

market.

Shepherd (1963, p96) puts forward a formula by which the quantity required to bring in the highest total revenue can be calculated. He states that the "...derivation of this formula can be visualized by remembering that if the data are plotted in index form, so that the base is 100 = the average of a series, a tangent to the demand curve would cut the x axis to the right of 100 at a point equal to the coefficient of elasticity (ignoring sign) multiplied by 100". The formula is

$$P = \frac{(1 + e) 100}{2},$$

where P is the production that maximises total revenue, and e is the coefficient of elasticity of demand.

The elasticity of demand for all the vegetables in the study are greater than one which implies that if a larger quantity were supplied to the market the total revenue would be increased. The prices and quantities of the vegetables that would result in the maximum total revenue being obtained are shown in table 4.9. In the case of pumpkins, potatoes and cabbages, which had the highest elasticities, the elasticities would become one after the quantities had been increased by 52, 32 and 32 percent respectively. For these three vegetables the market could therefore support a far larger quantity than has been supplied on average. The market could support larger quantities of the other vegetables but not increases of the same magnitude.

Table 4.9: Elasticity at average price and quantity and price and quantity where elasticity is one.

	Midpoints		Elasticity at Mid- points	Elasticity:-1	
	Price (R/tonne)	Quantity (tonnes)		Price (R/tonne)	Quantity (tonnes)
Cabbages	27,54	323,08	-1,63	22,20	426,20
Carrots	93,44	38,79	-1,23	84,80	43,19
Onions	80,49	128,66	-1,17	74,56	139,78
Potatoes	66,03	707,02	-1,64	53,13	933,75
Pumpkins	35,95	97,26	-2,03	26,83	147,39
Tomatoes	100,30	260,34	-1,31	88,50	300,41

4.2.2 Determination of months with highest prices

Once the price means of the vegetables had been adjusted for the quantities making use of the formula put forward in the previous chapter an analysis of variance was made on the adjusted prices. The analysis of variance tests whether the adjusted means are significantly different from each other. For this to be the case the calculated F values must exceed the tabular F value for 11 and 131 degrees of freedom which is 2,37 at the 1 percent level of significance. The calculated F values for the vegetables tested on the East London market ranged from 4,89 for onions to 10,86 for potatoes. The adjusted means of the vegetables are therefore all significantly different from each other at the one percent level of significance.

The prices are adjusted as if a fixed quantity had been supplied

to the market each month. This is the same as holding the supply constant for each month of the year. Therefore if the prices vary from month to month it must be the result of shifts in the demand for produce. Factors such as the level of income and the size of the population do not change as quickly and frequently and are therefore not likely to cause such short term changes in demand. The prices of other vegetables and seasonal changes in tastes and preference are more likely to result in the differences in demand. A decrease in the price of other vegetables should cause a decrease in the demand for the vegetable concerned and vice versa. At particular times of the year tastes and preferences may change in favour of a particular vegetable, which may be the case, for example, out of season, and could result in an increase in demand.

Since the adjusted means for the months are significantly different from each other it is necessary to investigate the adjusted means for the individual months. By calculating the average least significant differences it is possible to determine which individual months are significantly different from each other. In this way it is possible to establish which month has the highest adjusted mean price and which months are significantly lower than it.

The month that has the highest adjusted mean price for cabbages is May (Table 4.10) although there is no significant difference even at the 5 percent level between the months from May to August. The adjusted mean price for April is significantly

Table 4.10: Cabbages: Adjusted means for months and tests of significance.

<u>MONTHS</u>	<u>UNADJUSTED MEAN</u>	<u>ADJUSTED MEAN</u>
JANUARY	22,02	21,20*
FEBRUARY	23,85	20,09*
MARCH	30,56	26,39*
APRIL	34,19	28,85**
MAY	40,02	35,00
JUNE	37,61	31,98
JULY	33,97	30,65
AUGUST	31,05	31,81
SEPTEMBER	23,62	27,72*
OCTOBER	18,28	26,49*
NOVEMBER	15,98	25,11*
DECEMBER	19,35	25,19*

Test of significance of adjusted means for months $F = 5,41^*$

Average least significant differences (2 adjusted treatment means) (131 D F):-

5% level of significance = 5,49 (T = 1,960)

1% level of significance = 7,22 (T = 2,576)

* = 1% level of significance

** = 5% level of significance

Table 4.11: Carrots: Adjusted means for months and tests of significance.

<u>MONTHS</u>	<u>UNADJUSTED MEAN</u>	<u>ADJUSTED MEAN</u>
JANUARY	76,96	69,72*
FEBRUARY	91,34	81,74*
MARCH	120,84	104,46
APRIL	143,14	117,65
MAY	117,74	108,65
JUNE	112,28	101,56
JULY	103,29	99,37**
AUGUST	93,12	100,52
SEPTEMBER	71,19	90,14*
OCTOBER	63,58	91,82*
NOVEMBER	62,52	84,57*
DECEMBER	65,25	71,06*

Test of significance of adjusted means for months

F = 5,45*

Average least significant differences (2 adjusted treatment means)

(131 D F):-

5% level of significance

= 17,32

(T = 1,960)

1% level of significance

= 22,76

(T = 2,576)

* = 1% level of significance

** = 5% level of significance

Table 4.12: Onions: Adjusted means for months and tests of significance.

<u>MONTHS</u>	<u>UNADJUSTED MEAN</u>	<u>ADJUSTED MEAN</u>
JANUARY	53,82	63,33*
FEBRUARY	58,84	61,07*
MARCH	68,31	72,83*
APRIL	75,14	71,88*
MAY	88,08	84,97*
JUNE	101,56	92,05**
JULY	114,66	106,84
AUGUST	128,09	114,48
SEPTEMBER	93,65	89,87**
OCTOBER	64,65	68,85*
NOVEMBER	58,31	64,46*
DECEMBER	60,80	75,27*

Test of significance of adjusted means for months

F = 4,89*

Average least significant differences (2 adjusted treatment means)

(131 D F):-

5% level of significance

= 20,63

(T = 1,960)

1% level of significance

= 27,12

(T = 2,576)

* = 1% level of significance

** = 5% level of significance

different from that for May at the five percent level. The remaining months of the year are significantly different at the 1 percent level. The demand for cabbages appears to be greatest during the winter months. January and February are the months that exhibit the lowest demand during the year and therefore have the lowest prices. Relatively low prices of other vegetables at this time could be the reason for this decrease in demand.

As was the case with cabbages the highest adjusted prices for carrots (Table 4.11) are obtained during the winter months although the prices did not increase earlier in the year. The month that had the highest adjusted price was April but the prices in March, May, June and August were not significantly different. Of the remaining months, the adjusted price for July was significantly different from that of April at the 5 percent level while the rest were significantly different at the 1 percent level. After a relatively long period during the year with a high demand for carrots it decreases quite substantially until December and January as can be seen by the low adjusted prices for those months.

The demand for onions (Table 4.12), potatoes (Table 4.13) and pumpkins (Table 4.14) appears to be fairly stable throughout the year. This is evident by the relatively small number of months that are significantly higher than the rest. In the case of onions, August had the highest adjusted price. July was not significantly lower and May and September were different at the 5 percent level of significance. The lowest adjusted prices, as

was the case with cabbages, were in January and February. The fact that they are so close substitutes for onions could probably account for the relatively constant demand throughout the year.

All the adjusted prices for potatoes were significantly lower at either the 1 or 5 percent level than the highest adjusted prices which occurred in October. The adjusted prices for November and December were lower at the 5 percent level of significance and the remaining months at the 1 percent level. Potatoes in most households are a staple food and therefore there is a fairly constant demand throughout the year. On the East London market the seasonal quantity index is at a low point in October and consumers are probably prepared to pay a higher price in order to obtain a given supply of potatoes. This may account for the higher demand in October.

The same pattern is evident in the adjusted prices of pumpkins as was seen with potatoes. Only one month, October, was significantly higher than the rest. The difference between the highest adjusted price and the lower ones is of a large order. The magnitude of the October price is probably caused because of the same reason put forward for potatoes. The one difference is that the seasonal quantity index for pumpkins falls to a much lower level than does that of potatoes. The lowest prices are obtained between December and February when the harvest takes place. The prices of a number of other vegetables are also relatively low at that time of the year.

Table 4.13: Potatoes: Adjusted means for months and tests of significance.

<u>MONTHS</u>	<u>UNADJUSTED MEAN</u>	<u>ADJUSTED MEAN</u>
JANUARY	63,15	60,58*
FEBRUARY	60,40	55,50*
MARCH	56,84	54,32*
APRIL	65,72	61,01*
MAY	58,49	59,90*
JUNE	61,99	61,62*
JULY	63,84	64,28*
AUGUST	62,85	68,91*
SEPTEMBER	71,05	69,41*
OCTOBER	82,07	81,73
NOVEMBER	74,44	77,20**
DECEMBER	71,57	77,94**
Test of significance of adjusted means for months		F = 10,86*
Average least significant differences (2 adjusted treatment means)		(131 D F):-
5% level of significance	= 7,41	(T = 1,960)
1% level of significance	= 9,74	(T = 2,576)
* = 1% level of significance		
** = 5% level of significance		

Table 4.14: Pumpkins: Adjusted means for months and tests of significance.

<u>MONTHS</u>	<u>UNADJUSTED MEAN</u>	<u>ADJUSTED MEAN</u>
JANUARY	20,12	26,66*
FEBRUARY	20,71	27,29*
MARCH	26,00	32,59*
APRIL	26,66	33,46*
MAY	31,21	36,74*
JUNE	36,08	34,75*
JULY	44,14	41,21*
AUGUST	46,60	44,76**
SEPTEMBER	51,45	43,42*
OCTOBER	67,11	54,28
NOVEMBER	37,47	29,77*
DECEMBER	23,87	26,58*

Test of significance of adjusted means for months

F = 7,37*

Average least significant differences (2 adjusted treatment means)

(131 D F):-

5% level of significance = 7,80

(T = 1,960)

1% level of significance =10,26

(T = 2,576)

* = 1% level of significance

** = 5% level of significance

Table 4.15: Tomatoes: Adjusted means for months and tests of significance.

<u>MONTHS</u>	<u>UNADJUSTED MEAN</u>	<u>ADJUSTED MEAN</u>
JANUARY	68,20	89,95*
FEBRUARY	78,25	83,16*
MARCH	96,45	99,41**
APRIL	123,50	112,02
MAY	118,98	112,59
JUNE	106,82	98,37**
JULY	97,70	97,07*
AUGUST	92,88	92,30*
SEPTEMBER	131,71	110,98
OCTOBER	107,75	98,90**
NOVEMBER	90,52	98,58**
DECEMBER	90,86	110,28

Test of significance of adjusted means for months

F = 5,08*

Average least significant differences (2 adjusted treatment means)

(131 D F):-

5% level of significance

= 11,57

(T = 1,960)

1% level of significance

= 15,20

(T = 2,576)

* = 1% level of significance

** = 5% level of significance

The pattern of the adjusted prices for tomatoes is completely different to that of the other vegetables studied. The demand for tomatoes appears to change throughout the year. The month that had the highest adjusted price was May. There were three months, April, September and December, which were not significantly lower than the adjusted price of May. March, June, October and November are significantly different at the 5 percent level and the remaining months at the 1 percent level. The adjusted prices are high in April, May and September when there are seasonal lows in the supply to the East London market. This is not the case in December because the seasonal quantity index is at a high point in December. The reason for this increase in demand is possibly a change in taste at that time of the year. For example, during the summer months people will possibly consume more in the way of salads of which tomatoes are often a major constituent.

CHAPTER 5SUMMARY AND CONCLUSIONS

The aims of the study were, firstly, from a time series point of view, to establish whether any predictable patterns were present in the prices of vegetables on the East London market and whether could be of any assistance in the forecasting of prices. Secondly, making use of the analysis of covariance to establish if certain months were "better" than others in terms of price, given a fixed quantity, for the marketing of a particular product. The empirical results put forward in the previous chapter will now be studied in order to establish whether these aims have been achieved.

5.1 Time series

The secular trend as shown by the linear regression fitted to the prices obtained for the particular vegetables did not return any startling results. All the trends showed that there was a general increase in the prices over the time period studied. The increase in the prices as shown by the trend was, however, not significantly different from zero. The fact that there was an increase in the prices was expected because of the state of inflation that has been present in the Republic for some period. Therefore it is concluded that producers can expect the general level of prices to increase but not to any great extent over the short run.

The component of the time series analysis that is of the most use as

a guide to future production patterns is the seasonal variation. The average seasonal index gives a good indication of the months that receive the highest and the lowest seasonal prices. This may be the case even if variation from that average is rather large. In many of the cases the large variation was due mainly to a small number of months that displayed unusually high or low seasonal price indexes. The variation diminished by substantial amounts when the extreme values were omitted. This can be seen in the reduction of the variation in the seasonal indexes of carrots for January, February and November by 13, 16 and 15 percent respectively. The variation in the cost of pumpkins for July reduced by 17 percent when the extreme values were excluded. This lowered the variation in many of the cases to levels that can be accepted as a reliable guide to the seasonal prices for that month. There were a number of months that had coefficients of variation of less than 10 percent after the exclusion of the extreme values. The lowest coefficient of variation from the average seasonal price index was for carrots in September which was only 6,25 percent.

The coefficient of variation for some of the vegetables were reduced by less than 5 percent when the extreme values of those particular months were omitted. This is an indication that the individual items were not very consistent and there was a fairly wide spread in the indexes. Such a result would be acceptable if the original coefficient of variation was of an acceptable order but mainly when there was a small reduction in the coefficient the variation in the seasonal indexes was large. After omitting the extreme values for pumpkins in March the coefficient dropped from 23,61 to 22,22

percent and in November fell from 26,42 to 23,08 percent. The vegetable that proved to be the exception was potatoes where the reduction in the variation was relatively small and actual variation was also small.

The one point that became evident from the seasonal indexes is that the highest seasonal prices for the vegetables studied were mainly in the cooler months. Some may occur a little earlier and others a little later in the year but the seasonal prices in the summer months were always below average. The period studied was divided into three in order to establish whether this pattern was consistent. The general pattern for all the vegetables was found to have remained constant over the different periods. There were a number of inconsistent movements and occasions where the variation between the different periods was rather large but did not persist for any length of time. The producer therefore can be reasonably certain that the seasonal price index is not likely to change over a period of time.

The cyclical influences that were isolated from the data did not show up any consistently recurring movements. The cyclical variations are therefore not of any significant use for producers who are attempting to forecast the cyclical tendencies of the vegetable concerned.

5.2 Analysis of covariance

The analysis of covariance, which was used to adjust the prices received on the East London market according to the quantities supplied to the market, returned some interesting results.

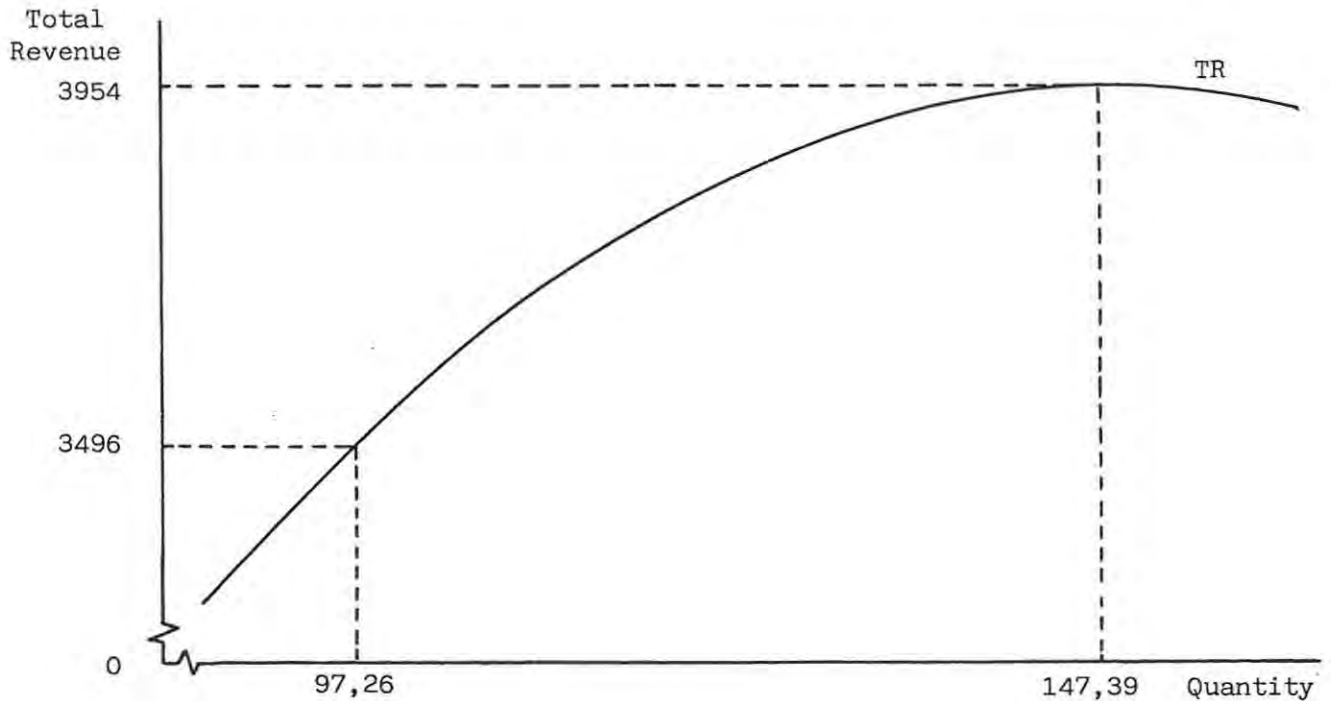


Figure 5.1 Total revenue for pumpkins supplied

The regression analysis of the quantity on the price, which is used to adjust the prices of the vegetables for the differences in the quantities, showed that in half the cases the quantity supplied was the major determinant of the price. The largest coefficient of determination, however, was only 0,66 for tomatoes, while the lowest was 0,34 for potatoes. In other words, the quantity supplied to the market of the various vegetables explained between 34 and 66 percent of the variation in the price. This means that for cabbages, onions

and potatoes, other factors play a more important role in explaining the differences in the price than does the quantity supplied. A multiple regression analysis quantifying the other factors will be necessary to determine the effect on the prices of the vegetables due to the other factors. The demand elasticities calculated from the regression analysis were useful in determining the monthly quantity supplied to the market that will result in the greatest revenue to the producers. This will occur at the point where elasticity of demand is equal to one. The elasticities of demand for the vegetables at the average prices and quantities were all in excess of one and therefore the market was undersupplied in terms of the total revenue that could be attained. Figure 5.1 shows how the total revenue of pumpkins changes with various quantities supplied to the market. The vegetable that came closest to having the optimum average quantity supplied to the market was onions, which had an elasticity of $-1,17$ at the midpoints. The average supply of pumpkins was far short of the quantity that would result in the maximum revenue for that crop, the midpoint elasticity of demand being $-2,03$. The analysis of variance showed that there were significant differences in the prices of the vegetables once they had been adjusted for the differences in the monthly quantities supplied. The fact that the prices vary when the quantities are fixed implies that the demand is varying from month to month. From the point of view of the marketing of vegetables it would be favourable to market the produce when their demand was at its greatest. This occurs when the adjusted prices are at their highest. The demands for cabbages and onions were at their highest during the middle of the year although the high demand for cabbages

persisted for a longer duration. The demand for carrots was higher earlier in the year than the previous two vegetables.

In contrast to the vegetables already mentioned the demands for potatoes and pumpkins were at their highest in October. These increases in demand were also of a shorter duration than with the others. The demand for tomatoes was much more irregular during the year than the demand for any other vegetables. The demand was high during April, May, September and December although the highest adjusted price was received during May.

The months which received the lowest adjusted prices in the case of

Table 5.1: Best and worst months for the marketing of selected vegetables

Vegetable	Best Month	Worst Month
Cabbages	May	February
Carrots	April	January
Onions	August	February
Potatoes	October	March
Pumpkins	October	December
Tomatoes	May	February

each of the vegetables lay between December and March. The one possible reason for the low demand at this time is the availability of other vegetables at relatively low prices. Table 5.1 shows the best and the worst months for the marketing of particular vegetables. It must be borne in mind that there are months for

which the adjusted prices are not significantly different from the best or worst months. They must, therefore, not be seen as the only months when the demand is beneficial or detrimental to the marketing of those vegetables.

The amount of empirical work that has been performed into the marketing of fresh produce on the municipal markets in South Africa has been minimal. The author feels that the scope for further study into this field is vast. This study could take the form of similar studies of the prices of selected vegetables on other municipal markets. This information could be collated and differences in the demand at different times of the year on other markets could be exploited to the benefit of the producers. Another possibility is a study of the prices of a particular vegetable between the different municipal markets in order to develop a strategy for the marketing of that particular vegetable.

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