PRICE INFORMATION IN THE FRESH FRUIT AND VEGETABLE INDUSTRIES IN AUSTRALIA
An Exploratory Analysis of its Effectiveness of Transmission

Occasional Paper No. 47

Bureau of Agricultural Economics, Canberra
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D.A. Weisset and R.B. Whittingham

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The results of preliminary research conducted into the marketing of some key horticultural products by the Bureau of Agricultural Economics are presented in this Occasional Paper. This project has focussed on price information in the central wholesale fruit and vegetable markets in the eastern States and on the provision and use made of price information by market participants.

The volatile nature of short-run fruit and vegetable price movements draws into question the effectiveness with which currently available information is being transmitted through the marketing system and back to producers. Consignments through the markets are determined by the various market participants who act on the information available to them from a number of sources. The investigation reported here has analysed price relationships for selected commodities in order to draw conclusions about the effectiveness with which price information for the fruit and vegetable industries is transmitted through the marketing system.

Grateful acknowledgment is made to officers of State Departments and central market administrations and to many wholesalers in each market visited for their co-operation and advice with aspects of fruit and vegetable marketing.

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PRICE INFORMATION IN THE FRESH FRUIT AND VEGETABLE INDUSTRIES IN AUSTRALIA: AN EXPLORATORY ANALYSIS OF ITS EFFECTIVENESS OF TRANSMISSION

SUMMARY

D.A. Weisell and R.B. Whittingham*

The Wholesale Marketing System

- The wholesaling of fresh fruit and vegetables in Australia occurs mainly through central markets located in capital cities and regional markets distributed throughout the States.

- Increasing urban expansion and improved transportation have resulted in fresh fruit and vegetables being grown at greater distances from these markets.

- Despite the seasonal nature of production in one growing area, rapid inter-market flows of produce occur from other areas in response to price differentials between selling centres.

Price Information Flows

- Responsibility for the establishment and operation of price recording services in wholesale fruit and vegetable markets has historically been vested in State government institutions, growers' organisations and wholesalers' associations.

- Market price reports are distributed via radio, newspapers, farming journals and direct by post.

- It was judged that certain market impediments exist to the collection and reporting of price information but that these imperfections are overcome through a high level of communication between wholesalers, and wholesalers and growers.

Effectiveness of Transmission of Price Information

- For most commodities examined there appears to be an effective transmission of price information at the national level.

- While none of the series examined contain regular seasonal patterns, this does not rule out the likelihood of irregular seasonal patterns.

- It was found that in the short run of periods up to about 8 weeks, price movements tend to be random. In practice, this means that market participants most likely would find it difficult to speculate on price movements over this period.

* With the usual caveat, the authors wish to thank E.L. Jenkins (now with the Department of Primary Industry) and R.C. Trewin for helpful discussions in the formative stages of this study and to G.M. White and J.C. Kerin in the latter stages. Sincere thanks are also due to P. Twyford-Jones for assistance with data collection.
Whenever a consistent timing relationship was found between price series for the same commodity sold in different markets, movement in the prices tended to be in phase. One exception to this was for pineapples where it was found that Sydney prices lagged Brisbane and Melbourne prices.

The physical features evidenced in this study only highlight the technical price relationships involved and do not provide evidence for causation. Follow up research is needed for clarification of particular features of price series.

INTRODUCTION

The national marketing system for fresh fruit and vegetables in Australia comprises a number of State marketing systems, each formed by a central wholesale market located in the capital city and a number of regional or local markets distributed throughout the rest of the State. These marketing systems are facilitated in their operation by the transmission of information between and within all markets. Marketing information enables trade to take place and reduces risk and uncertainty, the effects of which are normally transferred through the system by price.

There is limited knowledge of the temporal and spatial supply and demand relationships for fruit and vegetables passing through various fresh market outlets in Australia. The relative absence in the past of accurate statistics of movements for most commodities throughout Australia has been one cause of sudden fluctuations in wholesale prices in the short to medium term due to the inability of growers and wholesalers to anticipate their production and market requirements respectively through adequate planning. There has been speculation about the importance and meaning of price movements in wholesale markets because of uncertainty of the volume of production not passing through traditional wholesale market outlets, and also, about the importance of wholesale markets compared to alternative competing outlets.

An investigation is made of the effectiveness with which currently available price information is being transmitted. Observations of activities in the Adelaide, Brisbane, Sydney and Melbourne wholesale markets during the development of this study, including information gathered in discussions with people who collect, collate, interpret and distribute price information, have been used to understand better how marketing information promotes the operation of and interaction between wholesale markets. Information was also obtained by surveying wholesalers in Melbourne and Sydney seeking details of information used by wholesalers in their pricing, purchasing and selling decisions. Although referred to in the text, full details of the survey are shown in Appendix A.

The paper is in three main sections. Chapter 1 provides a description of the wholesale marketing system for fresh fruit and vegetables in the Eastern States of Australia, including some principal structural features of the four markets visited. This is followed in Chapter 2 by a discussion of marketing information outlining sources of price and other marketing data and their suitability for empirical analyses and as input to decision making by various industry personnel. Finally, Chapter 3 is an account of an empirical study investigating the effectiveness with which price information is transmitted.
Chapter 1

WHOLESALE MARKETING OF FRESH FRUIT AND VEGETABLES

1.1 THE STRUCTURE OF THE NATIONAL WHOLESALE MARKETING SYSTEM

In the early stages of this study visits were made to the Adelaide, Melbourne, Sydney and Brisbane wholesale fruit and vegetable markets. Reference is made in this Report to the Perth Metropolitan Market for completeness only. It was decided to exclude the Perth, Darwin and Hobart markets because, in the main, produce from Tasmania, Western Australia and the Northern Territory is generally not traded in the markets in the Eastern States due to problems of costs of long-distance freight and perishability of produce. Similarly, it has been reported that produce from the Eastern States is not normally imported into Western Australia except for Queensland bananas and pineapples, South Australian oranges and some vegetables, mainly onions and potatoes, which are occasionally in short supply.

The wholesaling of fresh fruit and vegetables in Australia is transacted mainly in central markets located in each capital city and a number of regional markets distributed throughout each State. Regional wholesale markets are supplied in the main with produce from local growers and by produce subject to secondary wholesaling. A large proportion of the total production of any particular commodity may be sold by direct negotiation between the grower and retailer or pre-packer although prices are usually based on those prevailing in the wholesale markets. A small proportion may also be sold by growers directly from farm or road stalls. Diagram I is a representation of the marketing chain for fresh fruits and vegetables in Australia.

Most fruit entering particular wholesale markets is grown in the same State, but, because of the location and concentration of growing areas for particular commodities, such as Riverland (South Australia) and MIA (N.S.W.) for citrus and the Stanthorpe area (Queensland) for apples, heavy supplies will from time to time originate from other States. For example, tropical fruits such as pineapples and bananas come from Queensland and Northern New South Wales.

The bulk of fresh vegetables sold in the Melbourne and Adelaide wholesale markets is produced locally, that is within 80-100 km of the market although this distance is increasing with increased urban expansion and improved transport facilities. However, in a study of fresh fruit and vegetable marketing in Sydney it is reported that the bulk of both fruit and vegetables moving into the Sydney fresh wholesale markets is produced 300 km or more from Sydney.

(1) Comprehensive details of the operation and structure of the Perth Metropolitan Markets and of fresh fruit and vegetable marketing in Western Australia may be found in [1].

(2) Secondary wholesaling refers to buying or selling farm produce from a principal who is a wholesaler.
Diagram I

DISTRIBUTION OF COMMERCIALY GROWN FRUIT AND VEGETABLES IN AUSTRALIA

Production

II Packing

III Marketing and Distribution

IV Retailing and Consumption

Grower

- Own Packing Shed
- Central (Co-Op) Packing House
- Bulk Shipments
- Prepacking Sheds

Export Trade

- Wholesale
  - Merchant
  - C/Agent
  - Grower/seller

Retailing

Consumer

Farm Sales, Road Stalls, etc
The ease of movement of fruit and vegetables to interstate wholesale markets is greatly influenced by such matters as provision for orderly marketing arrangements in the State in which the produce was grown, restrictions from quarantine and statutory constraints on the movement of produce, the costs of transporting and handling relative to prices received in interstate markets and the structural features of individual markets, such as provisions for the receival and sale of interstate produce.

1.2 CENTRAL WHOLESALE MARKETS(3)

The central wholesale markets are an integral part of the national wholesale marketing system for fresh fruit and vegetables. These markets can be considered, along with other factors such as quality and quarantine standards, to show the manner in which trade is conducted and product movements occur in response to available marketing information.

1.2.1 Description

Within the general trading area(4) provision is usually made for the following types of markets:

(i) an agents' market (including a banana agents' market)
(ii) a grower-sellers' market
(iii) a heavy produce market.(5)

Among the wholesalers, who are also called commercial sellers, operating in the agents' market are:

(i) Primary wholesalers - who are wholesalers who buy farm produce from a grower or who receive for sale or sell farm produce on commission for or on behalf of a principal who is a producer. Thus primary wholesalers may be either

. Merchants - who are primary wholesalers trading other than by receiving for sale or selling farm produce on commission and/or

. Commission agents - who are primary wholesalers who trade by receiving for sale or selling farm produce on commission.

(3) Information provided in Section 1.2 is designed to give an overview of the central wholesale market system. For detailed information on the operation and structure of individual markets, refer to one of the appropriate publications listed in the references.

(4) The 'general trading area' in wholesale markets is usually characterised by the presence of commercial sellers of fruit and vegetables as opposed to pre-packers, trade and bulk suppliers of produce.

(5) Heavy produce includes potatoes, pumpkins and onions.
(ii) Secondary wholesalers - who buy farm produce from another wholesaler or receive for sale or sell farm produce on commission for or on behalf of a primary wholesaler.

The survey showed that in Sydney and Melbourne combined, over 50% of wholesalers operating both as commission agents and merchants, derived more than half their sales turnover as merchants. However, there is a large difference in the total number of wholesalers operating in the various central wholesale fruit and vegetable markets around Australia as the following table shows:

Table 1

APPROXIMATE NUMBER(a) OF WHOLESALERS LICENSED TO TRADE IN CENTRAL FRESH FRUIT AND VEGETABLE WHOLESALE MARKETS IN AUSTRALIA 1975

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<tr>
<td>Melbourne</td>
<td>500 (+ growers)</td>
</tr>
<tr>
<td>Sydney</td>
<td>350 (+ growers)</td>
</tr>
<tr>
<td>Brisbane</td>
<td>40 (No separate growers' markets)</td>
</tr>
<tr>
<td>Adelaide</td>
<td>50 (+ growers)</td>
</tr>
<tr>
<td>Perth</td>
<td>11 (+ growers)</td>
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(a) Although there has been a gradual reduction in the number of wholesalers operating in central markets the number of wholesalers at any point in time can be expected to vary from that shown in the table. The industry has a high turnover of wholesaler tenants caused by liquidation of businesses, amalgamations and retirements.


Primary wholesalers occupy permanent sites for which a rental is payable to the market authority. Permanent sites may be developed such as through the installation of cool room facilities and the provision of office space. The results of the survey indicate that in Sydney and Melbourne combined the majority of wholesalers in the general trading area occupy only one site. Where another site is rented, it is used for selling fruit and vegetables, other than heavy produce, in 70% of cases. It was also found that, for these two markets combined, around 25% of wholesalers have their own cool room facilities but marked differences were noted between the two markets.

On the other hand, grower-sellers may take out a permanent lease on a temporary site or make arrangements for a casual lease, in which case the site used may vary. However, temporary sites must be vacated daily.
1.2.2 Market Administration

There are marked differences between authorities responsible for the administration and control of wholesale markets in Australia and in the degree of autonomy held by these authorities in exercising control. The type of authorities include private companies, departments within local government bodies and autonomous trusts. In general, facilities and market services provided by trusts will be more extensive than those provided by private companies, although the latter assist with some of these facilities and services, such as by calling for tenders and leasing land and buildings for carrying out traditional market activities.

Statutory authorities (Trusts) in Perth, Brisbane and Sydney provide a range of services which include:

- facilities for the storage, sale and packaging of fruit and vegetables
- public utilities such as electricity, sewerage, internal road systems, car park facilities and attendants for policing of internal rules and regulations
- market refuse disposal or the letting of contracts for refuse disposal
- arrangements for casual labour
- the provision of other market facilities such as pallet hire, fork lift trucks, cool rooms and warehouses.

As well as the above functions the Trusts may make appropriate recommendations to parliament (through the Minister) concerning any matter related to the wholesale markets. Recommendations may be made about hours of trading, licensing of wholesalers, collection and recording of the movements of produce, inspection of wholesalers' books, wholesalers' guarantee funds and any matter likely to affect the manner in which trade is conducted and organised within the markets and for the continued efficiency with which farm produce passes through the markets.

In Melbourne, the Melbourne City Council is responsible for the provision, operation and control of the wholesale fruit and vegetable markets, but legislation proposing the formation of a Trust has been passed by the Parliament. (6) In Adelaide, the central markets are operated by two private companies, the Adelaide Fruit and Produce Exchange Company Limited and the East End Market Company. These two companies are owners of real estate and lease stalls to licensed wholesalers. The Melbourne City Council and the Adelaide market companies provide a small staff of service personnel, maintain public utilities (water, sewerage, electricity, refuse disposal, etc.) and assist by providing accommodation for other facilities normally found in a market, such as pallet and barrow hire and warehouses.

(6) This legislation arises in part from recommendations made by the Report of the State Development Committee on The Administration and Operation of the Melbourne Wholesale Fruit and Vegetable Market, Victoria 1973.
1.2.3 Impediments to the Free Movement of Produce and the Collection of Market Prices

The physical size of markets and the allocation of floor space between different classes of commercial sellers influence patterns of trade in the markets. The spatial separation of sellers in different buildings, separation by car parks, loading bays and storage sites, etc. impedes the assemblage of quantity and price information by sellers, buyers and market news officers.

Buyers tend to meet these circumstances by established buying patterns and dealing with a limited number of commercial sellers. Price and quantity recording by market news officers, on the other hand, takes place during the period of active trading. However, some sales may be negotiated outside this period so that all price movements, qualities and quantities traded may not be reflected in published data.(7)

Variations between market regulations covering entry and exit of produce from the markets may affect the profitability of an agent's business while also affecting some growers' consignments. Regulations restricting the delivery of produce from specified growing areas place some growers at a disadvantage for access to particular markets. Also, as operations in fruit and vegetable markets are generally labour intensive, wholesalers may be required to pay wages and salaries for casual labour at overtime and penalty rates, particularly when deliveries are restricted to specific hours.

(7) Market price recorders typically take a number of quotes, usually about twenty for each commodity, in order to obtain a range of prices before averaging to give a market price.
AN EXAMINATION OF THE AVAILABILITY AND TRANSMISSION OF PRICE INFORMATION

This chapter describes the main features of the commodity reporting services and assesses the price information collected.

2.1 DEFINITION AND AVAILABILITY OF MARKETING INFORMATION

'Market information includes or may be defined as any information about prices, supply, demand and stocks, as well as about government policy and other background factors affecting the markets on which the operator (end-user of the information) bases his actions' [4].

This definition includes data which, in total, are used to reduce the degree of risk and uncertainty associated with decision making about markets and marketing activities. Accurate and timely marketing information is the core of the efficient performance of any marketing system. The importance of information in facilitating effective trade in the market, in reducing costs in the marketing system and the consequences of decisions made on incomplete information, has been investigated by Vincent ([5], pp. 80-81).

'Producers, traders and consumers all require accurate information on demand, supply and price if the marketing mechanism is to work effectively. Improved market information reduces risks in marketing and thereby reduces costs and ensures the most efficient operation of the market'.

The way in which information performs these functions is difficult to quantify. It can be readily understood how exchange could fail to take place with a complete lack of knowledge. However, while the market cannot work without some information the assumption of 'the more, the better' may not hold true. The satisfactory functioning of a market requires a level of information together with appropriate characteristics such as accuracy, timeliness, type, cost relative to benefit and intelligibility.

If marketing information is to be useful for decision making on future actions it should also be adequate in coverage and reliable. In particular, marketing information does not relieve individuals from the responsibility of judgments on their own behalf. Thus information relates to particular uses and requires appropriate presentation, dissemination and collection procedures.

Existing information services available to the Australian fruit and vegetable industries are largely centred on Government sponsored authorities such as respective State agriculture departments, State marketing boards, the Commonwealth Department of Primary Industry and rural industry organisations. These organisations provide information about prices, quantities, market assessments, predictions, commodity surveys, outlook reports, trade and policy developments and many other...
related fields of information. (8) The principal media used for disseminating currently available information are published reports, radio broadcasts and newspapers.

Reliable statistics of the volumes of commodities marketed through wholesale fresh outlets and the distribution by outlets are generally available from marketing boards or committees controlling the handling and movement of supplies of fruit and vegetables. Examples are the Citrus Organisation Committee of South Australia, the South Australian Potato Board and the Western Australian Potato Marketing Board, which are each responsible for the orderly marketing of their products in their respective States. As the vast majority of Australia's fresh fruit and vegetable produce is not distributed through Boards or under marketing arrangements there remain few reliable statistics measuring the volume of produce entering alternative markets.

The process of recording throughput of the fruit and vegetable wholesale markets in Australia is mostly a recent phenomenon. The Sydney Farm Produce Market Authority and the Melbourne City Council instigated systems in mid-1976 to record throughput in the markets. The Brisbane Market Trust has been recording throughput since 1964 and the Perth Metropolitan Market Trust has been recording the volume of produce sold only by agents since around 1958. To date, no data are available of the throughput of fruit and vegetables for the Adelaide markets.

In general, little research has been conducted into aspects of temporal and spatial supply relationships of fruit and vegetables entering the wholesale marketing system in Australia. As a result there exists little empirical knowledge concerning movements of fresh fruit and vegetables entering wholesale markets, origins of supply, methods of transport, price information and the other issues which affect growers' consignment decisions.

Some recent work has been carried out on the timing and location of potato production in Australia by Hackett and Rattigan [6] in which typical monthly production cycles in Australia's principal potato growing districts were estimated. These authors also investigated the extent of on-farm storage and disposals of potato production in Australia [7]. This has been, perhaps, the first attempt to co-ordinate detailed statistics to estimate national flows of a fruit or vegetable in Australia. Other studies have, however, investigated particular aspects of flows onto a single market (for example see [8], [9], [10], [11], [12], [27] and [28]).

The lack of detailed quantity statistics for fruit and vegetables entering wholesale markets in Australia leads to conjecture about the importance of these markets as indicators of the industry's situation. Hackett and Rattigan claim that only 20% of the total value of apparent retail sales of potatoes in N.S.W. passes through the Sydney primary wholesale markets. In Adelaide it is reported [13] that between

(8) More complete details of the organisations involved in the collection and dissemination of marketing information and sources in Australia may be found in Deficiencies in Market Information, Report, 4, Chapter 4 and Annex A.
40% and 60% of wholesale produce sold in the Adelaide metropolitan area by-passes(9) the central markets, although a more recent estimate places this figure at 38% [14]. In Melbourne no firm estimates of the incidence of by-passing the markets are available but the incidence and issues surrounding by-passing provided a 'good deal of evidence, some of it ill-informed' concerning the situation, and 'no other matter was so exhaustively covered in evidence submitted' to a State Development Committee Investigation ([15] p. 41).

The price and commodity reporting services provided by the various State agriculture departments and grower and wholesaler organisations provide information in each of the central wholesale markets. They form the primary source of price information about the central fresh fruit and vegetable wholesale markets which is transmitted to growers, wholesalers, retailers and other interested persons and organisations.

2.2 MARKET REPORTING SERVICES IN THE FRUIT AND VEGETABLE WHOLESALE MARKETS

Responsibility for the establishment and control of information services in wholesale fruit and vegetable markets in Australia has historically been vested in public institutions as part of the wider recognised responsibility of government to provide facilities in the community for the wholesaling of fruit and vegetables. In recent years the trend towards the establishment of Trusts to administer and control wholesaling operations has brought about an awareness of the role of public institutions in the provision of marketing information services, particularly in view of the high costs of providing these services. The role and relationship of alternative price recording services, such as occurs in Queensland and South Australia, may also show the need for a reassessment of the bases for providing these services by State governments, particularly in relation to the degree of emphasis expected to be placed on the relevancy and adequacy of existing services.

The South Australian Fruit Growers' and Market Gardeners' Association has provided a fruit and vegetable wholesale market price and commodity reporting service since about 1930 and the Chamber of Fruit and Vegetable Industries has been recording and reporting market prices for more than fifteen years. The Perth Metropolitan Market Trust compiles a market report of prices which are collected from agents who complete a Fruit and Vegetable Schedule indicating lines of produce sold and the range of prices, namely most sales, specials and others.

The market news officers in the State agriculture departments in New South Wales, Victoria and Queensland have provided a continuous service of recording marketing information for fruit and vegetables for a number of years. In Sydney, officers of the Division of Marketing and Economics have provided a continuous record of wholesale and retail prices for fruit and vegetables since the late 1920s. In Melbourne, officers of the Market News Service have been recording price and other marketing information since the markets commenced operations at Footscray in 1969 and prior to this at the Queen Victoria markets since 1965. In

(9) By-passing the market refers to transactions concerned with the wholesaling of fruit and vegetables through channels other than those provided for this purpose in wholesale markets.
Queensland, officers of the Marketing Services Branch have been recording market price information at the Sherwood Road markets since trading commenced there in 1964, and prior to this at the old Roma and Turbot Street markets since the late 1940s.

In each of these markets price information is collected for a wide range of produce and a qualitative assessment is made of levels of supply and demand and of carryover stocks. Reports are prepared each day the markets are open and these are made available for collection at the markets and for postal distribution. The information is also distributed via radio broadcasts through the ABC and selected regional commercial networks, newspapers and agricultural journals.

In addition to the market price reporting services offered by the Queensland Department of Primary Industries, the Queensland Chamber of Fruit and Vegetable Industries, which is an Association of merchants and commission agents in the Brisbane markets, has extended its interests into a wide range of commercial and marketing areas. In particular, the Chamber commenced a market price reporting service in mid-1976. The price recording activities and market reports prepared are similar to the State Department's reports but have the essential difference that the Chamber interprets its own reports and advises operators on the basis of these reports.

Published market prices are usually quoted in ranges, although attention is given to relating these to qualities, descriptions and sizes of produce with interpretation being left to individual users. The general principles underlying official daily quotations include:

- only fair average quality produce is quoted
- only produce sold is quoted
- prices quoted are most sales at which most produce is actually sold.

However, it is possible that buyers using published information as an input to decision making are using a sale price different from that received by growers whose produce may be sold at a discount (or perhaps premium) from published prices.

2.3 ASSESSMENT OF PRICE INFORMATION FLOWS BETWEEN MARKETS

The essence of efficient market operation is that prices facing producers and consumers should reflect the long-run marginal cost of producers. Prices are used to allocate available supplies, guide production and investment decisions for producers and determine consumption levels for consumers. Therefore a marketing system cannot function efficiently without adequate and suitable price information.

The operation of an efficient market requires that prices reflect all available information and that the information is free, instantaneously available and that agreement exists on what the information means. Where markets are not informationally efficient, considerable and costly external information will be needed such as about producers, consumers, competitors, lags in production and certain technical imperfections in the supply of information. Harris et al,
report studies that doubt whether market participants use all available information, particularly in commodity markets ([16], p. 14). Markets are also likely to be less than fully efficient because information is undersupplied and used inadequately or because of certain non-competitive market behaviour such as through group action in the marketplace.

Flows of price information and produce within a marketing system will be efficient when, after a short adjustment period, movements in prices occur simultaneously in each market. However, this is not to say that prices in each market will necessarily be at the same level after the adjustment; factors such as transport and storage, marketing strategies and costs and quality differences in produce will generally result in price differentials between markets for a particular commodity.

In the absence of efficient flows of price information and produce between markets several situations could arise. If changes in the market conditions (e.g. a change in supply) always occur in one particular market first then it is likely that price changes in this market will lead price changes in other markets over a particular time period. Alternatively, if changes in market conditions occur with equal probability in any market then there will not be consistent relationships between price movements in these markets (during the adjustment period), although price changes will occur simultaneously after this initial adjustment.

Another possibility is that the central markets may be effectively independent of each other due to such factors as geographical isolation, the existence of certain orderly marketing arrangements and the orientation of supplies for a particular market. In these circumstances, it is likely that price movements in the different markets will be independent of each other.

Discussions held with wholesalers in Brisbane, Sydney, Melbourne and Adelaide markets indicated that direct-contact between wholesalers is more important than published information as a source of information about prices. It was also found on the basis of the survey results, that in Sydney and Melbourne combined, around 44% of wholesalers read market reports with interest. Comments by wholesalers about the adequacy and suitability of details contained in reports were concerned with the accuracy of quotes, although other comments included:

- the range of produce quoted was not large enough
- there were not enough details provided, such as sizes, qualities and origins of individual commodities
- prices quoted were not related closely enough to particular commodities
- reports indicated only sales, while not enough details were provided about stocks and unsold produce.

Apart from the general availability of marketing information, a high level of communication between growers and wholesalers, and among wholesalers themselves, is required for the efficient operation of a market. Wholesalers normally anticipate the arrival of produce, after advice from growers of prospective consignments. However, it was found
that in Sydney and Melbourne combined only 60% of wholesalers are notified in advance of the arrival of produce. While a number of growers regularly consign produce to the same wholesaler irrespective of price movements, many wholesalers, including some of those normally in contact with growers, are still largely uncertain of growers' consignment decisions. A large number of consignments are split either between markets or between different wholesalers in the same markets.

The qualitative material contained in wholesale fruit and vegetable market price reports, and the fact that prices tend to be quoted in ranges, emphasises the need for reported prices to be related to particular qualities, sizes and varieties of produce which are also quoted. The long-term success of these reports depends largely upon the accuracy of quoted information and this depends largely on methods of collection. Consistency over time in the activities associated with the preparation of price information is also necessary so that trends in market behaviour are correctly reflected. To enable valid comparisons to be made between markets some attention should be given to standardising methods of collecting, writing up and quoting price information.

One of the most important aspects determining the relevance of price information for growers is the element of 'timeliness'. Because many decisions which have to be made by growers are essentially short-run decisions, such as about harvesting and consignments, price information needs to be current and not historical. For this reason a great deal of published price information is only relevant for growers' longer-term decisions, such as plantings and investment, for which price trends may be more appropriate.

Despite limitations in scope and detail the price data published by the various market reporting services appear to reflect adequately the levels and movements of prices for most commodities sold in the markets. The prices may not, of course, reflect any one individual's transaction price although movements in these prices over time may be expected to follow the general level of market prices.
Chapter 3

AN EXPLORATORY ANALYSIS OF THE EFFECTIVENESS OF PRICING INFORMATION IN THE FRUIT AND VEGETABLE INDUSTRIES IN EASTERN AUSTRALIA

Prices collected by market news officers are used to make some inferences about the effectiveness of transmission of all marketing information. The analysis undertaken examines how effectively information is being transmitted within and between markets by analysing the price movements for selected commodities sold in each of the Brisbane, Sydney and Melbourne central wholesale markets.

In wholesale fruit and vegetable markets, a series of negotiations take place between buyers and sellers in order to arrive at a final transaction price. This price may deviate from the long-run equilibrium price under conditions of imperfect knowledge concerning such matters as market supply and demand, future supplies and qualities of produce. Market prices 'arranged' by wholesalers in the markets move quickly towards equilibrium prices because of the reduced degree of risk and uncertainty of each transaction brought about by the increased availability and use of relevant marketing information [17].

Empirical studies by others have shown that changes in market supplies are responsible for most of the variation in commodity prices in the wholesale fruit and vegetable markets ([12], [18], [19]). Observations of daily price series together with information received from wholesalers and market news officers suggest that weekly price levels are generally established each Monday, when the bulk of supplies arrive in the market. Relatively smaller proportions of total weekly consignments are received for sale on other days of the week. In recent years, the planting of new and improved varieties of all produce, improved cultural methods and the increasing production of winter fruits in Queensland to take advantage of higher out-of-season prices in interstate markets, have tended to reduce the amplitude of seasonal fluctuations in supplies, and hence, of prices ([11], p. 104).

In the short run(10), quantities marketed can only be adjusted marginally, such as by delaying harvest or through the use of cool storage. In an efficiently operating market, prices vary continuously and automatically in response to changes in supply and demand. Prices for all produce will show both short-run and long-run movements as existing supplies are rationed impersonally among buyers prepared to pay the market clearing price.

The hypothesis to be tested is presented in Section 3.1 and the data used in the empirical analysis are explained in Section 3.2. The method of analysis used to test the hypothesis is described in Section 3.3. The spectral and cross spectral results for particular commodities are discussed in Section 3.4 and the results are assessed in Section 3.5.

(10) In this case the short run refers to periods less than the production period for the particular commodity. However, when discussing the results of the empirical analysis the short, medium and long run refer to periods of 2 - 3 weeks, 4 - 8 weeks and 9 weeks and over respectively.
which includes a discussion of some known characteristics of the industries. Finally, the conclusions are drawn together in Section 3.6.

3.1 HYPOTHESIS

As flows of information affect product movements and prices within and between markets it is possible to investigate the effectiveness of transmission of marketing information by analysing commodity price movements between markets.

The specific hypothesis of this study is:

that there are regular seasonal movements in fruit and vegetable prices and these price movements in the Sydney, Brisbane and Melbourne markets are in phase with each other over all periods of time.

3.2 DATA

Average weekly price data for the period 1 July 1966 to 3 September 1976 were available from the Queensland Department of Primary Industries and the N.S.W. and Victorian Departments of Agriculture. It was felt that the data series for South Australia were not comparable to the Brisbane, Sydney and Melbourne markets and consequently the Adelaide wholesale market was not included in the examination.

In choosing the commodities to be included in the analysis, consideration was given to the extent to which each commodity was on sale throughout the year in each of the three centres. Consideration was also given to the importance, or popularity, of the commodity in terms of frequency of use in the household. The commodities chosen are oranges, pineapples, bananas, green peas, green beans, potatoes and tomatoes. (Some details of frequency of use of these commodities are shown in Appendix B). Other than for oranges, the price series for all commodities were continuous, except for an occasional missing observation which was estimated by interpolation. None of the series contained regularly missing observations.

For oranges, a continuous price series was constructed by 'grafting' series for different varieties. This approach was considered acceptable based on the judgment that consumers view different varieties of oranges as much the same commodity. If this were not so, and consumers discriminated between varieties to the extent that prices were significantly different, the analysis would reveal a strong annual effect in the data series.

3.3 METHOD OF ANALYSIS

Prices were chosen as the medium for examining the inter-relationships between markets, for the reasons outlined at the beginning of the chapter. Given the hypothesis to be tested and the form of the data to be analysed, spectral techniques were considered to be the most appropriate analytical method. The application of these techniques will provide information enabling the hypothesis to be tested and the evaluation made of information about prices. They are considered to be particularly appropriate for this type of problem as they do not require
the specification of a rigid model (in the sense of a formal econometric model) for their application, thus eliminating the risk of introducing specification errors in the analysis.

3.3.1 Cross Spectral Analysis

Cross spectral analysis provides a means of examining the relationship between two series, e.g. the relationship between the annual component of two series may be examined ([20], pp. 135-148).

The interpretation of the cross spectrum of two series is aided by consideration of three derived statistics, namely the coherence, phase angle and gain, of which only the first two are required to test the hypothesis.

The coherence between two series X(t) and Y(t) can be interpreted as the proportion of the variance in either series which can be explained by its linear regression on the other series ([21], p. 142). (11)

The phase angle indicates the timing difference between the periodic component of the X(t) and Y(t) series ([22], p. 138).

A useful (and logical) extension of cross spectral analysis is partial cross spectral analysis. Using this technique the relationship between two series may be investigated at each frequency where the effects of other variables in the system have been removed from these two variables ([23], p. 74). It will be necessary to consider partial cross spectral statistics in this study since the ordinary cross spectral statistics when considered in isolation may prove to be misleading. For example, the coherence between Brisbane prices and Sydney prices may be quite high, not because the two variables are highly related themselves over the relevant frequencies, but because both series are strongly related to, say, Melbourne prices. The true relationship between Brisbane and Sydney prices can only become apparent once the effect of Melbourne prices is removed from each of these other price series.

The hypothesis can be tested by the application of cross spectral techniques (both ordinary and partial) to each pair of series. When examining a subset of the frequency range, the coherence between two price series indicates the strength of linear association (or correlation) between these two series over the relevant frequency band. If the phase diagram is a straight line within this frequency band, this indicates that there is a consistent timing relationship between the two series over the relevant frequencies ([22], pp. 96-98).

There are several special examples of straight line phase diagrams of particular interest. If the phase diagram is a straight line of slope k units passing through the origin this indicates that one series (which is identifiable) lags the other by k time units over the relevant frequencies. If the phase diagram is a horizontal line passing through the origin (or equivalently through 2\pi radians), this indicates movements of the two series are perfectly in phase over the relevant frequencies,

(11) The coherence is analogous in concept to $R^2$ of regression analysis.
i.e. movements in the two series occur simultaneously over the particular frequencies.

Thus, cross spectral techniques can be used to assess the degree of linear and timing association between two series, and whether or not any consistent relationship present is invariant over the entire frequency range; the use of these techniques allows the hypothesis to be tested.

3.4 RESULTS OF EMPIRICAL ANALYSIS

3.4.1 Spectral Analysis of Individual Price Series

All of the estimated spectra exhibited the same general shape of downward sloping to the right. This is the typical spectrum shape of an economic time series as discussed by Granger [21] and indicates that short-run price movements contribute relatively less to the total variance of the series than do longer-run price movements.

None of the estimated spectra contained statistically significant peaks indicating that none of the price series examined contained regular seasonal behaviour. However, this evidence does not preclude the existence of very irregular seasonal price movements. Granger [21] points out that if a time series contains a cycle which is not strictly periodic, this will result in any 'peaks' in the spectrum merging together to form a smooth continuous curve.

The spectrum for banana prices in Melbourne lies well above the spectra in both Sydney and Brisbane, indicating that the total variance of the Melbourne series is greater than that for either the Sydney or Brisbane series. The Melbourne banana price spectrum is also very flat across periods of two to twenty weeks, indicating that price movements tend to be random over these periods. (12)

The estimated spectra for several other price series also provide evidence of random price movements in the short run; namely peas (for all cities) over frequencies of periods two to six weeks, beans (for all cities) over periods two to five weeks and potatoes (for all cities) for periods two to three weeks.

The implication of random movements in the price series mentioned is that in the short to medium run prices are random, or approximately random, while in the longer run prices exhibit an upward trend. This appears to be consistent with observed behaviour of the relevant price series and, in practice, this means that 'today's' price will be of no use to a buyer or seller in attempting to ascertain 'tomorrow's' price.

Further details of the results obtained from the spectral analysis of individual series are presented in Appendix C.

(12) A random series will have a flat spectrum since no one particular frequency band predominates.
3.4.2 Results of Cross Spectral Analysis of Series

In order to test the hypothesis both ordinary and partial cross spectral statistics were calculated for each pair of commodity price series among the three cities. It was found that for most pairs of series considered, both sets of cross spectral statistics had to be considered for the nature of the relationship between series to be fully appreciated. The coherence and phase diagrams are shown for pineapples only as this set of partial cross spectral results fully illustrates the range of results obtained in all analyses (see Figures I to III).

Whenever a consistent timing relationship between a pair of series was found, this relationship only held for a subset of the frequency range. Pairs of series which are covered by this general picture are Melbourne and Brisbane pineapples, Sydney and Brisbane bananas, oranges for all three cities, tomatoes for Sydney and Brisbane, peas for all three cities, Melbourne and Brisbane beans (only in the short run) and potatoes for all three cities.

However, while the series appeared to be in phase, the coherences generally ranged from low to very high. Coherences were moderate to high between Sydney and Brisbane bananas and Sydney and Brisbane tomatoes; moderate between Melbourne and Brisbane pineapples, Sydney and Brisbane potatoes, and Melbourne and Sydney potatoes; low to moderate between Melbourne and Sydney oranges, Sydney and Brisbane oranges, Sydney and Brisbane peas, Melbourne and Brisbane peas and Melbourne and Brisbane potatoes; and low between Melbourne and Brisbane oranges and Melbourne and Sydney peas.

There were several exceptions to this general picture. The principal exception being pineapples for which it was estimated that after periods of about 3 weeks, Sydney prices lagged Brisbane (and Melbourne) prices by about 1.5 to 2.0 weeks. There was also some evidence of consistent out-of-phase behaviour in the medium term for beans, although this relationship was not well defined and the interpretation of this behaviour is only tentative. In general, it was found that when a consistent timing relationship was evident between two price series, movements in these series tended to be in phase and, therefore, the hypothesis may be accepted for all commodities except pineapples.

Complete details of the cross-spectral results for individual series, including the analysis of pea and bean prices within the same market, are presented in Appendix D.

3.5 ASSESSMENTS

The results from the empirical analyses show that for most commodities there appears to be an effective transmission of marketing information about prices between the different markets over periods of two weeks and longer. However, the cross spectral results suggest that some factors which may include items such as transport costs, quality differences and perhaps restrictive marketing practices affect these flows to varying degrees for different commodities and cities. In some cases imperfections to the uninhibited market operation may be quite significant, e.g. for oranges in Melbourne and Brisbane. These comments are consistent with the observation that in a given wholesale market prices tend to be inflexible in the very short run responding over time mainly to changes in supplies.
Evidence to support the hypothesis of effective flows of price information and supplies is provided by the results of the spectral analysis of individual series. There was no evidence of regular price movements for any of the commodities in the markets considered, despite the fact that in a given geographical area, production of the commodities investigated tends to be seasonal. This result most likely reflects the atomistic nature of production of most agricultural commodities in Australia, the wide range of climatic regions existing in the eastern zones of Australia and a marketing system which distributes produce relatively freely from marketing controls (e.g. for potatoes see [26], p. 17).

It may also be due to the effective distribution of supplies throughout the year from all production areas in response to anticipated price differentials. Nonetheless, it is still possible that some short-term pricing rigidities may exist due to pricing practices within the industry. A very strong linear and timing relationship was found between Sydney and Brisbane banana prices, while there was no relation between Melbourne prices and either of these other two series. Stability of prices in one market, especially when price stabilising measures are operating, has been associated with a high variability in other markets. (13) For example, the estimated spectrum for Melbourne banana prices suggested that, over periods up to about 26 weeks, these prices are random and have a very large variance.

The results for pineapples are not as readily explained in terms of orderly marketing arrangements. Although about 75% to 80% of pineapple production moves into processing outlets, growers consigning pineapples to fresh outlets are relatively free to consign their produce to whichever market they wish, subject only to State quality and quarantine inspections, especially in Victoria and South Australia. As movements in Sydney prices for pineapples lag both Melbourne and Brisbane prices by 13 and 10 days respectively, it seems that growers send pineapples to both Brisbane and Melbourne markets before sending produce to Sydney which, for some reason, is seen as a less preferred market.

The results obtained for potatoes, green peas and green beans are also consistent with the results obtained in the survey of wholesalers in the Sydney and Melbourne markets, where it was found that around 36% of wholesalers were involved in secondary wholesaling of salad vegetables and around 19% were involved in the wholesaling of green peas and green beans, but that only around 10% were involved in the secondary wholesaling of heavy produce. Results from both the empirical analysis carried out and the survey suggest that the more perishable produce is being sold more quickly before deterioration while other produce such as potatoes is able to be held over during small price fluctuations.

In contrast to the general pattern for most commodities, the results of cross-spectral analysis of banana price series for Sydney and Brisbane show a very strong relationship in both a linear and timing sense. However, no consistent relationship was found between banana prices in Melbourne and either of the other two cities. From the results

(13) This observation has been made by Bureau officers for a number of commodities sold in fresh market outlets. However, empirical support from this study does not provide explanations for this phenomenon.
it seems that bananas supplied to the Victorian market are a residual of supplies to the northern markets which are closer to the production areas in Queensland and Northern N.S.W. From prior information it is expected that a strong relationship should exist between banana price movements in the Sydney and Brisbane markets as supplies to these markets are subject to selected marketing arrangements regulated by the Banana Growers' Federation of N.S.W. and the Banana Sectional Committee of the Queensland Committee of Direction.

The estimated spectrum for Sydney banana prices is notably different from that obtained by Aggrey-Mensah and Tuckwell [11] in a study examining seasonality in the demand for bananas. They found that Sydney wholesale banana prices contained a significant annual component. The difference in the two sets of results is most likely due to the different data periods used in each study. The data used by Aggrey-Mensah and Tuckwell are from 1953 to 1966 while the data used in this study are from 1969 to 1976.

3.6 CONCLUSIONS

This study has examined price relationships for selected fruit and vegetables sold in different wholesale markets. Information gained from a survey of wholesalers in Sydney and Melbourne has been used, together with the results from the empirical analysis, to make some tentative conclusions and draw some inferences about the effectiveness of marketing information in general and of product flows through the marketing system. The methods used in the empirical estimation present the underlying physical properties of the marketing system for fruit and vegetables without necessarily creating evidence of technical relationships in the production and marketing areas. In fact, the analysis of markets for their use made of price and other information does not necessarily lead to clear conclusions, as pointed out by Harris, (16), p. 15.

Similar patterns of behaviour were observed in the different markets for the various commodities considered. It was found that the price series all exhibited the usual behaviour of normal economic variables, but none of the series examined contained regular seasonal movements. With the exception of bananas in Melbourne, the short-run components of the price series all contributed a relatively insignificant amount to the total variance of the series. Further, it is suggested from the results that when a consistent timing relationship existed between price movements in different markets, these movements tended to occur simultaneously, except in the case of pineapples where lags in price adjustments between markets were found.

Although the analysis has been concerned with price data, the results have general implications for the distribution of supplies throughout the marketing system because of the strong relationship between supplies onto the market and wholesale prices, as evidenced by prior information. Therefore, it is suggested from the results, that as supplies are being quickly distributed throughout the wholesale marketing system there is an effective distribution of price information throughout the markets and between the markets and growers which further suggests that, at the wholesale level, there is a relatively high elasticity of supply. Because of the random nature of most short-run price movements
there is limited opportunity for speculative activity over periods of up to about eight weeks. However, in the longer run prices for all commodities exhibited an upward trend.

From a policy viewpoint, there may be limited opportunity for advantage from marketing controls to be implemented for the commodities considered over and above those that may already be in operation. However, due to the problem of by-passing the central markets, which has been highlighted in the study, it is not known whether the results for each commodity are generally applicable over the whole industry. Further detailed information is needed about volumes and prices and percentages of the total crop which is by-passing the markets before the full potential of selected marketing arrangements can be assessed.

Finally, aspects which have not been analysed in this study and which require further investigation include an analysis of very short-run price behaviour over periods up to two weeks. To analyse periods of up to two weeks by the method used in this study would require daily data. From the results of this study it is suggested that wholesalers play an important role in re-directing supplies throughout the marketing system in response to price differentials between markets. It is not known, for example, whether effective flows of produce throughout the marketing system result primarily from the collective action of wholesalers or of growers or whether some contribution is being made by both market participants. As a result, future work in this area should be directed at obtaining relevant price and quantity data at different stages of the marketing process. Estimation of price elasticities of supply at these various stages would assist in understanding and explaining flows of market supplies at all levels as well as assist in the formulation and application of future marketing arrangements should they become necessary.
1. **Background**

The use of marketing information by operators in markets helps to reduce risk and uncertainty which are normally transferred through the system by price. Market recording and disseminating services in wholesale markets have been an important source of marketing information for a number of years.

It was decided to obtain information about certain wholesaling operations and of the usage of marketing information services by conducting a survey of wholesalers in the two largest markets with questionnaires completed during a personal interview.

2. **Aims of the Survey**

The survey was designed to provide information to supplement material obtained during a visit to the Brisbane, Sydney, Melbourne and Adelaide markets. The type of information sought related to wholesalers (and their businesses) operating as commission agents and merchants within the general trading area in the markets i.e. the commercial selling area as opposed to warehouses and other bulk handling depot areas.

The type of information sought about businesses related to general wholesaling operations rather than to detailed activities. The information mainly concerned the type of wholesaling licence held, methods of sale including the type and range of produce handled and some details about the use of published and unpublished marketing information.

3. **Methodology**

The survey was restricted to the Sydney and Melbourne wholesale markets because these two markets account for around 73% of the population of wholesalers in the general trading areas in Brisbane, Sydney, Melbourne and Adelaide markets. It was considered there would be little gain in extending the survey to Adelaide and Brisbane.

Discussions with various wholesale market personnel and market authorities in October 1976 indicated that, to achieve maximum response rate in a survey of wholesalers, the questionnaire should deal with matters of a general nature rather than contain questions seeking detailed information, such as financial statistics and questions about business operations which would require wholesalers to refer to their office records. In view of these comments the questionnaire was designed to yield the required information with the highest possible response rate. Further, the information sought related to the normal business operations over a whole year rather than to any particular time or to any particular activity.

4. **Selection Procedure**

The population of wholesalers was defined as the total number of commercial sellers trading as primary wholesalers i.e. either commission
agents or merchants, in fruit and vegetables within the general trading area in both Sydney and Melbourne markets. Lists of wholesaler tenants were obtained from the market authorities responsible for leasing stalls in the markets. The lists were adjusted to eliminate multiple tenants i.e. tenants carrying out commercial selling under the same business name but from different stalls in the general trading area.

The sample was chosen by systematic selection through the lists. As commission agents and merchants are located in different areas in the two markets, systematic selection ensured that both groups were well represented. Final listings gave a population of 278 wholesalers divided 122 in Melbourne and 156 in Sydney.

The total sample size was restricted to enable two officers to complete personal interviews of wholesalers in two days in each market. Final sample size was 53 wholesalers, which by the nature of the selection procedure, gave 30 wholesalers in Sydney and 23 in Melbourne.

5. Response Rate

Personal interviews were performed in Sydney on 27 and 28 April 1977 and in Melbourne on 3 and 4 May 1977. Questionnaire response rate is as follows:

<table>
<thead>
<tr>
<th></th>
<th>Melbourne</th>
<th>Sydney</th>
<th>Both Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>23</td>
<td>30</td>
<td>53</td>
</tr>
<tr>
<td>No. of respondents</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Percentage response rate</td>
<td>87%</td>
<td>100%</td>
<td>94%</td>
</tr>
</tbody>
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The three non-respondents arose because one wholesaler had closed the business, one was not interested in co-operating under any circumstances and one had finished trading each day before the interviewers had called (at about 8.30 a.m.) although the business appeared to be operating in the registered name shown on the tenant list.

B. SURVEY RESULTS

The results of the survey were used to estimate certain characteristics relating to types of business operations among the population of commercial sellers in the Sydney and Melbourne wholesale markets. The estimates derived relate to the operations of wholesaling businesses in these markets over a full twelve-month period and not to any particular period.

The survey estimates are likely to differ from estimates that would have been obtained if information had been collected from all wholesalers. This difference is called sampling error and a measure of the likely difference is given by the standard error of the estimates.
There are about two chances in three that sample estimates will differ by less than one standard error from figures that would have been obtained from a comparable collection from all wholesalers and about nineteen chances in twenty that the differences will be less than two standard errors.

For example, the survey showed that an estimated 44% of wholesalers operate as both a commission agent and merchant and the standard error of this estimate is 5.8%. This means that there would be two chances in three that a comparable complete collection would give a figure in the range 38.2% to 49.8% and nineteen chances in twenty that the figure would be in the range 32.4% to 55.6%.

In addition to sampling errors, biases are possible from a number of sources (e.g. questionnaire design, interview technique, estimation process). Such biases are expected to be negligible because the survey was intentionally kept small and simple.

It was found that approximately 44% of the population of wholesalers in the Sydney and Melbourne markets combined operate their businesses as both a commission agent and merchant. This compares with 21% who operate as a commission agent only and 35% who operate as a merchant only. These results and others showing the differences between Sydney and Melbourne are shown in Table A-1.

It was also found that, of those wholesalers who operate as both a commission agent and merchant, around 52% derived more than half of their sales turnover as a merchant. Wholesalers who conduct all or part of their business as a merchant were asked to indicate the five major commodities handled on a merchant basis. Answers given were grouped into a number of categories (14) for each of fruit and vegetables. These categories were then ranked according to the percentage frequency of replies. These results show that around 26% included citrus and 22% included apples and/or pears in their answers. For vegetables, around 38% included heavy produce and around 27% included salad vegetables in their answers. These results are shown in Table A-2.

The majority of wholesalers operate only one stall for selling fruit and vegetables. It was found that only 27% of wholesalers have any legal business interest in any other stalls. The results show that 70% of these other stalls were used for selling fruit and vegetables other than heavy produce. The remaining 30% of stalls were more or less evenly divided between those which were used for selling heavy produce only and those used for selling all types of produce. These results and the comparison between Sydney and Melbourne are shown in Table A-3. The results refer to stalls located elsewhere within the general trading area used for commercial selling purposes and exclude warehouses, office space etc.

An increasing trend in wholesale fruit and vegetable markets and of marketing in general has been the greater mechanisation to reduce unit costs of the operations involved in handling, storing and transporting commodities. Individual wholesalers have attempted to contain their

(14) For definitions of categories of produce refer to Appendix A, Table A-2.
expanding rental charges for warehouses, cool storage and other market facilities and of labour costs for all intra-market handling and selling. Included in this capital expansion of individual wholesaling businesses has been the installation of cool room facilities within stalls. The survey results show that currently around 25% of wholesalers have their own cool room facilities but that a significant difference exists between Sydney at around 6% and Melbourne at around 50%.(15)

By estimating the incidence of secondary wholesaling undertaken by commercial sellers, alternative flows of produce within and between markets can be better understood. The results show that around 48% of wholesalers engage in secondary wholesaling in their own market, while around 33% engage in secondary wholesaling in other markets (see Table A-4). Wholesalers were asked to list the five major commodities traded when undertaking secondary wholesaling. These replies were also categorised as before and ranked according to the frequency of replies. These results show that around 30% of wholesalers included citrus and the same percentage included apples and/or pears, while around 12% included grapes in their answers. For vegetables, around 36% included salad vegetables and around 19% included green peas' and/or beans in their answers. These results are shown in Table A-5.

The questions on marketing information were designed to elicit the principal methods of communication between growers and wholesalers and between different wholesalers. Details of methods of communication can be related to growers' and wholesalers' actions which are made on the basis of marketing information made available to them. When asked about the type of information sought by growers, 40% of wholesalers said that growers did not ring up. The remaining 60% indicated that the main information sought by growers included market conditions (price, supply and demand), origins of supplies into the market, details about sales of previous consignments and expected market developments.

On the other hand, when wholesalers were asked for the main details they consider when advising growers about sending their produce, 10% said that they never advise growers. Of the remaining 90% who do, the range of information given to growers included current details of market price and supplies, condition of produce on arrival at the market including presentation and packaging, and advice about despatching consignments such as timing of produce into the market and whether to cool store. Wholesalers provided this information to growers as feedback to help growers make short-run decisions about timing and conditions of produce at harvest and methods of packaging, as all these factors affect prices realised in the market.

In order to carry out secondary wholesaling of produce with wholesalers in other markets certain marketing information is required. The results show that around 55% of wholesalers would like additional information about other markets. Presumably the other 45% of wholesalers who do not want additional information, either have sufficient information at present or do not have any use for this type of information.

When wholesalers want to obtain information about markets in other States it was found that the most frequently used method is the telephone. Around 47% included telephone contact with agents in other

(15) This difference was found to be significant at the 1% level.
markets in their answer, around 29% included information provided by growers and observations of fruit and trucking movements around the markets, around 13% included word of mouth among wholesalers in their own market, only 7% included radio broadcasts as a source of information about interstate markets and the balance of 4% of wholesalers included other means. An interesting result is that none of the wholesalers interviewed indicated published material, such as market reports, as sources of information about interstate markets. These results are summarised in Table A-6.

It was found that 44% of wholesalers read with interest the commodity and price reports prepared daily by market news officers in their own market. This compared with 30% who gave only a casual glance at the reports and 26% who never read them at all (see Table A-7). Comments about the adequacy and suitability of details contained in published market reports were concerned with accuracy of quotes, although other comments included: the range of produce quoted was not wide enough; there were not enough details, such as sizes, qualities and origins of supplies, provided about individual commodities; prices quoted were not related closely enough to particular qualities; reports provided information about sales only, not enough details were provided about stocks and unsold produce.

Table A-1

PROPORTION OF WHOLESALERS IN SYDNEY AND MELBOURNE OPERATING AS COMMISSION AGENTS AND MERCHANTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Melbourne</th>
<th>Sydney</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>S.E. %</td>
<td>%</td>
</tr>
<tr>
<td>Commission agent only</td>
<td>5 (4.4)</td>
<td>33 (7.7)</td>
<td>21 (4.7)</td>
</tr>
<tr>
<td>Merchant only</td>
<td>75 (8.8)</td>
<td>3 (2.8)</td>
<td>35 (4.2)</td>
</tr>
<tr>
<td>Both</td>
<td>20 (8.2)</td>
<td>64 (8.1)</td>
<td>44 (5.8)</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Table A-2

MAJOR CATEGORIES OF FRUITS AND VEGETABLES HANDLED
BY MERCHANTS IN SYDNEY AND MELBOURNE

<table>
<thead>
<tr>
<th>Fruits</th>
<th>%</th>
<th>S.E. %</th>
<th>Vegetables</th>
<th>%</th>
<th>S.E. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus</td>
<td>25.5</td>
<td>(6.4)</td>
<td>Heavy produce(c)</td>
<td>37.8</td>
<td>(7.1)</td>
</tr>
<tr>
<td>Apples and/or pears</td>
<td>22.3</td>
<td>(6.2)</td>
<td>Salad vegetables(d)</td>
<td>27.3</td>
<td>(6.5)</td>
</tr>
<tr>
<td>Queensland fruit(a)</td>
<td>15.8</td>
<td>(5.4)</td>
<td>Carrots</td>
<td>4.5</td>
<td>(3.2)</td>
</tr>
<tr>
<td>Bananas</td>
<td>9.5</td>
<td>(4.4)</td>
<td>Green peas and/or beans</td>
<td>12.2</td>
<td>(4.8)</td>
</tr>
<tr>
<td>Grapes</td>
<td>7.9</td>
<td>(4.0)</td>
<td>Other vegetable varieties</td>
<td>18.2</td>
<td>(5.6)</td>
</tr>
<tr>
<td>Soft fruits(b)</td>
<td>4.7</td>
<td>(3.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other fruit varieties</td>
<td>14.3</td>
<td>(5.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>100.0</strong></td>
<td></td>
<td></td>
<td><strong>100.0</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(a) Tropical fruit varieties, but mainly bananas and pineapples.
(b) Typically stone fruits, not including cherries. (c) Includes potatoes, onions, pumpkins only. (d) Includes cucumbers, tomatoes, lettuce and celery only.

Table A-3

PROPORTION OF WHOLESALERS IN SYDNEY AND MELBOURNE OPERATING MORE THAN ONE STALL FOR SELLING FRUIT AND VEGETABLES:
PROPORTION BY TYPE OF PRODUCE SOLD

<table>
<thead>
<tr>
<th>Item</th>
<th>Melbourne</th>
<th>Sydney</th>
<th>Weighted Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage operating more than one stall</td>
<td>35 (9.8)</td>
<td>20 (6.6)</td>
<td>27 (5.6)</td>
</tr>
<tr>
<td>Proportion of Other Stalls Selling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- heavy produce</td>
<td>28 (16.5)</td>
<td>- ( - )</td>
<td>15 (9.6)</td>
</tr>
<tr>
<td>- other fruits and vegetables</td>
<td>57 (18.2)</td>
<td>83 (15.0)</td>
<td>70 (12.4)</td>
</tr>
<tr>
<td>- both</td>
<td>15 (15.5)</td>
<td>17 (15.0)</td>
<td>15 (9.6)</td>
</tr>
<tr>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Table A-4

PROPORTION OF WHOLESALERS IN SYDNEY AND MELBOURNE ENGAGED IN SECONDARY WHOLESALING

<table>
<thead>
<tr>
<th>Item</th>
<th>Melbourne</th>
<th>Sydney</th>
<th>Weighted Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>S.E. %</td>
<td>%</td>
</tr>
<tr>
<td>In own market</td>
<td>55</td>
<td>(10.2)</td>
<td>43 (8.8)</td>
</tr>
<tr>
<td>In other markets</td>
<td>50 (10.2)</td>
<td>20 (6.6)</td>
<td>33 (5.8)</td>
</tr>
</tbody>
</table>

Table A-5

MAJOR CATEGORIES OF FRUITS AND VEGETABLES TRADED BY WHOLESALERS IN SYDNEY AND MELBOURNE WHEN UNDERTAKING SECONDARY WHOLESALING(+)

<table>
<thead>
<tr>
<th></th>
<th>Fruits</th>
<th>%</th>
<th>S.E. %</th>
<th>Vegetables</th>
<th>%</th>
<th>S.E. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus</td>
<td>29.5</td>
<td>(6.7)</td>
<td></td>
<td>Salad vegetables(d)</td>
<td>35.7</td>
<td>(7.0)</td>
</tr>
<tr>
<td>Apples and/or pears</td>
<td>29.5</td>
<td>(6.7)</td>
<td></td>
<td>Green peas and/or beans</td>
<td>19.0</td>
<td>(5.7)</td>
</tr>
<tr>
<td>Grapes</td>
<td>11.8</td>
<td>(4.8)</td>
<td></td>
<td>Heavy produce(c)</td>
<td>9.5</td>
<td>(4.3)</td>
</tr>
<tr>
<td>Soft fruit(b)</td>
<td>11.6</td>
<td>(4.8)</td>
<td></td>
<td>Carrots</td>
<td>7.2</td>
<td>(3.7)</td>
</tr>
<tr>
<td>Bananas</td>
<td>5.8</td>
<td>(3.4)</td>
<td></td>
<td>Other vegetable varieties</td>
<td>28.6</td>
<td>(6.6)</td>
</tr>
<tr>
<td>Queensland fruit(a)</td>
<td>-</td>
<td>(-)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other fruit varieties</td>
<td>11.8</td>
<td>(4.8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(+): For footnotes see Table A-2.
Table A-6
PROPORTION OF WHOLESALERS IN SYDNEY AND MELBOURNE OBTAINING MARKETING INFORMATION ABOUT INTERSTATE MARKETS: RELATIVE FREQUENCY OF PRINCIPAL METHODS OF OBTAINING INFORMATION

<table>
<thead>
<tr>
<th>Item</th>
<th>%</th>
<th>S.E. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of wholesalers who seek interstate marketing information</td>
<td>74</td>
<td>(5.6)</td>
</tr>
<tr>
<td>Relative frequency of methods of obtaining interstate marketing information:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- phone calls to merchants in other markets</td>
<td>47</td>
<td>(7.7)</td>
</tr>
<tr>
<td>- Information from growers and observations of fruit and trucking movements</td>
<td>29</td>
<td>(7.0)</td>
</tr>
<tr>
<td>- Word of mouth around own market</td>
<td>13</td>
<td>(5.1)</td>
</tr>
<tr>
<td>- Radio broadcasts</td>
<td>7</td>
<td>(3.9)</td>
</tr>
<tr>
<td>- Other means</td>
<td>4</td>
<td>(3.0)</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table A-7
PROPORTION OF WHOLESALERS IN SYDNEY AND MELBOURNE WHO READ MARKET NEWS REPORTS PREPARED DAILY

<table>
<thead>
<tr>
<th>Item</th>
<th>Melbourne %</th>
<th>S.E. %</th>
<th>Sydney %</th>
<th>S.E. %</th>
<th>Weighted Proportion %</th>
<th>S.E. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read with interest</td>
<td>35 (9.8)</td>
<td></td>
<td>50 (8.2)</td>
<td></td>
<td>44 (6.3)</td>
<td></td>
</tr>
<tr>
<td>Casual glance</td>
<td>45 (10.2)</td>
<td></td>
<td>20 (6.6)</td>
<td></td>
<td>30 (5.8)</td>
<td></td>
</tr>
<tr>
<td>Never read reports</td>
<td>20 (8.2)</td>
<td></td>
<td>30 (7.5)</td>
<td></td>
<td>26 (5.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100</td>
<td></td>
<td>100</td>
<td></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
# Appendix B

## Table B-1

<table>
<thead>
<tr>
<th>Fruit</th>
<th>% of Households Indicating Fruit as Variety Most Recently Purchased</th>
<th>% of Households Indicating Frequency of Fruit use as 1.2 or More Days per Week as Fresh Product(a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bananas</td>
<td>70.9</td>
<td>72.9</td>
</tr>
<tr>
<td>Oranges</td>
<td>61.7</td>
<td>70.7</td>
</tr>
<tr>
<td>Pineapples</td>
<td>24.7</td>
<td>43.0</td>
</tr>
</tbody>
</table>

(a) Except Pineapples, which are one or more per fortnight.

Source: Queensland Department of Primary Industries, *Householders' Purchasing Habits and Attitudes to Fruit*, Marketing Services Branch, November 1974, various tables.

## Table B-2

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>% of Households Indicating Frequency of Vegetable Use as Two Times a Week or More</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>74</td>
</tr>
<tr>
<td>White potatoes</td>
<td>62</td>
</tr>
<tr>
<td>Green beans</td>
<td>na</td>
</tr>
<tr>
<td>Green peas</td>
<td>22</td>
</tr>
<tr>
<td>Carrots</td>
<td>24</td>
</tr>
</tbody>
</table>

Appendix C

RESULTS OF SPECTRAL ANALYSIS OF SERIES

In the process of obtaining cross spectral results the estimated spectrum for each price series was obtained. These were analysed for evidence of regular cyclical and seasonal price movements as these phenomena are expected (except under certain distribution and marketing systems) from the seasonal nature of production of the commodities considered. The analyses provided further empirical understanding of market operations and were used, along with the cross spectral results, to obtain a more complete picture of the marketing system in Eastern Australia.

The estimated power spectrum for each of the price series considered in this study are shown in Figures C.I to C.VII. All of these estimated spectra exhibit the same general shape of downward sloping to the right, which is the typical spectrum shape of an economic variable discussed by Granger [21]. The shape indicates that the short-run components of the series contribute relatively less to the total variance of the series than do the longer-run components.

While none of the estimated spectra contain any statistically significant peaks (apart from that at zero frequency), the three-market comparison of spectra for particular commodities reveals some interesting features. This indicates that none of the series examined contained regular cyclical behaviour of any importance. However, this evidence does not preclude the existence of very irregular cyclical price movements (e.g. see [24], p. 32). Granger and Hatanaka [22] point out that if a time series contains a cycle which is not exactly regular this will result in any peaks present in the spectrum merging together to form a smooth, continuous curve.

The spectrum for banana prices in Melbourne lies well above the spectra for both Sydney and Brisbane, indicating that the total variance in the Melbourne series is greater than that for either the Sydney or Brisbane series. Further, this relationship holds over most periods (see Figure C.III). The Melbourne banana price spectrum is flat over the period of two to twenty weeks indicating that price movements tend to be random over these periods. (12) These spectral results differ from those obtained from an analysis of Sydney banana prices by Aggrey-Mensah and Tuckwell ([11], p. 109) who found that a 'substantial proportion of the total variance is attributed to a 52 week cycle'.

The estimated spectra for some other price series also provide evidence for random price movements in the short run, namely, peas (for all markets) over periods of two to six weeks, beans (for all markets) over periods of two to five weeks and potatoes (for all markets) for periods of two to three weeks. The estimated spectra for other series, while not flat, are gently downward sloping to the right.

The spectral results show evidence that for the price series investigated, longer-run price movements assume much more importance than shorter-term price movements but there is no evidence that these movements occur regularly.
FIGURE C.1
ESTIMATED SPECTRA—ORANGES
FIGURE C.II
ESTIMATED SPECTRA—PINEAPPLES
FIGURE C.III
ESTIMATED SPECTRA—BANANAS
FIGURE C.IV
ESTIMATED SPECTRA—TOMATOES

95% Confidence Interval
FIGURE C.V
ESTIMATED SPECTRA—POTATOES

95% Confidence Interval
FIGURE C.VI
ESTIMATED SPECTRA—PEAS

Log$_{10}$ of Estimated Spectrum

95% Confidence Interval

Weeks

Syd.

Melb.

Bris.
FIGURE C.VII
ESTIMATED SPECTRA—BEANS

95% Confidence Interval

Log of Estimated Spectrum

Weeks
Appendix D

RESULTS OF CROSS SPECTRAL ANALYSIS
OF PRICE SERIES

(i) Pineapples

Pineapple prices for Melbourne and Brisbane exhibited moderate coherence (16) over all periods, while the phase diagram indicated that both price series were more or less in phase over all periods.

There were moderate coherences in the medium to long run between Sydney and Brisbane prices, and the phase diagram indicated that Sydney prices lag Brisbane prices by about 10 days over these periods.

Similarly, there were moderate coherences in the long run between Melbourne and Sydney prices, Sydney prices lagged Melbourne prices by around 13 days over these periods. For both these pairs of series, i.e. Sydney and Melbourne, and Sydney and Brisbane, there was no consistent relationship evident between prices in the short run.

Hence, the overall picture of the pineapple market is that Melbourne prices tend to be fairly strongly related to Brisbane prices over all periods (Melbourne prices moving in phase with Brisbane prices) and that Sydney prices lag Brisbane prices (and consequently also lag Melbourne prices) by about 10 to 13 days in the medium to long run.

(ii) Bananas

There was moderate to very high coherence extending over all frequencies between banana prices for Sydney and Brisbane and these price series were effectively in phase over all periods. There appeared to be a very strong linear relationship between banana prices in Sydney and Brisbane and prices in both cities effectively moved simultaneously over all periods (from two weeks to the very long-run periods).

The coherence and phase diagrams for Sydney and Melbourne prices, and for Brisbane and Melbourne prices indicated that there was no consistent relationship between these price series over any periods. Coherences were generally low for these price series and the phase diagrams showed no consistent (timing) relationships.

(iii) Oranges

The cross spectral analysis of orange prices presented a slightly different picture from that obtained for pineapple, and banana prices. Except in the very long run, coherence between orange prices in Melbourne and Brisbane was low. However, the phase diagram indicated that these price series were effectively in phase over all frequencies and, from the results of a simulation study by Granger and Hughes [25], this can be taken as evidence of a consistent timing relationship between these series.

(16) Unless otherwise specified, the use of coherence and phase refers to partial coherence and partial phase respectively.
These results imply that, while price movements for oranges in each market occur in the same direction and at the same time, there is little relation between the magnitudes of price movements in the two cities.

The phase diagram for Melbourne and Sydney orange prices indicated that these price series were in phase over periods ranging from about 3 weeks to the very long run. The series were out of phase in the short run and exhibited low coherence over this period.

Sydney and Brisbane orange prices appeared to be in phase over periods of 2-8 weeks while the coherence values were generally low over these frequencies. In the longer run the two series were out of phase and also exhibited low coherence.

The overall picture obtained from the analysis of orange prices was that, generally, there was no strong linear relationship between any markets over all periods while price movements appeared to be in phase over part of the medium-run period.

(iv) Potatoes

Potato prices for Sydney and Brisbane showed moderate coherence over most of the frequency range and appeared to be in phase over all but the very short-run periods. These price series were out of phase over periods of 2-2½ weeks and the coherence was also low over this period.

Potato price series for Sydney and Melbourne showed moderate coherence over all periods and appeared to be in phase over these periods.

Coherence between Melbourne and Brisbane prices was generally low, particularly in the medium to long run. The phase diagram indicated that these series were roughly in phase over all periods, although the relationship was not well defined.

Hence, it appeared that there was a moderate linear association between price movements for potatoes in markets in adjacent States (i.e. N.S.W. and Victoria, and N.S.W. and Queensland) with the price series being in phase. The degree of linear and timing association between Melbourne and Brisbane prices did not appear to be as strongly defined.

(v) Tomatoes

The tomato price series for Sydney and Brisbane showed moderate coherence over all periods and appeared to be in phase over these periods.

The coherence between Sydney and Melbourne prices and between Melbourne and Brisbane prices was generally low and the phase diagrams indicated that there was no consistent timing relationship between these pairs of series.

Hence, it appeared that tomato prices in Sydney and Brisbane were relatively strongly related linearly and that price movements in these cities occurred simultaneously over all periods. Melbourne tomato prices did not appear to be related (in either a linear or timing sense) to those in Sydney and Brisbane.
(vi) Green Peas

Coherence between pea prices in Sydney and Brisbane was generally low particularly in the short run but these price series appeared to be approximately in phase over periods of 4 to 13 weeks.

The coherence between pea prices in Melbourne and Brisbane was generally low in the medium to long run, although the 104 week period of these two series exhibited moderate coherence. The two series exhibited moderate coherence in the short run, over which periods the series appeared to be in phase.

The coherence between pea prices in Sydney and Melbourne was generally low, although the annual (52-week) component of the two series was more highly related. The two series were generally out of phase although they appeared to be roughly in phase over periods of 3 to 4 weeks.

The overall picture gained from these results is that there was little relationship (in either a linear or timing sense) between the pea markets in the three cities considered.

(vii) Green Beans

Coherence between Melbourne and Brisbane bean prices was generally low in the medium to long run and moderate in the short run. These price series appeared to be out of phase in the long run, but were roughly in phase in the short run.

The coherence between Sydney and Brisbane prices was low to moderate over all periods. The coherence between Brisbane and Melbourne prices was generally low over all periods.

These results indicated that there was generally no strong linear relationship over any periods for any pair of bean price series. However, the phase diagram for each pair of series indicated some consistent out of phase behaviour over periods of 3 to 6½ weeks.

A possible interpretation of the behaviour being exhibited is that Sydney prices lag Brisbane prices by only about 2 days, Melbourne prices lag Sydney prices by about 2 days and Melbourne prices lag Brisbane prices by about 4 days over these periods. However, this suggested interpretation is by no means well defined and should be viewed as indicating an area which deserves closer examination.

Results of Cross Spectral Analysis of Pea and Bean Prices in Each Market

Since peas and beans are viewed by some consumers as substitutes to some degree, it was decided to carry out an investigation of cross product effects by analysing movements of pea and bean prices in each market.
The coherence between pea and bean prices in Melbourne was generally very low over all but the very long-run periods. The two series appeared to be roughly in phase over these periods with no consistent timing relationship evident over the short run. Similar results were obtained for Sydney, although in contrast to the Melbourne results, the coherence was relatively high in the long-run periods.

Coherence between the pea and bean prices in Brisbane was generally moderate in the short to medium-run periods but was high in the long-run period. The series appeared to be in phase over all periods. Hence, it appeared as though there was a strong degree of linear association over all periods between pea and bean prices in Brisbane, with price movements also being generally in phase. In contrast, there was little relationship in price series in the Sydney and Melbourne markets, although there was some (but generally weak) degree of linear and timing association between series over the medium to long-run periods.
REFERENCES


