

THE AGRICULTURAL SECTOR IN NEW ZEALAND -

A JOINT FARM-INDUSTRIAL PERSPECTIVE

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THE AGRICULTURAL ECONOMICS RESEARCH UNIT
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The Agricultural Economics Research Unit (AERU) was established in 1962 at Lincoln College, University of Canterbury. The aims of the Unit are to assist by way of economic research those groups involved in the many aspects of New Zealand primary production and product processing, distribution and marketing.

Major sources of funding have been annual grants from the Department of Scientific and Industrial Research and the College. However, a substantial proportion of the Unit's budget is derived from specific project research under contract to government departments, producer boards, farmer organisations and to commercial and industrial groups.

The Unit is involved in a wide spectrum of agricultural economics and management research, with some concentration on production economics, natural resource economics, marketing, processing and transportation. The results of research projects are published as Research Reports or Discussion Papers. (For further information regarding the Unit's publications see the inside back cover). The Unit also sponsors periodic conferences and seminars on topics of regional and national interest, often in conjunction with other organisations.

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PREFACE

The Agricultural Economics Research Unit has, over recent years, undertaken an increasing amount of research into the off-farm portion of the New Zealand Agricultural Sector. It is considered that more emphasis should be given to this aspect of the New Zealand Agricultural scene as it is apparent that an increasing importance will be associated with off-farm activities in determining the appropriate product forms and competitiveness of New Zealand agriculture.

This Discussion Paper presents the results of research undertaken to identify the macro-economic characteristics of the Agricultural Sector and identifies a number of important relationships that should be further investigated. Based on this background, further in-depth work is being undertaken on an industry/product basis to identify and review the relationships that are relevant to the competitive position of New Zealand agriculture.

J.B. Dent
Acting Director

SUMMARY

Two issues which have attracted the attention of economists and policymakers in New Zealand in recent years are a decline in the size of the farming sub-sector relative to the New Zealand economy and slow rates of growth of real net output and labour productivity in New Zealand when compared with rates achieved overseas.

Insight into the question of why the farming sub-sector has declined in size relative to the rest of the economy can be gained by looking at the Agricultural Sector in New Zealand (consisting of industries supplying inputs to farming, farming itself and the processing, distributing and retailing of farm products). The relative decline in the farming sub-sector has reflected both a compositional change within the Agricultural Sector, with the PDR sub-sector becoming relatively more important, and a decline in the relative size of the Agricultural Sector itself.

In Sections 3 and 4 of this Discussion Paper some attempt is made to explain why these changes have occurred. It is suggested that an increase in the profitability of processing as opposed to producing farm products, differences in the government assistance received and differences in the nature and rate of technological change have been responsible for the compositional changes noted within the Agricultural Sector. A decline in the size of the Agricultural Sector relative to the New Zealand economy is considered to be potentially due to declining terms of trade for Agricultural Sector exports, increasing protection overseas and again, to differing levels of government assistance.

The Agricultural Sector is large in relation to the New Zealand economy (e.g. producing 21 per cent of total real net output in 1976/77), hence, one can expect the growth performance of the Agricultural Sector to be reflected in the growth performance of the economy as a whole. It is found in Section 3 that the Agricultural Sector has performed worse than the New Zealand economy in the two periods 1959/60 to 1965/66 and 1965/66 to 1971/72, although the Sector performed better than the New Zealand economy in the period 1971/72 to 1976/77.

It is also found that significant differences in the rates of growth of real net output and labour productivity (and in changes over time in these rates) have existed between the three sub-sectors of the Agricultural Sector. Although some work has been done on the determinants of labour productivity in New Zealand, identifying the factors responsible for the differences (and changes) noted requires further research.

Attention is drawn to the possibility that rates of growth in the Agricultural Sector may decline in the future. This is thought to be likely given that rates of growth in the increasingly important PDR

sub-sector have declined over time. Further research into the determinants of compositional change and growth is required however.

To complete the picture of the Agricultural Sector, the three sub-sectors of the Agricultural Sector are disaggregated into component industries and the relative size of these industries in terms of real net output and employment is examined. In addition, estimated annual rates of growth of real net output and labour productivity in these industries are given.

A number of questions are raised in the study:

- what factors have been responsible for the compositional change which has occurred in the Agricultural Sector? What technological changes have occurred, for example, and how have government policies affected relative profitability?

- what factors have had the most effect on the size of the Agricultural Sector relative to the New Zealand economy - relative profitability, the relative stability of profits, or government policies as they have affected each of these?

- what factors have determined rates of growth of labour productivity in the three sub-sectors of the Agricultural Sector? Has technological change been important or has an increasing capital intensity exerted a greater effect ?

It is proposed that these questions be addressed in future research.

SECTION 1

INTRODUCTION

For the purposes of this analysis, the New Zealand Agricultural Sector has been defined to include the industries supplying inputs to farming, farming itself and the industries using the products produced in farming. As has occurred in other developed economies, this Agricultural Sector has increased in structural complexity over the past 50 years.

As a consequence of significant innovations in farming technology and changes in the product mix, farming systems have become increasingly complex and intensive in the use of purchased inputs. This has led to an expansion of those industries responsible for producing and supplying the wide variety of inputs used by the farm sub-sector - chemicals, machinery and equipment, credit, contract services etc. These industries may be defined collectively as the input-supply sub-sector of the Agricultural Sector.

The farming sub-sector of the Agricultural Sector has also undergone significant structural change over time, with for example the average size of holdings increasing significantly. One of the consequences of this structural change has been a dramatic increase in labour productivity on farms in New Zealand.

That part of the Agricultural Sector concerned with purchasing farm products and transforming them into final consumer goods for sale in New Zealand and overseas has grown significantly in the past 50 years. Growth has been in both absolute terms and relative terms and this processing, distribution and retailing (PDR) sub-sector now forms the largest part of the New Zealand Agricultural Sector.

In light of the increasing complexity of the Sector, it has become necessary to examine agricultural issues from the point of view of not only the farming sub-sector, but of the input supply and PDR sub-sectors as well.

Issues high on the current policy agenda include the growth prospects of the Agricultural Sector, the export performance of the Sector and the relative income positions of the three sub-sectors. As the relative income positions of the three sub-sectors will be related to their economic structures and behaviour (including the way they interact with one another) these are also issues which need to be discussed.

In order to analyze these matters from the point of view of each sub-sector of the Agricultural Sector, it is necessary to develop a consistent and comprehensive picture of the Agricultural Sector, both as it exists at present and as it has existed in the past. This is the task of the present study. In Section 2 the Agricultural Sector is

depicted diagrammatically and is defined in terms of the New Zealand system of industrial classification. In Section 3 (and Appendix A) the way in which estimates of the relative size of the Agricultural Sector were obtained are discussed. This is followed by estimates of the size of the Agricultural Sector relative to the New Zealand economy as a whole (Section 4), estimates of the relative size of the three sub-sectors of the Agricultural Sector (Section 5) and estimates of the relative size of the industries of each sub-sector (Section 5). An agenda for further research is given in Section 6.

SECTION 2

THE AGRICULTURAL SECTOR DEFINED

In this paper the term 'Agricultural Sector' is used to mean that area of economic activity which consists of supplying goods and services to farming (the input supply sub-sector), of producing farm products (the farming sub-sector) and of converting such output into final products used by domestic and foreign consumers (the processing, distribution and retail (PDR) sub-sector). The composition of the Agricultural Sector as defined in this study is depicted in Figure 1.

As can be seen from Figure 1, primary resources and imports are used by each sub-sector. All of a sub-sector's output need not go to the next stage in the Sector 'chain' but can be exported. The ultimate destination of Agricultural Sector products is the domestic or foreign consumer.

The term 'Agricultural Sector' is not often used as broadly in New Zealand circles as it is in this study - it typically being reserved to mean only farming activities. The broader interpretation has been used frequently abroad however - Phillips (1982) speaks of the Canadian 'Agri-Food' Sector as 'including input suppliers, farmers, processors, distributors, retailers and governments' for example. Similarly, Maunder (1969) identifies the United Kingdom 'Agribusiness' Sector as 'the food marketing industries and also those supplying requisites to farmers'.

The justification for adopting the broader interpretation of the term 'Agricultural Sector' is that the primary objective of farming is to make final products available to consumers. If the nation's efficiency in making these products available is to be studied, it is all links in the production and distribution chain which will need to be examined, not merely one. Thus the Agricultural Sector definition used in this study, and not merely farming, has been considered more appropriate.

The industries which have been included as components of the Agricultural Sector as defined in this study are listed below with their New Zealand Standard Industrial Classification (SIC) codes (Table 1).

Only a 'part' of each relevant industrial group of the input supply sub-sector has been included in the sub-sector definition given in Table 1. This is because not all of the output of these industries can be assumed to be destined for the farming sub-sector - a significant proportion of the output of the chemical products industry has been absorbed by the plastics industry, for example, in addition to farming. One of the tasks of this study has therefore been to devise a means of measuring the size of the input supply sub-sector, given that each input supply industry supplies a number of activities, farming being only one. The methods used are discussed in Section 3 and Appendix A.

Figure 1 The New Zealand Agricultural Sector

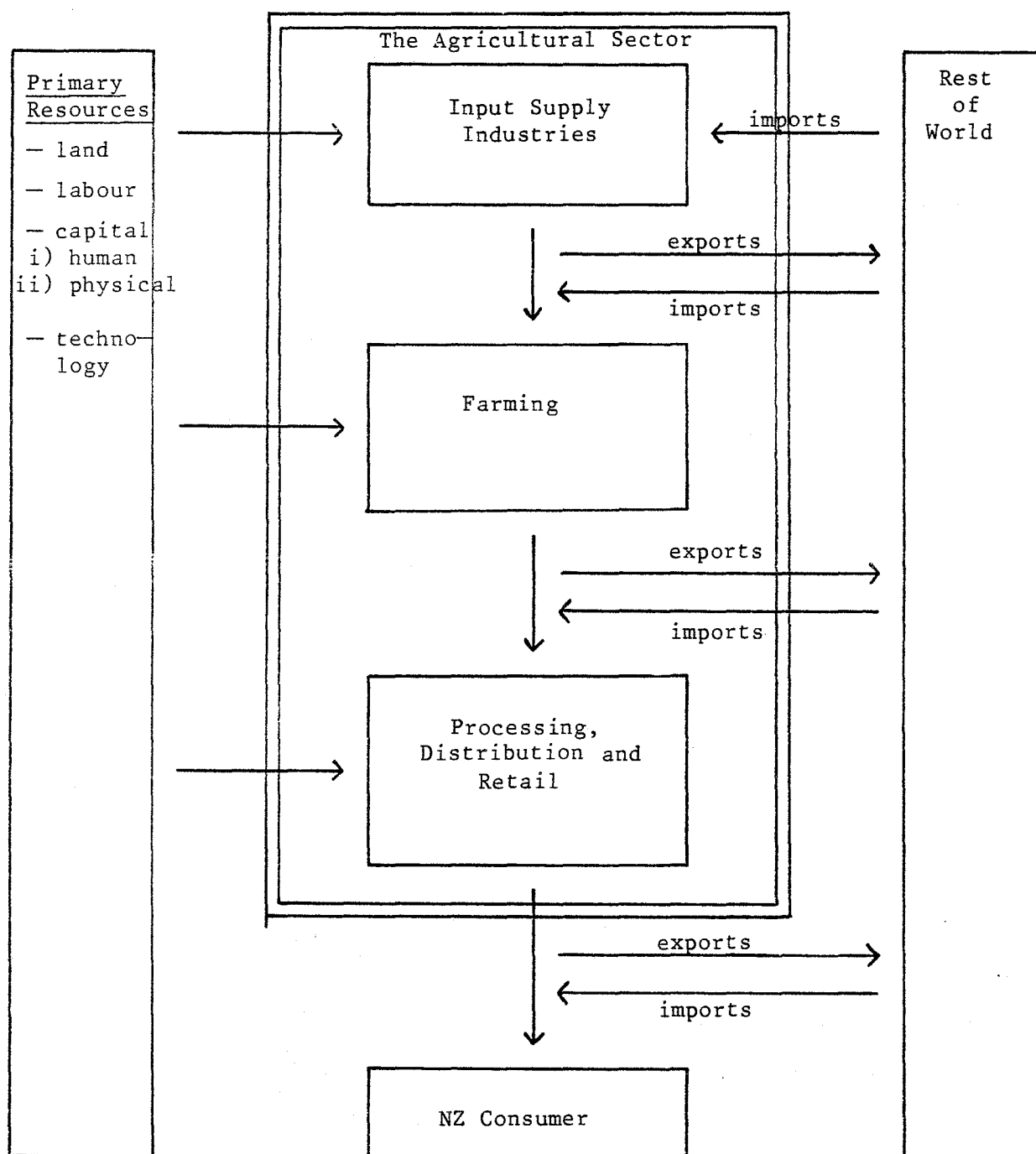


TABLE 1

Components of the Agricultural Sector

 PART (A)
Input Supply

1. MATERIAL INPUTS

- Chemical Products (fertilisers and chemical products 'nei')
 - Part of the following: NZSIC Groups 3511, 3513, Subgroups 35121, 35122, 35299.
- Metal Products (wireworking and nail and fastener making, agricultural machinery and equipment, and repair of motor vehicles)
 - Part of the following: NZSIC Subgroups 38191, 38192, Groups 3822, 9513.
- Energy (petroleum and coal products, electric light and power)
 - Part of the following: NZSIC Groups 3530, Subgroup 35409, Group 4101.
- Construction and Building
 - Part of the following: NZSIC Groups 5101, 5102, Divisions 52, 53

2. SERVICE INPUTS

- Agricultural services (e.g. aerial topdressing)
 - NZSIC Group 112.
 - Transport services (transport of material inputs into farming and horticulture: rail, road freight, supporting services, water, air)
 - Part of the following: NZSIC Groups 7111, 7114, 7116, 712, 713, 719.
 - Wholesale and retail services (wholesaling-retailing associated with material inputs into farming and horticulture)
 - Part of the following: NZSIC Divisions 61, 62.
 - Financial services
 - Part of the following: NZSIC Division 81.
 - Business, health and community services, communications
 - Part of the following: NZSIC Groups 832, 933, 932, 935, 9399, Division 72.
-

PART (B)
Farming

- Agricultural and livestock production (live animals, cereals)
 - NZSIC Group 111.

 - Other farming (fruit and vegetables)
 - NZSIC Subgroup 1199.
-

(Table 1 Contd...)

PART (C)

Processing, Distribution and Retail

1. PROCESSING

- Meat processing (meat freezing and preserving, ham, bacon and small goods, abattoirs)
 - NZSIC Subgroups 31111, 31112, 31113, 31114, 31115, 31116, 31119 (part).
- Dairy processing (butter, cheese and other milk products, icecream)
 - NZSIC Subgroups 31121, 31123, 31124.
- Fruit and vegetable processing (fruit and vegetable preserving)
 - NZSIC Group 3115.
- Grain milling and Manufacture of cereal-based products (grain milling, biscuits, cocoa, chocolate and sugar confectionary, food nec, food for animals and fowls)
 - NZSIC Subgroups 31161, 31162, 31174; Group 3119; Subgroup 31175; Groups 3118, 3121; Group 3122.
- Beverages (Wine-making and distilling, malting and brewing, aerated waters and cordials)
 - NZSIC Groups 3131, 3132, 3133 and 3134.
- Tobacco
 - NZSIC Group 3140.
- Textile manufacture and processing (wool scouring; woollen spinning and weaving; canvas goods; made-up textiles nec; hosiery and other knitting; other spinning and weaving; textiles nec; wearing apparel)
 - NZSIC Group 32 (excluding Group 3231, 3232, 3233, 3240).
- Leather and fur products (tanning and leather finishing; fellmongery and fur dressing; leather and substitute products; footwear except rubber, plastic, wooden)
 - NZSIC Groups 3231, 3232, 3233, 3240.

2. DISTRIBUTION

- Transport of farm and horticultural products and processed products to factories and final consumers (rail, road freight, supporting services, water, air).
 - Part of the following: NZSIC Groups 7111, 7114, 7116, 712, 713, 719.

3. RETAIL

- Wholesaling-retailing of farm and horticultural products and processed products to factories and final consumers.
 - Part of the following: NZSIC Divisions 61, 62.
-

SECTION 3

THE ESTIMATION METHODS USED

It is of some importance to indicate the way in which the estimates for Agricultural Sector real net output, employment, real valued exports and real valued imports were obtained.

Estimates of the net output produced in the industries composing the Agricultural Sector were obtained from the input-output tables of the New Zealand economy for the years 1959/60, 1965/66, 1971/72 and 1976/77. This net output was equal to gross output less intermediate inputs (which included imports but not import taxes).

It was clear that for only some industries could all of the net output produced be assigned to the Agricultural Sector - these industries were farming and all of the processing industries.

For the industries of the input supply sub-sector an estimate of the net output produced in supplying the farming sub-sector (as opposed to other sectors of the economy such as forestry) was obtained by multiplying the total net output produced in the industry by the proportion of the industry's gross output sold to farming.

The estimated net output produced in supplying transport services to the farming sub-sector was further sub-divided into the net output generated by transporting material inputs into farming (an input supply industry) and that generated by transporting farm products to processing industries and wholesalers (a PDR activity). This sub-division was based on farm survey data which indicated that only 15 per cent of the transport input into farming consisted of transporting farm inputs as opposed to farm output. The remaining 85 per cent was assigned to the PDR industry "distribution".

The net output produced in the "wholesaling/retailing associated with material inputs" industry of the input supply sub-sector was estimated by multiplying total net output in the wholesale/retail industry by the proportion of total "sellable" intermediate inputs in the wholesale/retail industry consisting of material farm inputs.

The net output generated by the distribution of farm and processed products (a PDR industry) was estimated by multiplying the proportion of the transport industry's gross output purchased by the processing industries and those wholesaling/retailing farm and processed products by the net output generated in the transport industry. In addition, 85 per cent of the net output produced supplying transport services to farming was included in the estimate (see above).

The net output generated by the wholesaling and retailing of farm and processed products was estimated by multiplying the total net output produced in the wholesale/retail industry by the proportion of

'sellable' intermediate inputs purchased by the wholesale/retail industry consisting of farm and processed products.

All of the net output estimates obtained were in current dollars and thus had to be deflated. This was done by using a number of the price indices which are reported in the New Zealand Department of Statistics publication 'Prices, Wages and Labour' (see Appendix A).

In the case of farming and all of the processing industries all of an industry's employment and imports were considered to belong to the Agricultural Sector. In the case of the input supply industries and the distribution and wholesale/retail industries of the PDR sub-sector, total employment and imports in an industry were divided into those which belonged to the Agricultural Sector and those which did not. This division was based on the proportion of the industry's gross output sold to farming if the industry was an input supply one, the proportion of the industry's gross output sold to processing industries and wholesale/retailers of farm and processed products if the industry was the distribution industry, and the proportion of sellable inputs consisting of farm or processed products in the case of the wholesale/retail industry. Employment figures were obtained from various issues of 'Industrial Production Statistics', 'Prices, Wages and Labour' and the 'New Zealand Census of Population and Dwellings'. Nominal import totals were obtained from the input-output tables and were deflated by relevant price indices contained in 'Prices, Wages and Labour'.

Estimates for real valued exports were obtained only for farming and for the processing industries. To the extent that those supplying farm inputs and those providing distribution and wholesale/retail services associated with Agricultural Sector products have exported, the estimates presented in Table 6 for total Agricultural Sector exports will be too low.

The nominal value of exports was obtained from the input-output tables and relevant price indices were used to deflate the totals obtained.

A number of points need to be made about the estimation procedure adopted.

First, as is acknowledged in the introduction to the 1976/77 input-output tables, the input-output estimates of net output will differ from official estimates presented in the National Accounts. This is because the National Accounts can be prepared in a much shorter time period and can thus incorporate more recent information than can the input-output tables. For this reason, the estimates of real net output in the Agricultural Sector presented in this Discussion Paper will be less accurate than those based on figures contained in the National Accounts.

Input-output tables have been used in this study because of the necessity of separating the net output, employment and imports of some industries into that portion accruing to the Agricultural Sector and the rest of the economy.

This division required detailed information concerning the allocation of an industry's gross output and the source of an industry's inputs and although the ratios based on this information could have been applied to National Account totals, it was thought that less error would be induced if the totals used were derived from the same document as the ratios used. It should also be noted that the industry breakdown given in the National Accounts is not as great as that given in the input-output tables and thus for only some industries could more accurate estimates have been obtained.

Second, the reliance on input-output tables has meant that estimates have been obtained for only four years. Because the probability that any given year may be atypical is high, any 'trend' statements made on the basis of these estimates must be appropriately qualified - although the differences noted for any given period do stand, care should be taken in inferring trends from the estimates presented.

SECTION 4

THE SIZE OF THE AGRICULTURAL SECTOR RELATIVE TO THE NEW ZEALAND ECONOMY AS A WHOLE

4.1 The Need for Definitional Clarity

There has been a considerable amount of work done in the recent past on the sectoral composition of economies and on patterns of economic growth. Two recent commentaries concerning the composition and growth of the New Zealand economy are Lloyd et al (1980) and Gould (1982).

In past studies, the phrase 'Agricultural Sector' has almost invariably been used to refer to farming activities - i.e. to the production and trading of raw agricultural commodities - and this interpretation differs from that adopted in this paper.

For the purpose of clarity, 'farming' will be used here to refer to purely farming activities (the production of raw agricultural products) and 'Agricultural' will be used whenever the 'inclusive' Agricultural Sector (as defined in Section 2) is being referred to.

4.2 The Changing Sectoral Composition of the New Zealand Economy

In past studies it has generally been found that as economic growth proceeds, and as an economy matures, the size of the farming sub-sector declines relative to the economy as a whole. This standard result, which has been observed in all OECD and most other countries, arises in part from Engel's Law. This law states that the income elasticity of demand for food (in general, the most important raw agricultural commodity) is less than one and that as real incomes increase a declining proportion of total consumer expenditure will consist of expenditure on food. This is borne out in reality; as economic growth has proceeded (i.e. as consumers' real incomes have increased) the proportion of total real output and employment in the economy represented by farming activities has declined.

It appears that in the post World War II period the New Zealand economy has followed this general trend (Table 2). The proportion of total employment represented by the primary sector (consisting primarily of farming) has declined from 15 per cent in 1962 to 11 per cent in 1981. Similarly, the proportion of total real output represented by the primary sector has declined from 19 per cent in 1971 to 15 per cent in 1981.

TABLE 2

Share of Employment and Real Output by Sector
for New Zealand and Selected Countries

	Share of Employment by Sector			Share of Real Output by Sector		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
=====						
New Zealand						
1962	15%	37%	48%	na	na	na
1971	13%	34%	53%	19%	28%	53%
1981	11%	44%	55%	15%	36%	49%
United States						
1962	7%		93%	4%	34%	62%
1971	4%	31%	65%	3%	36%	61%
1981	4%	30%	66%	3%	31%	66%
Canada						
1962	10%		90%	11%	31%	58%
1971	8%	31%	61%	4%	37%	59%
1981	6%	28%	66%	6%	28%	66%
United Kingdom						
1962	3%	36%	62%	4%	48%	48%
1971	3%	46%	52%	3%	44%	54%
1981	3%	38%	60%	na	na	na
West Germany						
1962	13%	48%	39%	6%	56%	38%
1971	8%	50%	42%	3%	54%	44%
1981	6%	44%	51%	2%	47%	51%
France						
1962	na	na	na	9%	46%	45%
1971	13%	39%	48%	6%	48%	46%
1981	8%	36%	56%	5%	39%	56%
=====						

Source: OECD Economic Surveys, various years.

A feature of Table 2 which should be noted is that although New Zealand has followed the general trend of developed economies, she nevertheless has a significantly greater reliance on the primary sector for output and employment. As can be seen from Table 3 New Zealand's dependence on farm-based (i.e. Agricultural Sector) exports is also far greater than is true for the developed countries (being closer to that of the less developed countries).

TABLE 3

Agricultural Sector Exports^a as a Proportion of
Total Exports for New Zealand and Selected Countries - 1981

	%
New Zealand	64.9
United States	19.3
Canada	10.8
France	16.7
West Germany	6.0
United Kingdom	8.0
Japan	0.7
India	37.5
Argentina	71.2
Brazil	42.0

a Includes food and live animals, meat and meat preparations, dairy products,...hides, skins and textiles. Excludes fish and forestry products and agricultural requisites.

Source: FAO Trade Statistics Yearbook 1982 and International Financial Statistics Yearbook 1982.

One cannot rely solely on Engel's Law to explain why there has been a decline in the relative size of New Zealand's farming sub-sector. It is true that as consumer real incomes in New Zealand have increased, a larger proportion of domestic spending has been upon non-tradeable goods and services (e.g. entertainment), but it is conceivable that an export demand for farm based products would have sustained the relative size of the New Zealand farming sub-sector.

With regard to export demand, it is true that the New Zealand economy is small relative to the rest of the World. This means that in principle any level of New Zealand output made available for export at prevailing prices will be easily absorbed by the international market.

Secondly, New Zealand has had a proven comparative advantage in the production of farm products; i.e. has encountered no difficulty in producing farm products at prevailing world prices.

These two factors have combined to create an export market for New Zealand farm products of potentially increasing size, but despite this potential, the farming sub-sector has nevertheless declined in relative size. Any explanation of the maturing process of the New Zealand economy must therefore include mention of the factors inhibiting or acting against increasing exports of farm products.

The decline in size of the New Zealand farming sub-sector relative to the rest of the economy could reflect one or both of two things.

First, it may be that this decline reflects a compositional change within the Agricultural Sector, with the processing, distributing and retailing of farm products becoming increasingly important. This compositional change could be due to a number of factors. Technological advance in New Zealand industries using farm products as inputs, enabling a reduction in input requirements per unit of output, could lead to a slower rate of expansion of farm output relative to PDR output, for example. Similarly, given the low income elasticity of consumer demand for farm products relative to goods containing value-added beyond the farm gate, the world-wide increase in real incomes occurring in the Post World War II period may have made it increasingly profitable to produce and export processed farm products from New Zealand - again, this would lead to the PDR sub-sector increasing in size relative to the farming sub-sector.

Government import protection policies, introduced to meet balance of payments and employment objectives, could also have led to this compositional change.

Second, it may be the case that despite the small size of New Zealand's agricultural trade relative to the production of the rest of the world, an expansion of New Zealand's exports of Agricultural Sector products may have nevertheless led to a decline in the terms of trade. Such a decline would discourage resources from entering the Agricultural Sector (and hence, farming sub-sector) and encourage the expansion of industries in import-competing activities.

In Table 4 post World War II trends in the terms of trade for selected New Zealand Agricultural Sector products are given. As can be seen from this Table, export prices have in general increased at a slower rate than import prices. The movements in export prices on which these terms of trade calculations are based do not take into account the export incentives received by exporters however, and thus the extent to which the relative returns to Agricultural Sector products have declined over time may be over-stated.

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1. It has been announced government policy for several decades to encourage the further processing of raw materials in New Zealand and protection from imports via quotas and tariffs, and encouragement of exports via incentives, has been given to processing activities.

TABLE 4

The Terms of Trade for Selected
Agricultural Sector Products 1950 - 1981

Year Ended June	Dairy Produce	Meat, Wool and by- products	Fruit and Vegetables	Food, Beverages & Tobacco	Textile Yarn, Fabrics etc.
1950	1000	1000	na	na	na
1955	964	1100	na	na	na
1960	995	974	na	na	na
1965	1020	1068	na	na	na
1970	759	871	na	na	na
1971	759	879	1000	1000	1000
1972	1197	819	1031	1155	977
1973	1064	1196	1050	1245	1029
1974	931	1367	1077	1222	1109
1975	807	699	950	847	908
1976	709	666	835	758	763
1977	659	791	806	762	829
1978	686	767	855	787	862
1979	719	876	899	891	856
1980	677	843	706	853	783
1981	734	717	710	845	752

Source: . Derived from Prices, Wages and Labour 1982 - Part A Tables 17 and 25 (pages 40 and 48).

It should be noted that there are two possible explanations for this decline in New Zealand's terms of trade. One is that the income elasticity of foreign import demand for New Zealand's products is less than the rate of growth of New Zealand export availability (Economic Monitoring Group (1983)) and the other is that New Zealand faces world demand conditions such that she is subject to immiserizing growth (i.e. faces a downward-sloping demand curve at a time when export availability is increasing).²

In addition to a declining terms of trade, increasing overseas restrictions placed on importing may merely have depressed expectations of future export sales of Agricultural Sector products and resources have correspondingly left the Agricultural Sector.

² Immiserizing growth occurs when, as a consequence of increasing the level output of goods made available for export, a country's terms of trade decline to such an extent that total income in that country declines also.

New Zealand government policies should also not be overlooked. In addition to encouraging the further processing of raw materials, successive governments have called for a diversification of exports. Agricultural Sector products have formed New Zealand's 'traditional' exports and as a group they have thus been discriminated against in many government export incentive schemes (e.g. the 'Increased Exports Taxation Incentive' scheme, now replaced by others). This 'discrimination' may have led resources to move into non-Agricultural Sector activities.

4.3 The Growth Issue

An important issue facing New Zealand policy makers is the growth prospects of the New Zealand economy.

It is clear from work by Gould (1982) and others that New Zealand's growth performance has been poor relative to that of other OECD countries throughout most of the post World War II period but particularly during the 1960's (Table 5). As the Agricultural Sector is large relative to the New Zealand economy (see Section 4.4) it is reasonable to assume that the Agricultural Sector has had a role in this poor growth performance; i.e. has been a contributing factor.

TABLE 5

Average Annual Rates of Growth of Real GDP,
Total and per capita

	1950-1960	1960-65	1965-1970	1970-1975
<u>Total:</u>	%	%	%	%
New Zealand	3.9	5.1	3.2	4.3
Japan	8.0	10.1	11.8	5.6
Developed Market Economies	3.8	5.3	4.6	3.3
EEC	5.8	5.4	4.7	3.0
<u>Per Capita:</u>				
New Zealand	1.7	2.9	1.7	2.4
Japan	6.8	9.0	10.6	4.2
Developed Market Economies	2.7	4.1	3.6	2.4
EEC	4.8	4.3	3.9	2.4

Source: Gould (1982) Table 1.2 page 25

The various explanations offered to explain New Zealand's poor growth performance (in addition to employment, income distribution and other performance measures) mirror the comments made above; a low rate of growth of New Zealand export availability, the possibility of an

immiserizing growth situation and government development policies have all been suggested as potential causes. In addition, Lloyd et al (1980) raises the question of structural rigidities in the economy, suggesting that the degree to which resources do not move between sectors in New Zealand in response to changing market opportunities may be partially responsible. The external 'shocks' of the OPEC oil crises have also had a detrimental effect on growth (Gould 1982).

Estimates of the rates of growth of real net output and labour productivity in the Agricultural Sector and the New Zealand economy as a whole are given in Section 4.6. As can be seen from Table 7 in that Section, the growth performance of the Agricultural Sector has been worse than that of the New Zealand economy as a whole for the two periods 1959/60 to 1965/66 and 1965/66 to 1971/72. In the period 1971/72 to 1976/77 its performance was better however. Possible reasons for the performance of the Agricultural Sector are given in Section 4.6 and in Section 5.

4.4 The Size of the Agricultural Sector and the Farming Sub-Sector Relative to the New Zealand Economy as a Whole

It was noted in Section 4.1 that the farming sub-sector has declined in size relative to the rest of the New Zealand economy and it was suggested that this may merely reflect a decline in the size of the Agricultural Sector as a whole relative to the New Zealand economy. In an attempt to determine whether or not such a decline has occurred (and to see whether or not the Sector has undergone compositional change) estimates were made of the size and economic importance of the Agricultural Sector and its three sub-sectors.

On the basis of the New Zealand input-output tables for the years 1959/60, 1965/66, 1971/72 and 1976/77, estimates of the real net output produced in the Agricultural Sector and the farming sub-sector were made. The results obtained are presented in Table 6 together with estimates of total employment, real valued exports and real valued imports in the Agricultural Sector and the farming sub-sector.

As can be seen from these estimates, the Agricultural Sector is large in relation to the New Zealand economy as a whole, contributing 21% of real net output and absorbing 26% of employment in 1976/77 for example. The Sector is also important in terms of generating exports. In 1976/77, 58% of the economy's exports were generated in the Agricultural Sector. The Sector appears to be less important in terms of imports.

Although acknowledging that there is a danger in inferring trends from only four data points, it would nevertheless appear that the size of the Agricultural Sector relative to the New Zealand economy as a whole has declined over the period 1959/60 to 1976/77. A number of possible reasons for the decline in size of the Agricultural Sector were given in Section 4.3 (declining terms of trade, increasing import restrictions overseas and government policies).

TABLE 6

Real Net Output, Employment, Real Valued Exports
Real Valued Imports and Proportion of Gross Output Exported
in the Agricultural Sector and the Farming Sub-Sector

Real Net Output, Employment, Real Valued Exports, Real Valued Imports and Proportion of Gross Output Exported	1959/60	1965/66	1971/72	1976/77
Real Net Output - 1977\$m				
- Agricultural Sector	2028	2493	2637	2970
(% of Economy Total)	(29%)	(26%)	(21%)	(21%)
- Farming Sub-Sector	1018	1197	1104	1268
(% of Economy Total)	(14%)	(12%)	(9%)	(9%)
Employment				
- Agricultural Sector	287,807	302,095	302,377	321,071
(% of Economy Total)	(32%)	(30%)	(28%)	(26%)
- Farming Sub-Sector	115,087	116,827	107,509	103,865
(% of Economy Total)	(13%)	(12%)	(10%)	(8%)
Real Valued Exports - 1977\$m				
- Agricultural Sector ^a	1369	1474	1648	2165
(% of Economy Total)	(78%)	(70%)	(61%)	(58%)
- Farming Sub-Sector	453	468	331	428
(% of Economy Total)	(26%)	(22%)	(11%)	(10%)
Real Valued Imports - 1977\$m				
- Agricultural Sector	404	482	517	534
(% of Economy Total)	(21%)	(16%)	(15%)	(13%)
- Farming Sub-Sector	104	80	101	69
(% of Economy Total)	(5%)	(3%)	(3%)	(2%)
Proportion of Gross Output Exported				
- Agricultural Sector	28%	30%	32%	34%
- Farming Sub-Sector	25%	22%	16%	18%
- New Zealand Economy	8%	7%	7%	8%

a Farming and Processed exports only

Source: Derived from New Zealand input-output tables produced for the years 1959/60, 1965/66, 1971/72 and 1976/77 and employment and price statistics. For details of the methods and statistics used see Section 3 and Appendix A.

4.5 The Agricultural Sector in Other Countries

Information is not available on the changes which have occurred in other countries concerning the relative size of the Agricultural Sector. Figures relating to the size of the Agricultural Sector in isolated years are available however.

Phillips (1982) reports that in 1979; 853,000 people were employed in the Canadian 'Agri-Food' Sector. This was 7 per cent of all those employed and compares with the 23 per cent estimated above for New Zealand (the similarity of Phillips's definition of the 'Agri-Food' Sector and the definition of the Agricultural Sector used in this paper should be noted). Similarly, Moore and Walsh (1973) report that in 1966 in the United States 'farming and industries related to agriculture' produced 19 per cent to 25 per cent of total Gross Domestic Product and employed 28 per cent to 33 per cent of all those employed. The U.S. figures are similar to those estimated for New Zealand for the same year.

4.6 Growth in the Agricultural Sector

It was said in Section 4.3 that New Zealand's post World War II growth performance has been poor relative to that of other countries and it was suggested that this might be true of the Agricultural Sector as well.

In Table 7 estimates of the annual compound rates of growth of real net output and real net output per person employed are presented. These are derived from the information contained in Table 6. As can be seen from Table 7, the growth performance of the Agricultural Sector was notably worse than that of the economy as a whole in the periods 1959/60 to 1965/66 and 1965/66 to 1971/72. In the period 1971/72 to 1976/77 this situation was reversed.

TABLE 7

Annual Compound Rates of Growth of Real Net Output
and Real Net Output per Person Employed in the Agricultural
Sector and in the New Zealand Economy

	1959/60 - 1965/66	1965/66 - 1971/72	1971/72 - 1976/77
Real Net Output			
- Agricultural Sector	3.5%	1.0%	2.4%
- New Zealand Economy	3.7%	4.5%	1.8%
Real Net Output Per Person Employed			
- Agricultural Sector	2.7%	0.8%	1.2%
- New Zealand Economy	3.2%	3.2%	-0.6%

Source: Derived from the estimates presented in Table 6.

If one is to explain the growth and productivity performance of the Agricultural Sector, a number of questions need to be asked: first, has this trend of poor performance relative to the rest of the economy in the first two periods followed by a better performance in the third, been true of all sub-sectors of the Agricultural Sector; second, what effect have the compositional changes occurring in the Agricultural Sector had on Sector productivity - e.g. have resources been increasingly attracted into activities which have had low rates of real output and productivity growth; and third, what are the most important factors determining labour productivity in the sub-sectors (or industries) of the Agricultural Sector - has the capital intensity of production been more important than technological change in production or changes in management practices, for example.

The first two of these questions are answered in the following Section, where the Agriculture Sector is disaggregated into its three sub-sectors (and each sub-sector disaggregated into its respective industries). The third question is identified in Chapter 6 as an area requiring further research.

SECTION 5

THE COMPOSITION OF THE AGRICULTURAL SECTOR

AND THE THREE SUB-SECTORS

5.1 The Composition of the Agricultural Sector

In Table 8 estimates of real net output and employment in the three sub-sectors of the Agricultural Sector for the years 1959/60, 1965/66, 1971/72 and 1976/77 are given. As can be seen from this Table, the PDR sub-sector was the largest in 1976/77, followed by the farming sub-sector. There appears to have been a significant change in the composition of the Agricultural Sector over time with the PDR sub-sector increasing in importance relative to the farming sub-sector. The relative size of the input supply sub-sector appears to have remained largely unchanged over time.

TABLE 8

Real Net Output and Employment in the Three Sub-Sectors of the Agricultural Sector

Sub-Sectors of the Agricultural Sector	<u>Real Net Output - 1977\$m</u>				<u>Numbers Employed</u>			
	1959- 1960	1965- 1966	1971- 1972	1976- 1977	1959- 1960	1965- 1966	1971- 1972	1976- 1977
Input Supply (% of Agricultural Sector Total)	163 (8%)	212 (9%)	226 (9%)	190 (6%)	30211 (10%)	34328 (11%)	33235 (11%)	34665 (11%)
Farming (% of Agricultural Sector Total)	1018 (50%)	1197 (48%)	1104 (42%)	1268 (43%)	115 087 (40%)	116 827 (39%)	107 509 (36%)	103 865 (32%)
PDR (% of Agricultural Sector Total)	847 (42%)	1084 (43%)	1307 (49%)	1512 (51%)	142 509 (50%)	150 940 (50%)	161 633 (53%)	182 541 (57%)
Total Agricultural Sector	2028 (100%)	2493 (100%)	2637 (100%)	2970 (100%)	287 807 (100%)	302 095 (100%)	302 377 (100%)	321 071 (100%)

Source: As for Table 6

One of the issues discussed in Section 4 was the decline in size of the farming sub-sector relative to the New Zealand economy. It was shown in Section 4.4 that this decline reflects a decline in the relative size of the Agricultural Sector as a whole. The estimates presented in Table 8 imply that a compositional change within the Agricultural Sector can also be said to be partly responsible. Due to technological change within the PDR sub-sector and/or to the increasing profitability of processing raw agricultural commodities relative to producing them, for example, an increasing proportion of Agricultural Sector resources appear to have been absorbed in the PDR sub-sector. This has been reflected in a decline in size of the farming sub-sector relative to the rest of the economy.

Comprehensive information on the technological change which has taken place in the processing industries of the PDR sub-sector is not available but figures relating to the relative movements of prices and costs in farming and processing do exist. In Table 9 the price index of output of farming has been divided by the price index of farm input costs to obtain an estimate of profitability trends in farming. A similar index has been constructed for the processing industries. As can be seen from Table 9, output prices have increased at a slower rate than input costs in farming since the mid-sixties, but have not done so in processing. It would thus appear that processing has indeed been increasingly profitable when compared with farming and this would appear to explain, at least in part, the compositional change in the Agricultural Sector (and the decline in size of the farming sub-sector relative to the New Zealand economy) which has occurred over time.

TABLE 9

The Ratio of Output Prices to Input Costs in Farming
and the Processing Industries of the PDR Sub-Sector

=====		
The Price Index of Output Relative to the Price Index of Inputs		
	Farming Sub-Sector	The Processing Industries of the PDR Sub-Sector
1958	1000	1000
1962	1018	1036
1966	962	1039
1970	916	1031
1974	946	1067
1978	909	1119
1980	810	1097
=====		

Source: Derived from Prices, Wages and Labour 1981, Part A Prices.
Tables 10, 11 and 12 (pg. 25, 27 and 28 respectively).

In addition to the levels of prices and costs, differences in the stability of prices and costs may have led to the compositional changes noted. To the extent resource owners are risk averse they will employ their resources in activities with relatively greater stability; Table 9 indicates that the ratio of prices to costs may have been more unstable in farming than in processing.

A second issue which was raised in Section 4 was the growth performance of the New Zealand economy. It was reported in Section 4.6 that the growth performance of the Agricultural Sector was poor relative to that of the New Zealand economy in the periods 1959/60 to 1965/66 and 1965/66 to 1971/72 but was better in the period 1971/72 to 1976/77. Two questions which were asked were firstly, has this pattern been true of all Agricultural Sector sub-sectors and secondly, what have the implications of a compositional change within the Agricultural Sector been for Sector real output and productivity growth rates.

In Table 10 estimated annual compound rates of growth of real net output and labour productivity in the three sub-sectors, the Agricultural Sector and the New Zealand economy are given.

TABLE 10

Annual Compound Rates of Growth of Real Net Output
and Labour Productivity

	Annual Compound Rates of Growth of Real Net Output			Annual Compound Rates of Growth of Labour Productivity		
	1959/60 1965/66	1965/66 1971/72	1971/72 1976/77	1959/60 1965/66	1965/66 1971/72	1971/72 1976/77
Sub-Sector						
- input supply	4.5%	1.0%	-2.8%	2.3%	1.5%	-4.2%
- farming	2.7%	-1.3%	2.8%	2.3%	0.2%	3.4%
- PDR	4.2%	3.2%	2.8%	3.2%	2.0%	0.4%
Agricultural Sector	3.5%	1.0%	2.4%	2.7%	0.8%	1.2%
New Zealand Economy	3.7%	4.5%	1.8%	3.2%	3.2%	-0.6%

Source: Derived from the information contained in Tables 6 and 8.

It can be seen from Table 10 that the growth of real net output in the farming sub-sector has followed the pattern found for the

Agricultural Sector as a whole. The input supply sub-sector and the PDR sub-sector had rates of growth of real net output higher than the economy average in the period 1959/60 to 1965/66, however, and the input supply sub-sector rate of growth in 1971/72 to 1976/77 was much lower than that of the economy as a whole. In terms of labour productivity growth, the pattern found for the Agricultural Sector as a whole was followed by both the farming sub-sector and the PDR sub-sector (the input supply sub-sector did not follow the Agricultural Sector pattern in the third period).

Perhaps the most important point which can be taken from Table 10 is that significant differences in real net output and labour productivity growth rates exist within the Agricultural Sector. The rates of growth of real net output and labour productivity were considerably higher in the input supply and PDR sub-sectors than in farming in the first two periods, for example. Furthermore, while there has been a steady decline in growth rates in the input supply and PDR sub-sectors, a significant downward and then upward movement in farming growth rates has occurred.

In 1965, Blyth published a paper in which he sought to identify the relative importance of the various factors determining output growth in New Zealand (Blyth, 1965). He found that over the period 1954/55 to 1961/62 real output growth in the manufacturing sector was equally due to increasing labour inputs, increasing capital inputs and technological progress, about three quarters of the output growth in services was due to increasing labour inputs and about three fifths of the output growth in farming was due to technological progress (with two fifths being due to increasing capital inputs). The significantly greater importance of technological progress to growth in farming as opposed to manufacturing was confirmed by Philpott (1971).

It would thus appear that the significant decline and then increase in growth rates in farming indicated in Table 10 has been due to the effect of technological progress. The factors determining real output and labour productivity growth rates in all the three sub-sectors of the Agricultural Sector is an area which requires further research, however.

The second question which was raised concerning growth rates in the Agricultural Sector concerned how these growth rates have been affected by compositional changes within the Agricultural Sector.

As was seen in Table 6, the PDR sub-sector has been responsible for an increasing proportion of Agricultural Sector real net output and employment. This compositional change will have depressed the growth rates of labour productivity in the Agricultural Sector as labour productivity in the PDR sub-sector has been consistently lower than in the farming sub-sector (Table 11).

TABLE 11

Real Net Output per Person Employed in the
Three Sub-Sectors of the Agricultural Sector
 (1977 \$)

	1959/60	1965/66	1971/72	1975/76
Sub-Sector:				
Input Supply	5395	6176	6800	5481
Farming	8845	10246	10269	12208
PDR	5943	7182	8086	8283

Source: As for Table 6.

The fact that the PDR sub-sector has increased in size relative to the other sub-sectors has meant that the rates of growth of real net output and labour productivity in the Agricultural Sector have come to more closely follow the rates prevailing in the PDR sub-sector. This has quite serious implications for future growth rates in the Agricultural Sector because if the PDR sub-sector continues to become increasingly important, and if its labour productivity growth rate continues to decline as it has in the past, one can expect that Agricultural Sector growth rates will decline also. Only when reasons for the compositional change occurring in the Agricultural Sector have been found and expectations about future compositional changes been made (and similarly reasons and expectations concerning PDR productivity growth rates formed) will predictions about future growth rates in the Agricultural Sector be possible however.

5.2 The Composition of the Three Sub-Sectors of the Agricultural Sector

To complete the picture of the Agricultural Sector thus far drawn, the composition of the input supply and PDR sub-sectors and labour productivity in the industries of each sub-sector is discussed in this Section.

In Tables 12 and 13 the composition of the input supply and PDR sub-sectors respectively, for the years 1959/60, 1965/66, 1971/72 and 1976/77, are given. From Table 12, it can be seen that in 1976/77 the "agricultural services", "other services" and "chemical products" industries were the largest in the input supply sub-sector. The "wholesaling-retailing associated with material inputs" and the "metal products" industries were also important, especially in terms of employment. It appears that over time a significant increase in the size of the "other services" industry relative to the remaining industries of the input supply sub-sector has taken place.

From Table 13 it can be seen that in 1976/77 the "meat processing" and "textile manufacture and processing" industries were the largest in the PDR sub-sector in terms of real net output and employment. It appears that over time a significant decrease in the relative size of the "beverages", "tobacco" and "distribution" industries has occurred.

One can expect that differences in the rate of increase of output prices and input costs, different degrees of stability in prices and costs, differences in government assistance and differences in the technological changes occurring (e.g. the degree to which processing industries are able to reduce the quantity of inputs required) will have led to the changing industry compositions noted in the input supply and PDR sub-sectors.

TABLE 12

Real Net Output and Employment in the Industries
of the Input Supply Sub-Sector

Industries of the Input Supply Sub- Sector	Real Net Output - 1977\$m (% of Sub-Sector Total)				Numbers Employed (% of Sub-Sector Total)			
	1959- 1960	1965- 1966	1971- 1972	1976- 1977	1959- 1960	1965- 1966	1971- 1972	1976- 1977
Material Inputs								
- chemical products	29 (18%)	29 (14%)	33 (15%)	29 (15%)	1696 (6%)	1504 (4%)	1579 (5%)	1424 (4%)
- metal products	29 (18%)	42 (20%)	16 (7%)	10 (5%)	3665 (12%)	4479 (13%)	4002 (12%)	4599 (13%)
- energy	13 (8%)	16 (8%)	23 (10%)	10 (5%)	686 (2%)	684 (2%)	561 (2%)	323 (2%)
- construction and building	10 (6%)	10 (5%)	3 (1%)	13 (7%)	588 (2%)	523 (2%)	270 (1%)	866 (2%)
Service Inputs								
- agricultural services	36 (22%)	46 (21%)	85 (38%)	59 (31%)	4903 (16%)	730 (21%)	9577 (29%)	10077 (29%)
- transport associated with material inputs	7 (4%)	10 (5%)	7 (3%)	3 (2%)	474 (2%)	652 (2%)	483 (1%)	406 (2%)
- wholesaling/retailing associated with material inputs	16 (10%)	36 (17%)	10 (4%)	10 (5%)	14827 (49%)	15204 (44%)	11451 (34%)	11259 (32%)
- financial services and insurance	7 (4%)	10 (5%)	36 (16%)	23 (12%)	592 (2%)	829 (2%)	1690 (5%)	1272 (4%)
- other services	16 (10%)	13 (6%)	13 (6%)	33 (17%)	2780 (9%)	3147 (9%)	3622 (11%)	4439 (13%)
Total Input Supply Sub-Sector	163 (100%)	212 (101%)	226 (100%)	190 (99%)	30211 (100%)	34328 (99%)	33235 (100%)	34665 (99%)

Source: As for Table 6.

TABLE 13

Real Net Output and Employment in the Industries
of the PDR Sub-Sector

Industries of the PDR Sub-Sector	Real Net Output - 1977\$m (% of Sub-Sector Total)				Numbers Employed (% of Sub-Sector Total)			
	1959- 1960	1965- 1966	1971- 1972	1976- 1977	1959- 1960	1965- 1966	1971- 1972	1976- 1977
Processing								
- meat processing	143 (17%)	197 (18%)	286 (22%)	371 (25%)	19407 (14%)	22472 (15%)	28493 (18%)	34399 (19%)
- dairy proces- sing	49 (6%)	26 (2%)	122 (9%)	132 (9%)	5230 (4%)	4910 (3%)	6031 (4%)	8292 (5%)
- fruit and vegetable processing	13 (1%)	21 (2%)	23 (2%)	36 (2%)	2096 (1%)	2556 (2%)	2934 (2%)	4481 (3%)
- grain milling and the manu- facture of cereal-based products	49 (6%)	75 (7%)	125 (9%)	161 (11%)	15957 (11%)	12068 (8%)	11093 (7%)	13791 (8%)
- beverages	104 (12%)	135 (12%)	62 (5%)	91 (6%)	2122 (1%)	2520 (2%)	3152 (2%)	4547 (2%)
- tobacco	86 (10%)	96 (9%)	21 (2%)	29 (2%)	1244 (1%)	1134 (1%)	1200 (1%)	1182 (1%)
- textile manu- facturing and processing	145 (17%)	190 (18%)	257 (20%)	319 (21%)	30168 (21%)	35985 (24%)	38804 (24%)	40802 (22%)
- leather and fur products	39 (5%)	47 (4%)	55 (4%)	60 (4%)	6570 (5%)	7416 (5%)	7768 (5%)	10473 (6%)
Distribution	101 (12%)	101 (5%)	101 (8%)	75 (5%)	7594 (5%)	7469 (5%)	7458 (5%)	5546 (3%)
Wholesaling/ Retailing	118 (14%)	196 (18%)	255 (20%)	238 (16%)	52121 (37%)	54410 (36%)	54700 (34%)	59028 (32%)
Total PDR Sub-Sector	847 (100%)	1084 (99%)	1307 (101%)	1512 (101%)	142, 509 (100%)	150, 940 (101%)	161, 633 (102%)	182, 541 (101%)

Source: As for Table 6.

In Tables 14 and 15 estimates of annual compound rates of growth of labour productivity in the industries of the input supply and PDR sub-sectors are given. The significant differences in rates of growth between industries, and between periods for some industries, should be noted.

TABLE 14

Annual Compound Rates of Growth of Labour
Productivity in the Industries of the Input Supply Sub-Sector

Industries of the Input Supply Sub-Sector	1959/60 - 1965/66	1965/66 - 1971/72	1971/72 - 1976/77
	%	%	%
Material Inputs			
- chemical products	2.0	1.3	-0.6
- metal products	2.8	-14.3	-12.2
- energy	3.5	9.3	-5.6
- construction and building	2.0	-9.0	6.0
Service Inputs			
- agricultural services	-2.5	5.7	-8.2
- transport assoc- iated with material inputs	0.7	-1.0	-13.4
- wholesaling/retail- ing associated with material inputs	13.2	-16.7	0.4
- financial services and insurance	0.3	9.5	-3.4
- other services	-5.5	-2.3	14.4
Total Input Supply Sub-Sector	2.3	1.5	-4.2

Source: Derived from Table 12.

TABLE 15

Annual Compound Rates of Growth of Labour Productivity
in the Industries of the PDR Sub-Sector

Industries of the PDR Sub-Sector	1959/60 - 1965/66	1965/66 - 1971/72	1971/72 - 1976/77
	%	%	%
Processing			
- meat processing	3.0	2.2	1.6
- dairy processing	-9.7	22.3	-4.6
- fruit and vegetable processing	4.7	-0.7	0.4
- grain milling and the manufacture of cereal-based products	4.2	0.2	0.8
- beverages	1.5	-16.6	0.2
- tobacco	3.5	-26.3	6.8
- textile manufacture and processing	1.5	3.8	3.2
- leather and fur products	1.0	2.0	-4.4
Distribution	0.2	0.0	0.0
Wholesaling/Retailing	7.8	4.3	-3.0
Total PDR Sub-Sector	3.2	2.0	0.4

Source: Derived from Table 13.

SECTION 6

AGENDA FOR FURTHER RESEARCH

A number of questions were raised in the study:

- what factors have been responsible for the compositional change which has occurred in the Agricultural Sector? What technological changes have occurred, for example, and how have government policies affected relative profitability?

- what factors have had the most effect on the size of the Agricultural Sector relative to the New Zealand economy - relative profitability, the relative stability of profits, or government policies as they have affected each of these?

- what factors have determined rates of growth of labour productivity in the three sub-sectors of the Agricultural Sector? Has technological change been important or has an increasing capital intensity exerted a greater effect?

It is proposed that these questions be addressed in future research.

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APPENDIX A

THE ESTIMATION METHODS USED

In this Appendix the methods used to obtain estimates of real net output, employment, real valued exports and real valued imports in the Agricultural Sector are outlined.

1. Real Net Output

The input-output tables produced for the New Zealand economy for the years 1959/60, 1965/66, 1971/72 and 1976/77 were the basis for the estimates obtained. Net output, equal to gross output less intermediate inputs and imports, in farming and in all the processing industries was obtained from the input-output tables and included in total in the Agricultural Sector. Of the total net output produced in the input supply industries, only some could be said to belong to the Agricultural Sector (this being the amount produced supplying farming as opposed to supplying other industries such as forestry).

The amount of net output produced in the input supply industries which could be included in the Agricultural Sector was estimated by multiplying the proportion of gross output sold to farming in a particular industry by the total net output produced in that industry and summing the estimates obtained. In 1976/77, for example, 85 per cent of the gross output of the agricultural services industry was sold to farming and it was thus assumed that 85 per cent of the net output produced in that industry in 1976/77 should be included in the input supply, and hence Agricultural Sector, (the remaining 15 per cent of agricultural services' gross output was sold to the forestry and the real estate industries).

With regard to the agricultural services industry it should be noted that total net output in the industry had to be estimated for 1959/60 and 1965/66 because in those years the industry was included in published 'farming' figures.

In 1971/72 and 1976/77 approximately 5 per cent of the combined total of net output in farming and agricultural services consisted of agricultural services net output and it was thus assumed that in 1959/60 and 1965/66, 5 per cent of the net output of 'farming' similarly consisted of agricultural services net output. This 5 per cent was deducted from the 'farming' totals of 1959/60 and 1965/66 and allocated to the agricultural services industry.

In 1971/72 and 1976/77, 81 per cent and 85 per cent respectively of agricultural services gross output was sold to farming - it was thus assumed that in 1959/60 and 1965/66, 80 per cent of the estimated net output produced in the agricultural services industry should be included in the Agricultural Sector.

The net output of the input supply industry "transport associated with material inputs" was estimated in the way outlined above for all input supply industries, with a slight modification.

First, as for most input supply industries, the proportion of the transport industry's gross output sold to farming was multiplied by total net output in the transport industry. Not all of the transport input into farming could be said to belong to the input supply sub-sector as opposed to the PDR sub-sector, however, as some of the transport purchases of farmers involve the transporting of produce to processing industries and wholesalers, not the transporting of material inputs to the farm, the only transport service belonging to the input supply sub-sector.

A sample farm budget obtained from the 1982 Farm Budget Manual of the Farm Management and Rural Valuation Department, Lincoln College, indicated that in 1982, 85 per cent of the transport input into farming consisted of the transporting of farm produce away from the farm. Using the data on volumes transported and distances covered in the 1982 example, and 1972 freight rates, it was found that for 1971/72 it could again be said that approximately 85 per cent of farm transport expenditure was on the transporting of produce away from the farm. It was thus assumed that in each of the years studied, 15 per cent of the estimated net output associated with supplying transport services to farming belonged to the input supply sub-sector (the transporting of material inputs) and the remaining 85 per cent was assumed to belong to the PDR sub-sector (the transporting of farm products).

The arbitrary nature of the way in which the transport input into farming was divided into 'input supply' and 'PDR' is acknowledged. The single sample budget used was for a Canterbury mixed farm and this was assumed to be typical of the wide range of regions and activities included in the farming sub-sector. The sample budget used was the only information available at the time, however, and discussions with those in the Farm Management Department at Lincoln College implied that the estimated division would be reasonably accurate for a wide range of farming activities.

Net output produced by those supplying wholesale/retail services associated with material inputs into farming (an input supply industry) was estimated by multiplying the total net output of the wholesale/retail industry by the proportion of the industry's total sellable inputs consisting of material farm inputs. Total sellable inputs consisted of all intermediate inputs into the wholesale/retail industry less inputs which could be considered 'administrative' (eg financial services, business services, insurance); material farm inputs consisted of products supplied by the chemical products and metal products industries.

This method of estimating the net output of 'wholesaling/retailing associated with material inputs', rather than the method adopted for most input supply industries, was adopted because some of the wholesale/retail input into farming would consist of services rendered in selling farm produce (a PDR activity), not in supplying material inputs.

In addition to including that proportion of the transport input into farming associated with transporting farm products to processors and wholesalers/retailers, net output produced in the distribution industry of the PDR sub-sector was estimated by multiplying the proportion of total gross output in the transport industry purchased by the processing industries and those wholesaling/retailing farm and processed products by total net output in the transport industry.

The amount of transport services purchased by those wholesaling/retailing farm and processed products was estimated by multiplying the total transport input into the wholesale/retail industry by the proportion of total wholesale/retail sellable inputs consisting of farm and processed goods.

All of the net output estimates obtained were in current dollars and thus had to be deflated. The most relevant price indices published by the New Zealand Department of Statistics were used for this purpose and were as follows:

- net output totals in the industries of the input supply sub-sector were deflated by the 'Wholesale Price Index of Commodity Prices by Sector of Origin - Output of Other Manufacturing Industries' (source: Prices, Wages and Labour 1980. Part A - Prices. Table 12 pg 29);
- net output in the farming sub-sector was deflated by the 'Wholesale Price Index of Commodity Prices by Sector of Origin - Farming' (source: as for input supply industries);
- net output totals in the processing industries of the PDR sub-sector were deflated by the 'Wholesale Price Index of Commodity Prices by Sector of Origin - Primary Produce Processing Industries' (source: as for input supply industries);
- net output totals in the distribution and wholesaling/retailing industries of the PDR sub-sector were deflated by the 'Wholesale Price Index of Commodity Prices by Sector of Origin - Other Manufacturing Industries' (source: as for input supply industries); and
- total net output in the economy was deflated by the 'Wholesale Price Index - Long Term Linked Series - Home Produced Goods' (source: Prices, Wages and Labour 1980. Part A - Prices. Table 10 pg 27).

2. Employment

Figures for total employment in the Agricultural Sector were arrived at in a manner analogous to figures for real net output, in that all of those employed in farming and in the processing industries were included in the Agricultural Sector total, whilst only some of those employed in the input supply industries and in the distribution and wholesale/retail industries of the PDR sub-sector were included.

With the exception of wholesaling/retailing associated with material inputs, estimates of those who were employed in an input supply industry and who could be included in the Agricultural Sector

were obtained by multiplying total employment in the industry by the proportion of the industry's gross output sold to farming - e.g. in 1976/77, 85 per cent of the gross output of the agricultural services industry was sold to farming and it was thus assumed that in 1976/77, 85 per cent of those in the agricultural services industry were employed servicing farming as opposed to other industries in the economy (and thus should be included in the Agricultural Sector).

The numbers employed wholesaling/retailing material inputs used by farmers was obtained directly from published statistics (these gave the numbers employed in wholesaling and retailing different products - the various totals given were merely added).

Employment in the distribution industry of the PDR sub-sector was estimated by multiplying total employment in the transport industry by the proportion of the transport industry's gross output purchased by processing industries and those wholesaling/retailing farm and processed products. In addition, 85 per cent of those employed in supplying transport to farming were included in the distribution industry (and correspondingly deducted from the input supply industry of 'transport associated with material inputs') - approximately 85 per cent of the transport input into farming has consisted of the transporting of produce away from the farm, not of the delivery of material inputs.

The numbers employed in wholesaling/retailing farm and processed products was obtained directly from published statistics.

The sources of the employment statistics used were as follows:

- farming - four issues of the New Zealand Census of Population and Dwellings. Volume 4. Industries and Occupations (the years of issue were 1961, 1966, 1971 and 1976 and thus do not directly correspond with the years of real net output, exports, imports and other employment estimates);
- the processing industries of the PDR sub-sector - various issues of Industrial Production (renamed Census of Manufacturing in 1976/77) and Prices, Wages and Labour - occasionally supplementary figures, obtained from the New Zealand Census of Population and Dwellings, were also used (the years of issues used were 1959/60, 1965/66, 1971/72 and 1976/77);
- industries of the input supply sub-sector - Industrial Production, Prices, Wages and Labour and the New Zealand Census of Population and Dwellings (the years of issues used were 1959/60, 1965/66, 1971/72 and 1976/77); and
- the distribution and wholesaling/retailing industries of the PDR sub-sector - Prices, Wages and Labour and the New Zealand Census of Population and Dwellings respectively (the years of issues used were 1959/60, 1965/66, 1971/72 and 1976/77).

Employment in two processing industries can be expected to be under-estimated in certain years. The numbers employed in the production of meat pies and puddings was not available for 1959/60 and 1965/66 and the estimated figures for employment in the meat processing industry in these years will therefore be too low relative to 1971/72 and 1976/77. Employment in meat pie and pudding production in 1971/72 and 1976/77 was only 0.2 per cent and 0.8 per cent of total meat processing employment respectively however, implying that the omissions in 1959/60 and 1965/66 may not be serious.

Figures relating to the numbers employed in producing the town milk supply were not available for 1959/60 and 1965/66 and were thus omitted from the 1959/60 and 1965/66 dairy processing industry totals. In 1971/72 and 1976/77, 14 per cent of total employment in the dairy processing industry consisted of employment in the production of town milk. It would therefore appear that the 1959/60 and 1965/66 omissions may be a significant source of error in the analysis.

3. Real Valued Exports and Imports

Estimates of real valued exports and imports in the Agricultural Sector were based on figures presented in the input-output tables. The nominal values given in the tables were summed to obtain the various industry totals and were then deflated by appropriate price indices.

The price indices used were obtained from various tables contained in Prices, Wages and Labour 1980, Part A Prices, and were as follows:

(a) Exports

- farming exports were deflated by the 'Wholesale Price Index of Commodity Prices by Sector of Origin - Output of Farming' (source: Prices, Wages and Labour 1980. Part A Prices. Table 12 page 29); and
- exports of the processing industries were deflated by the 'Wholesale Price Index of Commodity Prices by Sector of Origin - Output of Primary Produce Processing Industries' (source: as for farming exports).

(b) Imports

- input supply sub-sector imports were deflated by the 'Wholesale Price Index of Commodity Prices by Sectors of Destination - All Other Industries - Imported Commodities' (source: Prices, Wages and Labour 1980, Part A. Prices. Table 11 page 28);
- farming sub-sector imports were deflated by the 'Wholesale Price Index of Commodity Prices by Sectors of Destination - Primary Industries - Imported Commodities' (source: as for input supply imports);

- imports into the processing industries of the PDR sub-sector were deflated by the 'Wholesale Price Index of Commodity Prices by Sectors of Destination - Primary Produce Processing Industries - Imported Commodities' (source: as for input supply imports); and

- imports into the distribution and wholesaling/retailing industries of the PDR sub-sector were deflated by the 'Wholesale Price Index of Commodity Prices by Sectors of Destination - All Other Industries' (source: as for input supply).

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