

ECONOMIC INTERACTIONS IN FIJI: A STUDY
OF SECTORAL FLOWS AND LINKAGES

by

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D E C L A R A T I O N

Except where otherwise indicated, this dissertation is my own work.

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ABSTRACT

Input-output analysis has found an important application in the economics of development through the concept of linkages. This dissertation is an application of the input-output approach to identify sectoral flows and linkages in the Fijian economy. It makes use of a 23 - sector inter-industry table of the year 1972 to describe and analyse the structure of the economy.

The 1972 inter-industry table is used to obtain a range of statistics on structural aspects of the economy. For this purpose, the inter-industry linkages were calculated. The main purpose is to identify and analyse the degree of interdependence between sectors of the economy which can be of significance for development planning. This is supplemented by identifying other major functional relationships of significance for planning, e.g., sectoral dependence on various categories of final demand and detailed analysis of the final markets of the output of some important sectors' of the economy.

An important application of inter-industry models in structural analysis has been the analysis of the relationship between primary inputs and final demand. Hence, the inter-industry table is used to elucidate questions of the type: What is the import content of personal consumption? What is the wages and salaries content of exports?

The inter-industry transactions matrix is 'closed' with respect to 'Households' to determine the income and employment multiplier effects. The multiplier analysis is considered from two points of view. First,

the income (or employment) effects following a given increase in output delivered to final demand and second, the increase in output required from any sector to achieve a given level of change in income (or employment).

On the basis of the structural relationships some implications are drawn and the study concludes with an assessment of the limitations and further development.

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CHAPTER 1

HISTORICAL BACKGROUND

1.1 Introduction

Since the pioneering work of W.W. Leontief in the 1930s (Leontief 1936), input-output analysis has grown into one of the most widely accepted aids to economic planning and decision making. Both the developing economies and the highly complex industrial economies have made use of the approach. The extensive application of input-output analysis in free market, partially planned and totally planned economies demonstrates the value-free nature of the analysis. It is a model which does not rely upon any one political, social or economic system.

Over the years there has been a shift from emphasis on the problems of constructing input-output systems to the application of these systems to a variety of economic problems. The approach has been applied in the overall formulation of national development plans, where it offers a useful macro-economic framework, and it has featured in various other types of economic analysis, e.g. the analysis of price effects due to changes in primary inputs.

The first input-output table compiled for Fiji (Dommen 1970) was a Seers type model for the year 1966. The limitations and the weakness of this table were mainly due to lack of relevant and reliable data. However, subsequent tables depicted a more realistic picture of the economy using a conventional square table rather than the simplified Seers type configuration. Compared to many other developing countries, Fiji

has only recently adopted the inter-industry model for the purpose of nation-wide planning, and very little use has been made of the model to examine sectoral flows and linkages. It is the purpose of this study to analyse the sectoral interdependence and linkages among various sectors of the Fiji economy and to consider some of the implications for the economic development of the country.

1.2 Economic Interdependence

The systematic analysis of economic thought can be traced to Adam Smith and his immediate followers. Their approach to economic analysis was through what is known today as macro-economics. This approach faded into the background when economists in the neo-classical school (Marshall, Chamberlin, Robinson, etc.) took a new approach to economic analysis with emphasis upon the role of households and firms (micro-economics). Basically, they utilized a partial equilibrium approach to analyse forces which contributed to economic equilibrium. However, it was J.M. Keynes in the 1930's (Keynes 1936) who revived interest in aggregative economics. Emphasis was again placed on the economy as a whole and upon broad aggregates, viz., total employment, total consumption, total investment and national income. Neither the neo-classicals nor the Keynesians were directly concerned with economic interdependence, with the structure of the economy and the way in which its individual sectors fit altogether.

Some work on interdependence of economic activities had begun before the days of Adam Smith although it did not feature very prominently as other approaches to economic analysis. In 1759 Francis Quesnay, wrote Tableau Economique for Louis XV. The Tableau Economique was a

device which stressed the interdependence of economic activities.

In the original tableau the paradigm (which was a single farm) depicted graphically the successive 'rounds' of wealth producing activity which resulted from a given increment in output. Quesnay's modified version published by Cannit (1766) in the Journale de l'Agriculture depicted the entire economy of the nation. The theme of the Tableau was the annual distribution and circulation of the output of agriculture and manufactures.

The next major work on economic interdependence came in 1874 when Leon Walras published his Elements d'economie Politique pure. Walras worked on the principles which underlie the workings of an exchange economy. The model he developed was comprised of a system of equations to express the dependence of the amounts demanded and supplied by particular individuals on the system of market prices, and to express the equality of demand and supply in particular markets.

From the general equilibrium of exchange, Walras went on to general equilibrium of production. His work in this area was restricted to the situation where the 'Coefficients of production' are fixed, so that the quantities of all factors needed to produce a unit of each kind of finished product are technically given. According to Walras, given fixed coefficients and perfect competition the equilibrium prices of the products must depend on the prices of the factors; thus given the prices of the factors, the whole price-system (of products and factors) could be derived by simple process of addition. But, given this whole price system, the demands for products and the supply of factors could be ascertained from the tastes and abilities of the individuals in the economy. Hence, once the demands for products were determined, the demands for

the factors could be technically derived. In short, the demand for factors and the supplies of factors were seen to be functions of the set of factor prices; and to determine equilibrium in the factor markets. Thus, the equilibrium prices in the factor markets determine the equilibrium prices of the products.

The Walrasian model indicates interdependence among the producing sectors of the economy and the competing demands of each sector for the factors of production. Equations representing consumer expenditure and income were also included by Walras and allowed consumers to substitute the products of one sector for those of others. The costs of production in each sector, the total demand for and supply of commodities and the demand for and supply of factors of production were also accounted for in his system of equations. Walras regarded his system of equations as purely theoretical, but, given the data, computation is not a problem today because of sophisticated digital computers.

Many other writers contributed to the general theory of equilibrium but the greatest advance to the work started by Quesnay came when Wassily Leontief (Leontief 1936) developed a general theory of production based on the notion of economic interdependence. This is regarded as an empirical counterpart to the Walrasian model of general equilibrium. In fact, Leontief simplified the Walrasian system to the extent necessary to derive a set of parameters for his model from a single observation of the interindustry transactions in the economy. He, therefore, omitted the effects of limited factor supplies from the system. He also used the original Walrasian assumption of fixed coefficients of production instead of allowing for substitution among inputs. So by eliminating all effects

of price on the composition of consumer demand, on the purchase of intermediate goods and on the supply of labour and other factors the Leontief model avoids many of Walras' later refinements. Subsequently Leontief published the first input-output table for the American economy using an 'open static model' where final demand is related to other sectors but is determined autonomously outside the system.

The static open model has been widely used for regional, inter-regional and national economic analysis, in free market, partially and centrally planned economies and by nations in all stages of development. It has gained international acceptance as an analytical tool and as an important aid to policy makers in many countries. With increased acceptance of input-output analysis, more research is being carried out to rectify data and to resolve aggregation problems pertaining to input-output analysis. More recently, attention has been focused on the dynamic input-output analysis. Although a lot of work remains to be done in this area, elegant models have been built and significant progress has been made in identifying the data needs.

1.3 Input-Output Analysis and Economic Development

The decay of colonialism saw the rise of new independent nations after World War II and this provided a new, powerful stimulus to economic development. To attack and alleviate the problems of less developed countries (poverty, unemployment, inequality of income distribution, etc), these countries are looking for the best ways of utilizing investment resources. This, in many a case, has meant large changes in the structure of production whose effects on the rest of the economy are difficult to trace. The input-output approach has offered great advantages in handling such problems because it can deal explicitly with various types of structural change.

A number of theories of economic development have been propounded (Kindleberger and Herrick 1977). One such set of theories adopts a structuralist approach and focuses attention on the composition of the economy as a whole, principally on the sources of production. The division of an economy into distinct economic activities (by Leontief and his predecessors) coupled with their concern for technological interdependence and each sector's unique interaction with others, is clearly 'structuralist'. Later works of Kuznets (Kuznets 1971) on the empirical basis for the components of national income and output and research of Chenery and his associates (Chenery and Syrquin 1975) provided the necessary background to the structuralist theories. This approach attempts to detect specific rigidities, lags, and other features of the structure of the developing economies that effect economic adjustment and the choice of development policy. Structuralists view the relationships between sectors as being rigid. Continuous disequilibrium rather than a self-equilibrating system is seen as the prevalent state of most of the developing countries. They tend to identify the consequences of various kinds of structural disequilibria and advocate structural change as a means of rectifying such problems. This inevitably calls for the analysis of the structure of development, a process for which the input-output technique is ideally suited. As Leontief has pointed out, the "input-output table is not merely a device for displaying or storing information, it is above all an analytical tool" (Leontief 1963, p.166).

Economic development can be subject to many constraints involving, for example, the balance of payments, the availability of different resources, the composition of final demand. Hence, many countries have

used input-output analysis to estimate the proper balance among investment sectors and to determine the likely effects of a development programme on the balance of payments, employment, total investment requirements, etc. One advantage of such an analysis is that it may indicate inconsistencies in the development programme which can be rectified subsequently. In short, this type of application of input-output analysis is geared to synthesise and coordinate programmes which are drawn up on a sector basis and to determine the implications for other sectors (Seers 1966).

According to the proponents of development planning for developing countries, the unaided market economy can and often does lead to economic stagnation, fluctuating prices, low levels of employment and continuous disequilibrium in the economy. Even where market mechanisms are operating relatively well, circumstances can arise in which development is not smooth, continuous and automatic and the optimum development path cannot be achieved simply by making marginal adjustments.

Structuralists tend to advocate government planning to handle circumstances imperfectly treated by the unaided market system. Their interest is in macro-economic planning models, specific sectoral plans and policies. In particular, the plans and policies appear in such form as agricultural reforms, import substitution strategies, investment in infrastructure and other sector-wide changes. Ministries of planning, planning commissions, central planning offices have been established in many underdeveloped countries and planners flourish wherever these agencies exist. Initially, most of the plans were macro-economic in content but more recently detailed sectoral, physical and financial plans have been taken as prerequisites for development.

Input-output analysis has greatly facilitated the formulation of planning models. Planning models can be conveniently placed in three categories: the aggregate growth models, the sectoral projection models, and the comprehensive inter-industry model.¹ The comprehensive inter-industry model (one of the most sophisticated in use) utilizes some variant of the input-output model in which all productive sectors of the economy are inter-related. Given the planned output targets for each sector of the economy the inter-industry model can be used to ascertain intermediate material, imports, labour and capital requirements. Papua New Guinea is an example of a country that utilizes one such model (Papua New Guinea, CPO, 1977).

Experience with structural imbalance is one of the most persuasive arguments for studies of structural interdependence. However, although input-output analysis is acknowledged to be an appropriate tool for this task, there is a general disenchantment with the use of the conventional input-output model in undeveloped countries. This dissatisfaction stems mainly from the high degree of instability of technical coefficients in underdeveloped economies. Development economists (e.g. Chenery 1963) have expressed desire for a more flexible analytical tool.

Input-output analysis or any other analytical tool for that matter is not the panacea of all development problems. As stated by Leontief "the mere existence of an elaborate projection will not of course, bring about economic growth. Much political acumen and drive, much sweat and tears goes into the actual realization even of the best-conceived development plan. Progress, however, will be faster along a road well mapped in advance and the cost of progress in terms of labour, capital and human sacrifice considerably less" (Leontief 1963, p.166).

1 Todaro 1978.

1.4 Input-Output Analysis and Linkages

The development of economic models (from two sectors to 'n' sectors) has enabled relationships between sectors and economic variables to be more explicitly identified and quantified. In other words, it has made sectoral articulation possible, that is, the examination of interdependence among sectors in terms of various types of linkage effects. These can be classified into three broad categories:

- a. inter-industry linkages;
- b. employment linkages;
- c. income-generation linkages.

Linkages offer a measure of the degree of sectoral interdependence in an economy and the extent to which growth in one sector is induced by the expansion of other sectors. Hirschman (1958) was the first to make use of linkage effects to formulate a development strategy which identifies the key sectors in development planning. Since then linkages have been empirically verified and measured in a number of historical and case studies of development (Fishlow 1965, Rasmussen 1956, Pearson 1970, Roemer 1970, Hazari and Krishnamurty 1970, Acharya and Hazari 1971).

In this study an input-output table is used to identify linkage effects for the Fijian economy. In particular, use is made of the official inter-industry transactions table for 1972, the table of technical coefficients and the table of interdependence coefficients.

1.5 The Objectives of the Study

This study is an attempt to identify and analyse the sectoral flows and linkages in the Fijian economy that could be of relevance in development planning. The inter-industry linkages are calculated and

examined to ascertain a sector's ability to spread growth impulses to its economic environment. For this purpose, following attributes are considered:

- a. Direct backward and forward linkages.
- b. Total (direct and indirect) backward and forward linkages.
- c. Power of dispersion and sensitivity of dispersion.
- d. Coefficient of variations.

Since realization of linkages for domestic production depends largely on the level and structure of final demand, each sector's dependence on final demand was analysed through total dependence of a sector on various categories of final demand and the analysis of final markets.

The linkage coefficients help us to identify sectors that - due to their important position in the interindustrial network - are significant for initiating or disturbing growth impulses. However, they do not indicate what variations of central economic aggregates, e.g. trade and employment are affected. For this reason, the total requirements of primary input also have been calculated by means of the inverse matrix. The sectors are classified according to their total primary input requirements per unit of final demand. The analysis is supplemented by examining the effect on sectoral product prices due to a uniform change in average wages and salaries and the price of imports.

The income multiplier effects, and using statistical information from outside the input-output system, the employment multiplier effects are also determined.

For this study, the 1972 input-output table of Fiji (Bureau of

Statistics 1974) is used. The table, which is 'open and static', comprises of 23 producing sectors.

1.6 The Outline of the Dissertation

After this introduction, the next chapter reviews the structure and growth of the Fijian economy from 1971 to 1977. In the third chapter the methodology of input-output analysis is reviewed together with a discussion of the make of the input-output table of Fiji. Chapter 4 examines the inter-industry linkages in the Fijian economy. The sectors are ranked according to the magnitude of each type of linkage index and the structure of linkages is examined by using Spearman's rank order correlation. Some limitations of the inter-industry linkages are also discussed. Chapter 5 examines the primary input content of final demand, final markets for the output of each sector, total (direct and indirect) dependence of each sector on various categories of final demand and effects of a 10 per cent increase in wages and salaries and a 10 per cent increase in price of imports on sectoral prices and cost of living index. Chapter 6 analyses the income and employment multipliers and Chapter 7 presents the summary of results, the implications, limitations and the possible further development of the study.

CHAPTER 2

THE STRUCTURE AND GROWTH OF THE FIJIAN ECONOMY

Fiji is comprised of a group of over 300 tropical islands between latitude 15° - 22° south and longitude 174° E - 177° W. These small islands are scattered over 230,000 square kilometers of ocean with a total land area of 18,272 square kilometers, half of which is mountainous and steep. The two main islands of this group, Viti Levu and Vanua Levu, contain about 87 per cent of the total land area and approximately 93 per cent of the population.

2.1 Demographic Characteristics and Labour Force

Fiji has experienced a drastic decline in the rate of population growth from about 2.6 per cent in 1966 to about 1.7 per cent in 1976. This decline is attributed to two main factors: a reduction in the fertility rate and the growth of emigration. Some of the main demographic characteristics are shown in Table 2.1.

The population of Fiji is relatively young and the number of young men and women seeking productive employment over the next decade will exert considerable pressure on employment. The population density is lower than some other developing island economies.¹

The labour force has been growing at about 3.4 per cent per year over the last decade (Table 2.2).

The labour force has been growing more rapidly than the population because of the increased labour force participation by women and the changing age structure of a population with fewer children.

1 Jamaica 173 per Km², Mauritius 434 per Km²; Philippines 142 per Km² Trinidad/Tobago 215 per Km².

TABLE 2.1

DEMOGRAPHIC CHARACTERISTICS OF FIJI

	<u>1966</u>	<u>1970</u>	<u>1976</u>
<u>Population: ('000)</u>			
Male	243	267	297
Female	234	257	291
TOTAL	477	524	588
<u>Vital Statistics:</u>			
Crude birth rate per 1,000 of population	34.2	29.9	28.6
Crude death rate per 1,000 of population	5.3	4.7	4.4
Infant death rate per 1,000 live births	27.9	18.5	17.2
Average annual rate of population growth (%)	2.6	2.1	1.7
Population under five years (%)	17.3	15.3	13.3
Population 65 years and over (%)	2.5	2.8	3.0
Population density (Km ²)	26.1	28.7	31.1
Household size of total population	5.1	n.a.	6.0

Source: Bureau of Statistics (1978): Current Economic Statistics,
(October) Suva, Fiji.

TABLE 2.2

THE LABOUR FORCE IN FIJI

Labour Force	1966	1972	1976	% Annual Growth Rate
Both Sexes	125,809	144,060	175,785	3.4
Male	116,433	122,252	146,315	2.3
Female	9,376	21,808	29,470	12.3

Source: Bureau of Statistics op.cit.

2.2 Economic Setting

Many of the country's predominant economic characteristics are a function of its small size. The limited availability of domestic raw materials and the small size of the domestic market effectively restrict the types of products which can be produced economically within the country. Consequently Fiji is one of the most import dependent countries in the world. The relative isolation from the main centres of world population and markets significantly raises the cost of transport for both imported raw materials, consumer goods and exports. The economy has mostly depended on agriculture, dominated by sugar, as the main source of exports and income, although tourism and related economic activities have emerged as important sources of growth during past decade. Fiji has only limited potential for the development of agriculture due to the limited area of suitable land and the high transport costs applying in locations away from the main islands. However, there is considerable potential for development of forestry, fisheries and mining.

Fiji has an equable tropical climate, with clear demarcation of wet and dry zones. This allows some diversification of agriculture. Also because of its isolation, Fiji is relatively free of some important diseases of man (Malaria) and of animals. Fiji's picturesque setting, the social and personal characteristics of its people, and its location as a staging point on the main routes between America and Australasia make it attractive to the tourist.

However, the economy is facing some acute problems in relation to land tenure, decreasing agricultural productivity, a shortage of skilled manpower and high labour costs.

Estimates of the gross domestic product indicate high but variable rates of economic growth in terms of current prices (Table 2.3).

TABLE 2.3

GROSS DOMESTIC PRODUCT OF FIJI 1971-1977
(current prices)

Year	Gross Domestic Product at Factor Cost	Annual Growth Rate of Gross Domestic Product	Gross Domestic Product Per Head of the Population	Annual Growth Rate of Gross Domestic Product Per Head
	(\$M)	(%)	(\$)	(%)
1970	168.9	20.2	324	16.6
1971	184.7	9.3	347	7.1
1972	230.5	24.8	424	22.2
1973	300.6	30.4	541	27.6
1974	400.0	33.1	708	30.9
1975	502.4	25.6	872	23.2
1976	558.5	11.2	955	9.5
1977 (P)	636.2	13.9	1067	11.7

(P) Provisional

Source: Bureau of Statistics, Current Economic Statistics, October 1978, Suva, Fiji.

An important part of rural production in Fiji is 'subsistence production'. This component is difficult to estimate but an attempt is made to incorporate subsistence production in the national accounts. Despite the figures being in current prices there is a strong suggestion that there has been economic growth in the economy. When corrected for price increases, Fiji's GDP appears to have increased at an average of about 6 per cent. Average per capita incomes indicate that Fiji

is not poor by world standards. The average income is greater than in many countries in Africa and Asia.

TABLE 2.4
PERCENTAGE SHARES IN GDP BY INDUSTRIAL ORIGIN
(1968 constant prices)

Industrial Group	1971	1972	1973	1974	1975	1976	1977
Agriculture, Forestry & Fisheries	24.0	22.0	21.0	19.7	19.8	20.0	21.0
Mining and Quarrying	1.5	1.3	1.1	0.9	0.9	0.8	0.6
Manufacturing	11.2	10.8	9.9	10.0	10.1	10.6	11.0
Electricity, Gas & Water	1.5	1.5	1.5	1.5	1.6	1.7	1.8
Building and Construction	5.5	5.7	5.8	5.0	4.4	4.1	4.2
Distribution (including tourism)	21.7	22.5	23.0	22.9	21.6	21.0	21.0
Transport & Communications	7.0	7.4	7.5	7.9	8.4	8.4	8.2
Finance and Insurance	13.0	14.0	14.4	15.2	11.6	16.3	15.9
Government Services	10.4	10.6	11.3	12.2	12.7	12.7	12.0
Other Services	4.7	4.7	5.0	5.1	5.3	5.3	5.0
Total	100	100	100	100	100	100	100

Source: Derived from Bureau of Statistics, Current Economic Statistics, October 1978.

The share of Agriculture, Forestry and Fisheries in GDP fell from 24 per cent in 1971 to 21 per cent in 1977. Of Fiji's four major crops, i.e. sugar, coconuts, rice and bananas, which account for well over 75 per cent of the cultivated area, all except rice experienced a decline. Factors adversely affecting agricultural production are: underutilization of land, inadequate drainage, inadequate infrastructure and supporting

services, and labour shortages due primarily to the attraction of high wages in non-agricultural employment.

On the other hand the services sector (Government Services, Other Services, Distribution, Finance and Insurance) contributed about 57 per cent of total GDP in 1971 rising to about 62 per cent in 1977. Comparison with 1966 figure of 45.8 per cent indicates the emergence of a dominant services sector and marks an important structural change in the economy. The other elements of this change are a declining share of agriculture in GDP, an increasing dependence on imports and rising share of foreign capital in the financing of gross investment in the economy.

2.3 Employment

In view of the significant subsistence sector in the economy it is difficult to ascertain the size of the labour force. There are able bodied persons living in the subsistence sector who do not normally seek paid employment and thus they are not normally included in the labour force. Nevertheless, they are willing to undertake paid employment should work become available in the neighbourhood, e.g. during the construction of a rural road etc. Agricultural activities in the non-subsistence sector (particularly sugar cane farming), are characterised by family units producing crops for sale. Hired labour is common only during harvesting and employment can best be described as casual and seasonal. There is probably considerable under-employment among this group. In view of the difficulties in accurately defining and ascertaining the size of the labour force it is also difficult to estimate 'unemployment' precisely. Employment statistics compiled on a regular basis in Fiji, therefore, relate mainly to paid employees in the blue and white collar occupations.

Employment¹ has been growing at about 4 per cent per year since 1971 (see Table 2.5). The growth rate for salaried employees has been

TABLE 2.5
ESTIMATED PAID EMPLOYMENT, CLASSIFIED
BY WAGE AND SALARY EARNERS

Year	Wage Earners	% Annual Growth	Salaried Employees	% Annual Growth	Total Wage and Salaried Employees	% Annual Growth
1971	37,682	1	19,306	5.3	56,988	2.3
1972	38,074	4.8	20,325	6.1	58,399	5.3
1973	39,912	6.8	21,564	13.0	61,476	9.0
1974	42,634	5.2	24,364	3.1	66,998	4.4
1975	44,862	-3.9	25,114	6.9	69,976	0.03
1976	43,134	0.92	26,860	7.4	69,994	3.4
1977	43,530		28,853		72,383	

Source: Derived from Bureau of Statistics: Current Economic Statistics, October 1978, Suva, Fiji.

much higher than for wage earners. This increase is largely attributed to the growth of the services sector and growth in employment of salaried employees in agriculture, forestry, fisheries and manufacturing. Table 2.6 shows the divergent trends in paid employment between sectors. From 1971, employment in agriculture, mining and quarrying, manufacturing and construction has declined steadily in proportion to other sectors.

1 Paid employment only (it excludes self employment and the subsistence sector).

TABLE 2.6
PERCENTAGE DISTRIBUTION OF PAID EMPLOYMENT
BY ISIC SECTORS

ISIC Sectors	1970	1971	1972	1973	1974	1975	1976	1977
Agriculture, Forestry and Fishing	7	7	5	6	5	6	5	5
Mining and Quarrying	4	3	3	3	3	3	2	3
Manufacturing	18	18	17	16	18	18	16	16
Electricity, Water & Gas	2	2	2	3	3	2	3	3
Construction	14	15	14	15	14	12	11	11
Wholesale, Retail Trade, Hotels and Restaurants	17	16	17	16	14	15	17	18
Transport, Storage and Communications	8	8	9	8	9	9	10	10
Finance, Insurance, Real Estate and Business Services	3	3	3	4	4	5	5	6
Community, Social and Personal Services	27	28	29	29	30	30	31	30
Total	100	100	100	100	100	100	100	100

Source: Derived from Bureau of Statistics: Current Economic Statistics, October 1978, Suva, Fiji.

The most important sectors in terms of paid employment in Fiji are 'Community, Social and Personal Services', (which includes government), 'Wholesale and Retail Trade, Hotels and Restaurants, Manufacturing', 'Construction' and 'Transport, Storage and Communication'.

In 1976 the rate of unemployment was recorded as 7.3 per cent. Unemployment among males was higher than for females (Table 2.7).

TABLE 2.7
UNEMPLOYMENT ESTIMATES

Unemployment	1966	%	1976	%
Both Sexes	5,235	4.2	12,915	7.3
Male	4,225	4.2	8,654	4.9
Female	15	n.a.	4,261	2.4

Source: Bureau of Statistics: Fiji Facts and Figures, 1977, Suva, Fiji.

2.4 Role of State in the Fijian Economy

The movement towards deficit budgets in recent years can be traced to specific trends in both revenues and current expenditures (Table 2.8). Tax revenues as a proportion of GDP fell from 23 per cent in 1971 to 18 per cent in 1977. On the other hand, government expenditures have been rising since 1971 at a slightly faster rate than a 18 per cent increase in current revenues.

The government's fiscal effort has been substantial over the past decade when current revenues averaged about 24 per cent of the GDP.¹ In the last three years recorded, the ratio of current expenditures to GDP has declined to about 18 per cent. This has been accompanied by a structural change in the composition of tax revenues following recent tax reforms. The reforms have eroded the base of taxes on international trade and also resulted in reduced duties on imports.

1 The comparable ratios of some other developing countries are: Hongkong 14.9, Korea 17.3, Malaysia 21.0, Philippines 13.5, Singapore 20.8, Taiwan 20.6, Barbados 27.2 and Jamaica 22.0.

The average rate of growth of government current expenditures since 1971 has been about 22 per cent per annum. Expenditures have been rising at a faster rate than revenues, primarily because of substantial salary increases in the public sector. The continuous pressures for salary increases and a genuine need for expanding technical and professional staff in key sectors such as agriculture impedes the chances of containing the growth of current expenditures in the future.

In recent years, central government capital expenditures have accounted for about 80 per cent of total public investment. The current development plan (Development Plan Seven 1976-1980) programme is for \$F343 million, or about twice the actual expenditure under the last plan (in real terms). The composition of the proposed capital expenditure shows an increasing proportion of the total being directed towards infrastructure projects and economic services.

TABLE 2.8

TRENDS IN GOVERNMENT FINANCES
(\$F '000)

Year	Current Revenue	Current Expenditure	Current Surplus (Deficit)	Current Surplus as Percentage of GDP
1970	42,089	39,884	+ 2,235	1.3
1971	53,009	46,807	+ 6,202	3.4
1972	59,072	56,725	+ 2,505	1.1
1973	72,486	70,401	+ 2,085	0.7
1974	80,911	78,993	+ 1,918	0.5
1975	113,298	108,445	+ 4,853	1.0
1976	128,785	129,668	- 883	- 0.2
1977	150,434	155,077	- 4,643	- 0.7

Source: Bureau of Statistics (1978): Current Economic Statistics, October, Suva, Fiji.

Infrastructure expenditure is planned to increase from 41 per cent of the total in 1971-1975 to 51 per cent in 1976-1980 (Table 2.9).

TABLE 2.9

GOVERNMENT CAPITAL EXPENDITURE PROGRAMME

(\$F million)

	<u>Actual 1971-1975</u> (Sixth Plan)	<u>Program 1976-1980</u> (Seventh Plan)
Economic Services	<u>16.83</u>	<u>60.30</u>
Agricultural Sector	14.59	52.91
Other	2.24	7.39
Social Services	<u>20.57</u>	<u>49.38</u>
Education	6.26	17.78
Health	9.52	14.11
Housing	4.38	16.30
Other	0.41	1.19
Infrastructure	<u>46.48</u>	<u>174.98</u>
Electricity	0.05	59.80
Water/Sewerage	10.39	48.98
Communications	4.87	19.46
Transport	29.23	42.40
Other	1.94	4.34
Rural Development	<u>3.58</u>	<u>24.61</u>
Administrative Services	<u>10.08</u>	<u>29.55</u>
Miscellaneous	<u>15.98</u>	<u>3.77</u>
Total	<u>113.47</u>	<u>342.50</u>

Source: Central Planning Office: Fiji's Sixth (1971-1975) and Seventh (1976-1980) Development Plans.

Rural development programmes began in 1969 and the allocation of capital expenditure funds to rural development increased from \$F3.58 million in a Sixth development programme to \$F24.61 in the Seventh plan - indicative of the government's commitment to rural development.

The government relies heavily on external sources to finance its

capital expenditure programme. During the Seventh plan period government's own savings is expected to contribute 22 per cent, and overseas aid and lending agencies about 50 per cent of the total requirement of \$274 million.¹ Most of the remaining 28 per cent is expected to be borrowed locally (see Table 2.10 for details). These proportions are not very different from those which applied during the Sixth plan (1971-1975).

TABLE 2.10
FINANCING GOVERNMENT CAPITAL EXPENDITURE
1976-80

Domestic Sources (a)	\$ millions	% Share
Appropriations from general revenue	59	21.5
Miscellaneous contributions, repayments etc.	6	2.2
Local borrowing		
F.N.P.F.	25	9.1
Other Sources	47	17.2
Total domestic sources	137	50.0
External Sources		
Cash grants, soft and commercial bonus	102	37.3
Capital aid in kind	35	13.7
Total external sources	137	50.0
TOTAL, Government Capital Expenditure	274	100.0

Note: (a) The World Bank Mission estimates indicate that the external sources' share of financing government capital expenditure will be about 55 per cent.

Source: CPO, Fiji - Seventh Development Plan (1976-1980), Suva, Fiji.

1 Development Plan Seven projects capital expenditure of \$F274 million. This is lower than the detailed development programme of \$F343 million during 1976-1980, the shortfall being attributed to slippage in the implementation of projects.

2.5 International Trade and Balance of Payments

The limited availability of domestic raw materials and the small size of the economy ensures that Fiji must depend on imports for a wide range of the goods and services needed to sustain a modern society. To pay for these goods and services exports are imperative.

The total value of imports rose from \$F35 million in 1958 to \$F280.960 million in 1977 - an eightfold increase in about two decades. Over the same period total exports (including re-exports) increased at a much slower rate from \$F29 million to \$F162.822 million. The growth of imports has outpaced Fiji's capacity to increase exports, but the balance of trade deficit improved from 27 per cent of GDP in 1971 to about 18 per cent in 1977. This improvement has been largely due to the high price of sugar in recent years, surpluses generated on services account, mostly from tourism, and the inflow of external capital.

The composition of imports is illustrated in Table 2.11 which lists imports by standard international trade classification (SITC) from 1971 to 1977. Food, mineral fuels, manufactured goods and machinery account for the major part of imports.

The high level of imports of capital and intermediate goods suggests that capital expenditure in Fiji has a very high level of import content. Raw materials enter the country at a rate of duty lower than the prevailing general rate, in accordance with the government's policy of encouraging growth in existing industries and attracting further investment. Given Fiji's growing dependence on imports and considering the slower growth rate of domestic exports (compared to imports) the problem of import management will need close attention by the government in the future.

TABLE 2.11
IMPORTS BY VALUE AND SITC SECTIONS
(\$'000 f.o.b.)

	1971	1972	1973	1974	1975	1976	1977
Food	20,643	25,013	33,909	41,302	38,504	43,330	53,819
Beverages and Tobacco	2,364	2,240	2,961	2,943	2,988	3,286	4,532
Crude Materials	1,335	1,924	2,563	3,341	1,920	1,783	2,394
Mineral Fuels	11,690	13,068	15,619	34,490	38,508	38,205	54,133
Oils and Fats	1,599	1,601	2,408	3,582	3,604	3,406	4,203
Chemicals	6,433	7,684	10,787	14,641	16,660	14,639	20,201
Manufactured Goods	21,017	22,857	32,048	44,812	39,612	42,728	51,061
Machinery	24,722	32,671	41,150	35,220	44,734	49,421	51,368
Miscellaneous Articles	17,674	18,549	25,691	33,890	28,155	33,009	30,919
Miscellaneous Transactions	4,073	5,942	7,508	5,110	6,281	8,233	8,330
TOTAL	111,550	131,549	174,645	219,331	220,967	230,040	280,960

Source: Bureau of Statistics: Current Economic Statistics, October 1978
Suva, Fiji.

Merchandise exports are dominated by sugar which in 1976 accounted for about 56 per cent of the receipts from domestically produced exports. Table 2.12 lists the components of the exports from 1971 to 1976.

TABLE 2.12
MERCHANDISE EXPORTS
(\$m f.o.b.)

	1971	1972	1973	1974	1975	1976
<u>Commodity Group:</u>						
Sugar	32.9	34.3	34.3	67.0	94.4	68
Coconut Products	4.2	2.6	6.1	11.1	5.4	5
Gold	2.7	4.0	6.1	8.6	8.6	8
Other	3.7	4.0	5.9	8.7	7.0	8
Total Domestic Products	43.5	44.9	52.4	95.4	115.4	89
Re-exports Including Fish	18.1	20.7	22.0	28.3	26.4	33
TOTAL EXPORTS	61.6	65.6	74.4	123.7	141.8	122

Source: Bureau of Statistics: Current Economic Statistics, October 1978
Suva, Fiji.

Since 1971 Fiji's re-export trade has grown at an average rate of 13 per cent per year - major re-export items being petroleum, fish and textiles.

The increase in sugar receipts has been primarily due to high export prices for sugar. However, in 1976, total receipts were somewhat depressed primarily because of a fall in sugar prices. Sugar will continue to dominate exports and hence the 14 per cent projected growth of exports in 1976-1980 period will largely depend on the export price of sugar.

The growing trade deficits since 1973 have been increasingly financed by surpluses generated on the services account, mainly from tourism (Table 2.13).

TABLE 2.13

SUMMARY OF THE BALANCE OF PAYMENTS
(\$Fm)

	1973	1974	1975	1976	1977
Current Account	-44	-15.7	5.9	-33.7	-34.4
Trade (net)	-87	-65	-48	-80.6	-96.7
Exports	66	123.8	142.2	122.5	144.3
Imports	153	188.8	190.3	203.1	241.0
Services (net)	38	48	54.3	45.2	63.2
Transfers (net)	5	1.3	-0.4	1.7	-0.9
Capital Account	39	37.6	20.7	11.5	26.4
Private (net)	21	5.7	8.1	11.1	18.4
Government (net)	18	31.9	12.6	0.4	8.0
Other Items	9	7.3	9.1	-7.8	16.7
Changes in Reserves	-4	-30	-35.6	24.2	-15.2

Source: Bureau of Statistics: Current Economic Statistics, October 1978.

However, there are some unfavourable trends in Fiji's major foreign exchange earning capacity, notably from sugar and tourism. Volume of sugar has declined over the years, although the receipts increased considerably due to booming export prices. The tourist arrivals declined from 186,323 in 1973 to 173,019 in 1977, although receipts from tourism continued to increase because of a lengthening of the average stay (from 7.8 days in 1973 to 8.4 in 1977) and an increase in expenditure per tourist.

Balance of payments in the near future will continue to depend heavily on tourism and sugar, and thus will be highly vulnerable to exogeneous factors.

The foregoing analysis concentrated on the structure and growth of the Fijian economy from 1971-1977. In the later chapters, input-output approach is employed to further analyse the structure and the functioning of the economy. By using input-output table it is possible to describe and isolated the major structural relationships in the economy. Ideally, it is desirable to study the structure of the economy from 1971 to 1977 by using input-output tables for all years stated. However, 1972 input-output table of Fiji is used for this purpose since it is the latest one available.

CHAPTER 3

THE METHODOLOGY OF INPUT-OUTPUT ANALYSIS

Input-output analysis was developed by W.W. Leontief as a method of identifying the transactions of goods and services and the inter-relationships of the activities of each sector to the others, in a given area over a specified period of time. The basic notion of input-output analysis rests on the belief that the economy of any country can be divided into a distinct number of sectors, each consisting of one or more firms producing a similar but not necessarily homogeneous product. Each sector requires certain inputs from other sectors in order to produce its own output. Similarly each industry sells some of its output to other sectors so that they too can satisfy their intermediate needs for materials and services. The output of each sector is defined as the sum of the sales by the sector to all other sectors and to itself, sales to export, to government and to individuals. Sectors whose demands for goods and services arise out of their own decisions to produce are termed 'intermediate' or producing sectors. Sectors whose demand for goods and services can be attributed to other reasons, such as political decisions or individual or consumer preferences, are usually called 'autonomous'. They represent final demand or 'the final bill of goods'. Government outlays, foreign trade and households are usually placed in the 'final demand' category although various other arrangements can be adopted.

If all sectors are represented as both producers and consumers the model is said to be 'closed'. In such a model, households constitute

a sector whose output is labour and whose inputs are consumption goods. Closed models do not lend themselves readily to algebraic manipulations since they are completely circular with no exogenous variables.

In an 'open static' model final demand (i.e. exports, government consumption, household consumption and capital formation) is assumed to be related to other sectors but is autonomously determined by factors outside the system. Labour is considered as an input unit but not as a functionally related product of households.

3.1 The Assumptions of the Model

In the case of an input-output model which is open and static, the following basic assumptions are made (UN 1966):

- a. Each sector produces a single output with a single input structure and there is no substitution between the outputs of different sectors. This assumption is the homogeneity assumption which requires that:
 - (1) all products of a single sector should either be perfect substitutes for one another or they should be produced in strictly fixed proportions;
 - (2) each sector should have a single input structure, and;
 - (3) there should be no substitution between the products of different sectors. In other words the same product should not be included in the output of different sectors.
- b. The inputs into each sector are simple proportions

only of the level of output of that sector.

That is, the amount of each kind of input absorbed by any particular sector changes in direct proportion to the increase or decrease in that sector's total output.

Alternatively, factor inputs are consumed in fixed proportion of factor inputs (no substitution among inputs).¹ This is known as the proportionality assumption.

- c. The total effect of carrying out production in several sectors is the sum of the separate effects. That is, any form of external interdependence between the sectors is ruled out other than as specified by the input-output system.

The number of commodities involved usually makes the assumption of homogeneous sectors unrealistic. Even if each commodity could be represented by a separate sector, so that both inputs and outputs were perfectly homogeneous, there would be considerable substitution between sectors.

3.2 Valuation of Transactions

The transactions identified by an I - O table can be recorded

1 Samuelson (Koopmans 1951) has shown that in some circumstances this restriction is not as serious as it appears. Even where variations of input proportions is possible, it will never be advantageous provided that there are constant returns to scale, only one scarce input and no joint products. In other words, the input-output proportions may be fixed, as is assumed, but they will then be fixed by considerations of productive efficiency rather than immutable technological requirements.

using any of the following:

- a. Basic values: indirect taxes are excluded from the value of the outputs and the inputs;
- b. Approximate basic values: the value of output excludes indirect taxes but the inputs include indirect taxes;
- c. Producers' values: the valuation of both outputs and inputs includes indirect taxes. Marketing costs are shown as inputs from the appropriate sector (Transport, Trade, Finance, Services and Government) to the purchasing sector;
- d. Purchasers' values: transactions are valued to include trade and transport margins in addition to indirect taxes. The elements of marketing cost are shown as inputs to the producing sector.

Under the purchasers' price system, the row totals of each sector include the marketing costs incurred in the delivery of that sector's output. Since the marketing costs vary as output distribution changes this leads to variations in the value of total output even if actual production of that sector remains unchanged. Therefore, the coefficients recorded in the base year are likely to be unstable. Also the marketing costs are counted twice (in the value of output of the producing industry and as inputs to that industry, from the marketing cost sectors). Under the producers' price system, marketing costs are counted only once.

Coefficients calculated in the base year from a table valued at

producers' prices are more stable than under the purchasers' price system. This is because marketing costs vary with the input structure of a sector and the latter is usually more stable than the output structure. The basic value method has many advantages but very few less developed countries have the statistical resources to make use of this method of valuation.

However, the stability of the coefficients varies with the method of valuation - being greatest where basic values are used and least stable where it is necessary to record transactions at purchasers' values.

3.3 The Input-Output Model

The structural make-up of a typical input-output table is presented in Figure 3.1. Most of the important information contained in the table is located within the three main quadrants: the 'Inter-industry Transactions' quadrant (II), the 'Value Added' quadrant (III), and the 'Final Use' quadrant (I). The 'Direct Factor Purchase' quadrant (IV) is less important for many planning purposes but is necessary for accounting purposes, especially for measuring gross domestic product.

In Figure 3.2 entries along the rows represent the allocation of output of a given sector, partly to intermediate demand and partly to final demand. The entries in the columns show intermediate inputs and primary inputs used in production. From the method of entering figures in a matrix, it can be seen that each figure in each cell has a dual identity. For example, entries (in a particular cell) in the inter-industry transactions quadrant if observed along a row indicate the disposal of one sector's output to a particular intermediate sector. If

FIGURE 3.1

THE MAKE UP OF A TYPICAL INPUT-OUTPUT TABLE

USING SECTORS (INPUTS) → → PRODUCING SECTORS (OUTPUTS)		INTERMEDIATE USE COLUMNS		TOTAL INTERMEDIATE PRODUCTION	FINAL USE (DEMAND) COLUMNS		TOTAL FINAL DEMAND	TOTAL OUTPUT (SALES)
(1) SECTOR	(2) SECTOR				PRIVATE CONSUMPTION INVESTMENT	GOVERNMENT CONSUMPTION INVESTMENT, EXPORTS		
1 SECTOR 1								
2 SECTOR 2		OUTPUT PRODUCED FOR INTERMEDIATE USE		+	OUTPUTS PRODUCED FOR FINAL USE		=	TOTAL OUTPUT SECTOR 2
⋮								
⋮								
⋮								
ROWS								
⋮								
⋮								
⋮								
N SECTOR N								TOTAL OUTPUT SECTOR N
TOTAL INTERMEDIATE USE								
LABOUR								
CAPITAL								
LAND								
NATURAL RESOURCES								
VALUE ADDED								
TOTAL INPUTS (PURCHASES)								GROSS OUTPUT

Source: Todaro (1971).

FIGURE 3.2
LEONTIEF MATRIX OF INPUT COEFFICIENTS

SUPPLYING INDUSTRY	CONSUMING INDUSTRIES				INTERMEDIATE USE	FINAL DEMAND	TOTAL DEMAND
	1	2	3	j	n		
1	x_{11}	x_{12}	x_{13}	x_{1j}	x_{1n}	y_1	
2	x_{21}	x_{22}	x_{23}	x_{2j}	x_{2n}	y_2	
3	x_{31}	x_{32}	x_{33}	x_{3j}	x_{3n}	y_3	
i	x_{i1}	x_{i2}	x_{i3}	x_{ij}	x_{in}	y_i	$TD_i = \sum_j x_{ij} + y_i$
m	x_{m1}	x_{m2}	x_{m3}	x_{im}	x_{mn}	y_n	
TOTAL PRODUCED INPUTS	$\sum_i x_{ij}$				$\sum_{ij} x_{ij}$		
PRIMARY FACTOR INPUTS	w_1	w_2	w_3	w_j	w_n		
TOTAL PRODUCTION	$TP_j = \sum_i x_{ij} + w_j$				$\sum_{ij} x_{ij} + \sum_i w_j + \sum_i y_i$		

observed down a column, the figures in a particular cell represent an input which one sector has acquired from another. The arrangement of figures in matrix form shows an interwoven interdependence of activities between sectors. The allocation of a sector's output can be expressed as:¹

$$\begin{array}{rcl}
 X_1 & = & x_{11} + x_{12} + \text{-----} + x_{1j} + \text{-----} + x_{1n} + Y_1 \\
 X_2 & = & x_{21} + x_{22} + \text{-----} + x_{2j} + \text{-----} + x_{2n} + Y_2 \\
 \vdots & & \vdots \\
 X_i & = & x_{i1} + x_{i2} + \text{-----} + x_{ij} + \text{-----} + x_{in} + Y_i \\
 \vdots & & \vdots \\
 X_n & = & x_{n1} + x_{n2} + \text{-----} + x_{nj} + \text{-----} + x_{nn} + Y_n
 \end{array}
 \quad \text{eq (3.1)}$$

These equations can be shown in a general expression (Chenery and Clark 1959):

$$\sum_{j=1}^n x_{ij} + Y_i = X_i \quad \text{eq (3.2)}$$

where $i = 1, 2, \text{----} n$.

- 1 This balance equation means that the total output of a sector X_i equals the sum of the intermediate demand for the sector's output and the quantity of the i th sector's output going into final demand. This implicit assumption of input-output analysis is common to all general equilibrium models. In short, supply always equals demand.
- 2 Imports are treated as competitive and are included in such a way that inter-sectoral flows combine both imported and domestic produce. In such cases adjustments have to be made for the imported produce in determining the level of domestic output from the system, since by definition output has imported items deducted. Thus:

$$\begin{aligned}
 M_i + X_i &= \sum_j x_{ij} + Y_i \\
 \Rightarrow X_i &= \sum_j x_{ij} + (Y_i - M_i) \\
 \Rightarrow (I-A)^{-1}(Y-M) &= X
 \end{aligned}$$

where $(I-A)^{-1}$ is the matrix of interdependence coefficients
 X is vector of outputs
 $(Y-M)$ is a vector obtained by deducting from the total final demand of each sector (Y_i), the value of imports which are competitive with the i th output of that sector (M_i).

In reading the entries by columns, especially in the intermediate transactions quadrant, the figures in a given column represent the inputs needed for the production of that sector. The inputs for all the sectors may be expressed as:

$$X_j = \sum_{i=1}^n x_{ij} + W_j \quad \text{eq (3.3)}$$

where $j = 1, 2, 3 \dots n$.

3.4 Input-Output Coefficients

The input-output coefficients (or technical coefficients or the unit cost structure) a_{ij} may be derived as the amount of output from the i^{th} sector required per unit of output of sector j . The numerical value is determined by the units used to measure the output of sectors 'i' and 'j'. This makes it possible to bridge the gap between the theoretical input coefficients (which represent purely physical relations in production) and coefficients which can be derived from the actual value of relations recorded in an input-output table.

The physical input coefficient is defined as:

$$\bar{a}_{ij} = \bar{x}_{ij} / \bar{X}_j \quad \text{eq (3.4)}$$

where $\bar{X}_j$ = the total output of industry j (physical units)
 $\bar{x}_{ij}$ = the inter-industry flows, representing the amount of output of the i^{th} sector moving to the j^{th} sector (physical units)

Any element of a transaction matrix can be defined as $x_{ij}P_i$, a physical flow times its price. If each element in the table is divided by $\bar{X}_jP_j$, then the result will be a set of value coefficients, designated

a_{ij} , such that:¹

$$a_{ij} = \bar{x}_{ij} P_i / \bar{x}_j P_j \quad \text{eq (3.5a)}$$

$$\Rightarrow a_{ij} = \bar{a}_{ij} \cdot P_i / P_j \quad \text{eq (3.5b)}$$

Hence the observed coefficients a_{ij} will have the same value as the physical coefficient of the price at which a unit of output of each sector is valued as equal to unity. Calculated in this way the coefficients in each column of the matrix can be added. When all the primary input coefficients are included the sum of each column equals one. Each column of the input coefficient matrix may be referred to as the input structure or cost structure of the sector concerned. The coefficients can be used to illustrate the 'first-round' effects of a change in the output of one sector on the sectors from which it purchases inputs. The table of input coefficients can form the basis for a general solution and hence should meet the following stability conditions:²

- a. At least one column in the table add up to less than unity, and
- b. no column in the table (transactions table) add to more than unity.

1 Similarly

$$\begin{aligned} x_j &= \bar{x}_j P_j \\ x_{ij} &= \bar{x}_{ij} P_i \\ w_j &= P_i \bar{w}_j \\ y_i &= \bar{y}_i P_i \end{aligned}$$

where price (P) differs from variable to variable.

2 For mathematical proof see Robert Solow, "On the structure of linear models", Econometrica, XX (January 1952) p.29-46. See also Carl F. Christ, "A Review of Input-Output Analysis" in Input-Output Analysis: An Appraisal (Princeton: Princeton University Press 1955) pp.148-49.

Using the relationship in equation (3.1), the equation (3.5a) can be written as:

$$\begin{array}{l}
 X_1 = a_{11}X_1 + a_{12}X_2 + \text{-----} + a_{1j}X_j + \text{-----} + a_{1n}X_n + Y_1 \\
 X_2 = a_{21}X_1 + a_{22}X_2 + \text{-----} + a_{2j}X_j + \text{-----} + a_{2n}X_n + Y_2 \\
 \vdots \\
 X_j = a_{j1}X_1 + a_{j2}X_2 + \text{-----} + a_{jj}X_j + \text{-----} + a_{jn}X_n + Y_j \\
 \vdots \\
 X_n = a_{n1}X_1 + a_{n2}X_2 + \text{-----} + a_{nj}X_j + \text{-----} + a_{nn}X_n + Y_n
 \end{array}
 \quad \text{eq (3.6)}$$

These equations can be written in a general expression:

$$X_i = \sum_{j=1}^n a_{ij}X_j + Y_i \quad \text{eq (3.7)}$$

where $j = 1, 2, \text{-----} n$.

Therefore the balance equation can then be expressed as:

$$X_i - \sum_{j=1}^n a_{ij}X_j = Y_i \quad \text{eq (3.8)}$$

where $i, j = 1, 2, \text{-----} n$.

In matrix and vector notation this system can be expressed as:¹

$$X - AX = Y \quad \text{eq (3.9)}$$

where X represents a vector of sector outputs

Y represents a column vector of total final demand

A is a $n \times n$ (square) matrix of technical coefficients
of production (input-output coefficients)

3.5 Interdependence Coefficients

The inter-relationships which exist between different sectors of the economy ensures that a change in the final demand for the products

¹ See footnote 2 on page 35.

of one sector has ramifications throughout the system. Hence changes occur not only in the sector concerned but also in most (or perhaps all) of the other sectors of the economy. The technical coefficients show only a part of the interactions between sectors. They show only the direct (first order or first 'round') effects. However, there can be important second and higher order effects. An increase in the j^{th} sector output will require not only an increase in the inputs of sectors producing its inputs but also increases in the inputs of sectors which in turn produce the inputs for these sectors. The study of these effects is facilitated by first deriving interdependence coefficients.

Equation (3.8) can be expressed in the expanded form as follows:

$$\begin{array}{rcl}
 (1-a_{11})X_1 - a_{12}X_2 - \dots - a_{1n}X_n & = & Y_1 \\
 -a_{21}X_1 + (1-a_{22})X_2 - \dots - a_{2n}X_n & = & Y_2 \\
 \vdots & & \vdots \\
 -a_{n1}X_1 - a_{n2}X_2 - \dots + (1-a_{nn})X_n & = & Y_n
 \end{array} \quad \text{eq (3.10)}$$

In the matrix form this equation (3.10) takes the form:

$$\begin{bmatrix} (1-a_{11}) & -a_{12} & \dots & -a_{1n} \\ -a_{21} & (1-a_{22}) & \dots & -a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ -a_{n1} & -a_{n2} & \dots & (1-a_{nn}) \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix} \quad \text{eq (3.11)}$$

The matrix containing a_{ij} 's can be written as $(I-A)$ and the columns of X's and Y's are called vectors which may be written as X and Y

respectively; while the whole system may be written in abbreviated matrix form:¹

$$(I-A) X = Y \quad \text{eq (3.12)}$$

where I is the identity matrix

A is the technical coefficient matrix

The value of X now can be calculated as:

$$X = (I-A)^{-1}Y \quad \text{eq (3.13)}$$

The term $(I-A)^{-1}$ is termed the 'inverted' Leontief matrix. The inversion of $(I-A)$ matrix of coefficients gives the interdependence or total coefficients. This matrix inversion is used to derive the direct and indirect effects arising from an increase in the final demand.

Like the stability conditions for the table of direct coefficients, there is a fundamental condition that must also be met by the table of direct and indirect requirements known as the 'Hawkins-Simon condition' (Hawkins and Simon 1949, pp.245-48). Basically, the Hawkins-Simon condition states that there can be no negative entries in the table of direct and indirect requirements. In essence a negative entry in the table will mean that each time the industry with a negative entry expanded its sales to final demand, its direct and indirect input requirements would decline. At the extreme this would mean that the more this industry expanded its output the less it would buy from other industries. This is a logical contradiction and an economic absurdity.

$$1 \quad X_i - \sum_{j=1}^n a_{ij} X_j = Y$$

in matrix form this equals

$$X - A X = Y$$

$$\Rightarrow (I-A)X = Y$$

where I is the identity matrix.

Once the table of direct and indirect coefficients has been obtained, the input-output table can be used for a variety of analytical purposes. Some of these will be discussed in other chapters of the study.

3.6 Structural Analysis

Structural analysis is concerned with the qualitative properties of an input-output table, particularly the properties of the technical input-output matrix. The technical matrix indicates the extent of technical interdependence among sectors. The various types of structural inter-relations (Yau and Ames 1965) are depicted diagrammatically in Figures 3.3 A to E.

Figure 3.3 (A) shows the case of complete interdependence (i.e. all entries are filled with non zero numbers). Each industry buys and sells from all other industries. Hence an increase in the final demand for the product of any one industry will affect all industries in the economy. The case of random industrial interdependence is featured in Figure 3.3 (B). An industry in this case has direct input-output relations with some but not all other industries.¹ Figure 3.3 (C) is a triangular matrix indicating a complete hierarchical inter-industry relations. The industry in the top row purchases inputs from all other industries but sells its output only to final consumers, i.e. it is a final goods industry. The industry at the bottom row sells its product to all other industries as well as to final users, while it purchases none of its inputs from other industries, i.e. it is a basic or primary

1 If rearranged systematically these random pattern matrices can display interesting characteristics, e.g. this matrix can be rearranged to form triangular matrix with all elements above the leading diagonal being zero.

FIGURE 3.3

CLASSIFICATION OF TECHNICAL MATRICES

X	X	X	X
X	X	X	X
X	X	X	X
X	X	X	X

A Complete interdependence

	X		
X		X	
X		X	
			X

B Random pattern

X			
X	X		
X	X	X	
X	X	X	X

C Hierarchical pattern

X	X		
X	X		
		X	X
X		X	X

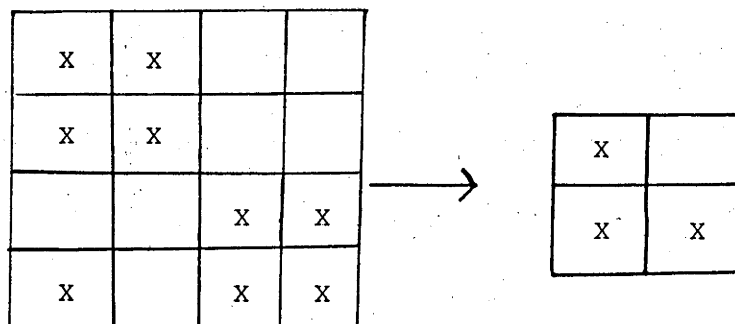
D Block triangular

	X		
		X	
			X
X			

E Complete specialization

industry. The rest of the industries buy only from the industries below and sell only to the industries above. Therefore, a change in the final demand for the product of one industry will affect only this industry and the industries marked below it. The industries above it will not be affected. A change in the final demand for the product of the top row industry, hence, will affect the whole economy, while a change in the demand for the product of the bottom row industry will have no affect at all on the rest of the economy. The case of complete specialization is depicted in Figure 3.3 (E) where each industry sells only to one industry and buys only from one industry. Each industry is specialized in the production of one product and requires input of only one kind of product.

In Figure 3.3 (D) (obtained by combining the top two industries and the bottom two industries) two blocks of industries are formed (diagram) which is block triangular.¹ Between the blocks, there is hierarchical interdependence; the top block



buys from the bottom block, but the bottom block does not buy from the top block. Within each block there is complete or nearly complete interdependence.

¹ For triangularization of the matrix see C. Yan and E. Ames, 'Economic Inter-relatedness' Review of Economic Studies, October 1965, Vol. XXXII, No. 4 and D. Simpson and J. Tsukui, 'The Fundamental Structure of Input-Output Table, An International Comparison', Review of Economics and Statistics, Nov. 1965.

Comparing tables covering different periods, it is possible to ascertain whether inter-industrial dependence has intensified or not.

3.7 Input-Output Production Function

In the input-output production function the relationship between output, Y , and any of the n inputs X_i can be expressed as (Chenery and Clark 1959 and Yotopoulos and Nugent 1976):

$$X_i = a_i Y$$

where a_i is the proportionality coefficient (which may differ for different inputs).

More generally a number of activities can be distinguished each with its own set of proportionality coefficients corresponding to the set of n inputs,

$$X_{ij} = a_{ij} Y_j$$

where $i = 1, 2, 3 \dots n$

$j = 1, 2, 3 \dots m$

Therefore, the input-output coefficients (a_{ij}) will vary not only from input to input but also from activity to activity. However, the above relationship exists between each and every input and each and every activity. Where X_{ij} and Y_j are homogenized in value terms (by market prices), the value of any input must be less than the value of output, i.e.

$$0 \leq a_{ij} < 1$$

The sum of all such input coefficients for any activity, j , must be less than or equal to its output, i.e.

$$\sum_{i=1}^n a_{ij} \leq 1$$

In other words, the general production function takes the form of minimum requirements of each input:

$$x_j \leq x_{ij}/a_{ij} \quad (i = 1 \text{ ---- } n)$$

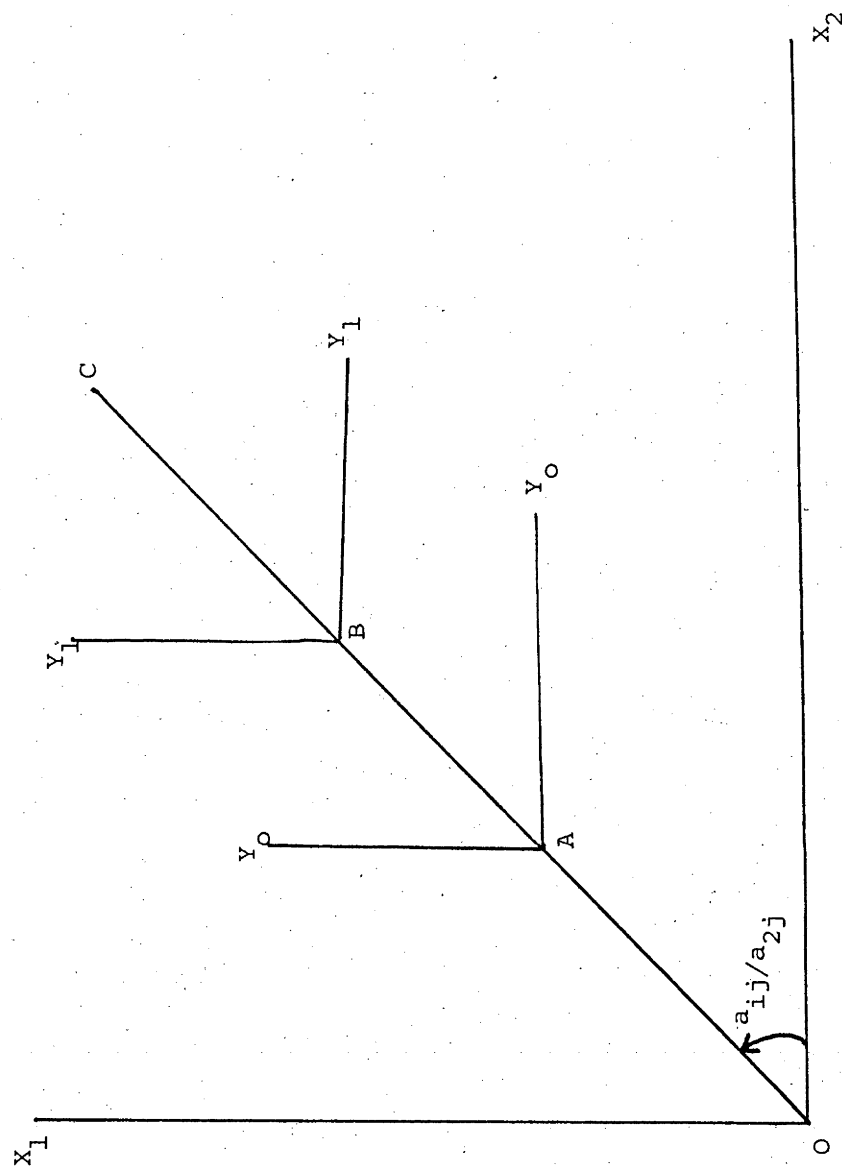
In contrast to C-D and CES production functions the basic characteristic of an input-output (I-O) production function (Figure 3.4) is that isoquants are right angles, Y_0 and Y_1 . However, these right angle isoquants collapse to individual point isoquants (to points A and B) because other points on the isoquants are less efficient. The I-O production functions are homothetic and have constant returns to scale. Furthermore the marginal rates of substitution are in general indeterminate and the elasticities of substitution are zero.

3.8 The Input-Output Table of Fiji

The input-output table used for this study (Table 3.1) is an orthodox table compiled by the Fijian Bureau of Statistics in 1974 to show the transactions of goods and services in 1972. Questionnaires sent out by the Bureau request information for a particular year based on the reporting establishment's nearest accounting period rather than the calendar year in question. Thus the input-output table for Fiji 1972 was compiled from data covering a time-period anywhere between July 1971 and June 1973. The table has 23 producing sectors which have been grouped into two sections, namely: 'industries' and 'producers of government services and other producers'.

Establishments classified as 'industries' may be incorporated or unincorporated businesses; and may be owned or controlled by private individuals, private non-profit organizations or organs of the government. The scope of 'industries' is extended beyond business establishments in

FIGURE 3.4



Production isoquants in the input-output function.

TABLE 3.1 INPUT-OUTPUT TABLE FOR FIJI 1972 BASIC VALUES (\$'000)

I S I C	INPUTS										OUTPUTS																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
1119 (a)	1	Subsistence																															
1115	2	Sugar Cane																															
1 (Less 1115/9)	3	Other Agriculture	115																														
2	4	Mining and Quarrying																															
3118	5	Sugar Manufacturing																															
31 (Less 3118)	6	Other Food Products	74	703																													
32, 33, 34, 35	7	Textiles, Wood, Printing, Rubber and Plastic Products	5	11	309	824	11	111	3562	1144	171	666	36	141																			
36	8	Cement and Earthenware Products	40	45	4	276	607	4	4	2508	1276																						
38, 39	9	Other Manufacturing	555	139	124	262	80	87	366	45	870	601	1020	761	821	1	23																
4	10	Electricity, Gas and Water	561	7	229	127	205	65	21	40	7	432	963	293	110																		
51	11	Building Construction	135	114	31	19	11	23	50	1105	6	40	18	97	62																		
52	12	Other Construction	520	5	11																												
61, 62	13	Distribution	1333	723	479	942	2327	1369	275	1311	497	1324	891	2316	1724	2242																	
63	14	Hotels, Restaurants, etc.																															
71	15	Transport	295	723	328	326	985	380	148	134	52	170	264	815	761	1284	44	18															
72	16	Communications	60	42	30	74	56	95	19	45	23	98	49	714	248	425	5	277															
81, 82	17	Banking and Insurance	57	47	66	158	180	190	35	53	15	136	95	560	413	685		47															
831	18	Ownership of Dwellings																															
9, (b), (c)	19	Other Private Services	2404	87	62	130	256	424	202	186	163	333	108	2925	682	2354	14	262															
1, 7, 9	20	Government Services	106	36																													
9320	21	Education																															
9330	22	Health																															
9 (Less 91)	23	Private Non-Profit Institutions																															
24	Imports of goods and services (d)	3332	1651	1204	2334	5934	3505	691	3359	1268	3383	2264	5781	4889	5675	622	1799																
25	Indirect taxes (e)	672	519	233	495	1052	604	136	576	223	591	411	1493	744	1253		886																
26	Compensation of Employees	7313	7683	2320	4969	1991	3628	830	2177	1389	8901	6365	12182	3909	7692	1196	2801																
27	Gross Income of Unincorporated Enterprises	31144	5540	4266	29	322	448	199	501	6	16627	1358	2936	264	13441	4729	23	359															
28	Gross Operating Surplus: Government Enterprises																																
29	Gross Operating Surplus: Companies																																
30	TOTAL INPUT	31144	22161	16809	7747	34361	22903	15458	5264	9539	5638	26140	13279	58555	21886	28961	3497	8691	13441	16810	19912	12022	5624	5102	57754	13797	37094	48356	36004	37903	53097	9455	798421
31	Direct tax paid by enterprises																																
32	Gross Fixed Capital Formation: Building and Works																																
33	Gross Fixed Capital Formation: Other																																

(a) hopefully, to be redefined after the USP subsistence seminar in August 1974.

(b) less 91, 9320, 9330

(c) less 81, 82, 831

(d) goods c.i.f.; excludes investment income

(e) net, on imports and locally produced goods and services

order to encompass units which produce similar goods and services and utilize similar inputs and production processes, though they may not operate to make a profit and dispose of their output on the market. Thus 'industries' will encompass not only private institutions but government bodies which are profit-making, viz., post and telegraph undertakings, electricity departments etc. Certain government departments that produce goods similar to private 'industries' but are not sold on the market are also included, viz. building programmes, water supplies, forestry etc. 'Producers of government services' furnish but do not normally sell to the community those services which cannot otherwise be conveniently produced. 'Other-producers' furnish social and community services to households on convenient terms that otherwise would not be available.

The rows and columns 1 to 19 depict the industrial producers; 20-23 depict 'producers of government services and other producers'. Jointly, these form the inter-industry matrix proper. Columns 24-31 describe final expenditure by user, while rows 24-29 describe primary inputs and the value added contribution of gross output.

The official Fijian input-output table for 1972 is presented in Table 3.1. The entries in any row of the table record the sales which a particular industry makes to other industries or to the final demand. For instance, in row 3, sales from 'Other Agriculture' total \$F16.809 millions. Part of this goes to other industries as intermediate inputs ('Other Agriculture', 'Other Food Manufactures', 'Textiles, Printing, Rubber and Plastic Products', 'Hotels and Restaurants') and the remaining goes to final demand (exports, tourist consumption expenditure, private consumption, government consumption).

In order to produce \$16.809m worth of total sales, the 'Other Agriculture' sector requires \$2.690m of intermediate inputs and \$14.119m of primary factor input (imports \$1.651m, indirect taxes \$0.519m, compensation of employees \$7.683m, gross income of unincorporated enterprises \$4.266m). These inputs are shown in column 3.

The table is compiled in basic values but the distinction between basic and producers' values is not marked in that only two important commodities pay significant excise dues; namely beer and tobacco.

3.8.a Subsidiary Production

In the collection of statistics required in input-output construction (the industrial census etc.) the main unit for which data is recorded is usually the establishment. This avoids problems at the enterprise level where one firm may be producing many different commodities. Even at the establishment level, however, problems remain where similar commodities have different input structures, and where an establishment produces more than one commodity. The existence of subsidiary production will mean that a specific commodity may be produced by different industries.

A number of methods are available to rectify this problem. The inputs of the secondary commodity can be subtracted and added to the commodity to which it more appropriately belongs. Alternatively the secondary production may be treated as though sold to the principle industry. This distribution of the secondary product is then included along with the main commodity.

The relevance of subsidiary production depends on how broadly industries are defined. Although aggregation reduces secondary

production, this can detract from the usefulness of the input-output table. However, considerations of the size of the table, the use to which it is to be put and the importance to the economy of production of certain commodities dictate the nature of the sectors identified in the table.

In the compilation of the 1972 table for Fiji the collection of data was at the establishment level and every effort was made to classify industries as narrowly as possible. Where secondary production was known to have existed and where subtraction of inputs was not feasible, the subsidiary production has been included along with the principle. Subsidiary production is not a major facet of industrial production in Fiji.

3.8.b Inventories

Stock changes occur if the annual purchases of materials for production of some commodities are not exhausted in the period of interest. If, however, materials are purchased and not absorbed into production then the column of technical coefficients derived will not accurately reflect the industrial structure. Therefore, changes in stock of material input were not classified by type of commodity in compiling the Fijian I-O table and thus it was not possible to make the necessary adjustment to inputs.

3.8.c The Treatment of Imports

There are three basic ways in which imports have been treated in the compilation of I-O tables. First at the bottom of the table (in the valued added quadrant) there can be two rows for imports. One row for imports that are competitive with local products and one row for

those imports which are not competitive. The second and more ambitious approach is to divide into two parts the entry in every cell in the inter-industry transactions table: the two parts being home-produced and imported purchases respectively. This 'double celled' gives a more accurate description of the actual course of events. The bottom row for non-competing imports is common to both methods. The third method simply takes the layout used in the second method and sums all imports vertically in each column, and then uses each column sum to provide an imported inputs coefficient for the sector.

In the I-O table for Fiji no distinction is made between competitive and non-competitive imports. The number of local products is small and thus all the imports are assumed to be non-competitive.

3.9 The Interdependence of the Fiji Economy

The construction and the usefulness of input-output tables in developing economies have been questioned by a number of economists (Peacock and Dosser 1957, Chenery 1961). Their reservations arise in part from the doubtful reliability of data of the type which is necessary for the construction of an input-output table. Also the concern is the limited degree of interdependence between the different sectors in developing countries.

The 1972 inter-industry transactions matrix for Fiji has 484 cells (excluding subsistence sector) and out of this number, 210 cells contain entries from domestic production. In other words, 43 per cent of the cells contained entries from domestic production and 57 per cent had no entries. The extent of interdependence can be further illustrated by the fact that in 1972 the deliveries from domestic production to

intermediate consumption were \$F106.924 million as against \$F393.457 million delivered to final demand. That is, 79 per cent of domestic production went to final demand and only 21 per cent went to intermediate consumption (see Table 3.2).

In the case of Fiji, the lack of strong interdependence (rather than lack of adequate statistics) can be said to present an argument against the usefulness of the input-output approach.

TABLE 3.2

AGGREGATE INTER-INDUSTRY FLOWS, 1972
('000)

Intermediate purchases	106,924	Intermediate sales	106,924
Primary inputs		Final Demand	
Imports	132,067	Exports	57,754
Indirect taxes	31,192	Re exports	13,797
Compensation of Employees	108,632	Tourist Consumption	37,091
Gross income of Enterprise	82,112	Private Consumers Consumption	148,356
Gross operating surplus		Other Private Consumption	36,004
Company	34,005	Government Consumption	37,903
Government	5,449	Gross Capital Formation	53,097
		Changes in Stock	9,455
TOTAL			500,381

CHAPTER 4

INTER-INDUSTRY LINKAGES IN THE FIJIAN ECONOMY

The interdependence of economic activities arises from the fact that each production activity or sector demands input supplies from one or more other production activities. A sector is linked with the other sectors which supply inputs to it and also with those which use its output. Thus an inter-industry transaction table and its derived matrix of input-output coefficients provides a means of assessing the degree of structural interdependence in the economy.

Table 4.1 shows the input-output or technical coefficients obtained from the official input-output table for Fiji. An input-output coefficient (a_{ij}) shows the amount of output from the i^{th} sector required per unit of output of sector j .

4.1 Structural Interdependence in the Fijian Economy, 1972

A sector's degree of interdependence with its economic environment can be expressed by the relation of intermediate to total transactions. The obtained ratios express the well-known sectoral linkages described by Hirschman (1961, pp.100,105). The backward linkage describes the impact upon the sectors that provide intermediate inputs to the specific sector. The forward linkage refers to the impact on the sectors that utilize the output of the specific sector.

The direct dependence of each productive sector on all productive sectors (including itself) for its intermediate inputs is given by the ratio of total intermediate inputs to total supply in each sector, i.e.:

$$U_j = \frac{\sum_i x_{ij}}{x_j} = \frac{\text{Total intermediate input of sector } j}{\text{Total output of sector } j}$$

$$= \sum_i a_{ij} \quad \text{eq (4.1)}$$

where a_{ij} = the input-output coefficients.

The ratio described by U_j expresses the direct backward linkage. The coefficient will be high if the sector observed draws heavily on the system of industries. Thus the coefficient expresses the impact upon the sectors that provide intermediate inputs to the specific sector, due to one unit increase in the output.

Conversely, looking at the demand side, the dependence of sector 'x' on all other sectors (including itself) for the disposition of its output can be calculated thus:

$$W_i = \frac{\sum_j x_{ij}}{Z_i} = \frac{\text{Total intermediate demand for output of sector i}}{\text{Total demand for sector i}} = \sum_j a_{ij} \quad \text{eq (4.2)}$$

The measure W_i expresses the direct forward linkage. Alternatively this can be defined as the impact on the sectors that utilize the output of the specific sector, following one unit increase in output.

The backward linkage (which induces an expansion in the system through the provision of inputs) is governed by the nature of input requirements and by the nature of the production function. The inducement will be the greatest where the required resources and technology permit an expansion in domestic production.¹

1 If the intermediate inputs have a high import content then stimulus for the supply of intermediate inputs leaks to a foreign country. Consequently, linkage effects are best measured (as in this study) using an input-output table which separately identified imports entering into production.

The more roundabout a production process, the more intermediate inputs, equipment and machinery are likely to be required, leading to higher measured backward linkage. Also externalities (e.g. from social overhead capital) are prime movers to generate linkages.

Correspondingly, the forward linkage is a measure of the expansion induced by utilizing intermediate inputs. While the backward linkage is triggered by an existing demand (for inputs), the forward linkage effect is dependent upon the supply (of inputs). Therefore, a pre-requisite for the generation of forward linkage is that supply creates its own demand (Say's Law). In this sense the backward linkage effect is a more meaningful concept than forward linkage.

Table 4.2 shows the backward and forward linkages derived for the various sectors identified in the Fijian inter-industry transactions table, together with the rankings of sectors with respect to the magnitude of each index. In Table 4.3, the sectors are presented in a four quadrant classification according to whether the values of the backward and forward linkages are above or below that of the economy as a whole ($\bar{U}$, $\bar{W}$).

In Table 4.3 the term 'secondary production' describes the sectors with high values of U_j , i.e. high backward linkages. Sectors in this category rely heavily on other production sectors for their intermediate inputs. The term 'primary production' describes the sectors with low values of U_j . The primary (value added) input content of these sectors exceeds the intermediate input content. Hence, quadrants II and III are identified as 'secondary production' sectors and quadrants I and IV as 'primary production' sectors. The sectors in quadrants II and III (having

TABLE 4.1

THE TECHNICAL CO-EFFICIENTS 1972 BASIC VALUES (\$'000)

I S I C	OUTPUTS	INPUTS	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31																																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
19 (a)	1 Subsistence																																			
15	2 Sugar Cane																																			
(Less 1115/9)	3 Other Agriculture																																			
18	4 Mining and Quarrying																																			
(Less 3118)	5 Sugar Manufacturing																																			
33, 34, 35	6 Other Food Products																																			
7	7 Textiles, Wood, Printing, Rubber and Plastic Products																																			
8	8 Cement and Earthenware Products																																			
39	9 Other Manufacturing																																			
10	10 Electricity, Gas and Water																																			
11	11 Building Construction																																			
12	12 Other Construction																																			
62	13 Distribution																																			
14	14 Hotels, Restaurants, etc.																																			
15	15 Transport																																			
16	16 Communications																																			
82	17 Banking and Insurance																																			
18	18 Ownership of Dwellings																																			
(b) 8, (c)	19 Other Private Services																																			
7, 9	20 Government Services																																			
20	21 Education																																			
22	22 Health																																			
(Less 91)	23 Private Non-Profit Institutions																																			
24	24 Imports of goods and services (d)																																			
25	25 Indirect taxes (e)																																			
26	26 Compensation of Employees																																			
27	27 Gross Income of Unincorporated Enterprises																																			
28	28 Gross Operating Surplus: Government Enterprises																																			
29	29 Gross Operating Surplus: Companies																																			
30	30 TOTAL INPUT																																			
31	31 Direct tax paid by enterprises																																			
32	32 Gross Fixed Capital Formation: Building and Works																																			
	33 Gross Fixed Capital Formation: Other																																			

(a) hopefully, to be redefined after the USF subsistence seminar in August 1974.
 (b) less 91, 9320, 9330
 (c) less 81, 82, 831
 (d) goods c.i.f.; excludes investment income
 (e) net, on imports and locally produced goods and services

TABLE 4.2
INTER-INDUSTRY LINKAGES: DIRECT BACKWARD AND
DIRECT FORWARD LINKAGES

	U_j	Ranking	W_i	Ranking
1. Sugar Cane	0.2393	11	1	1
2. Other Agriculture	0.1600	15	0.4532	9
3. Mining and Quarrying	0.2501	9	0.2197	13
4. Sugar Manufacturing	0.6976	1	0.0074	17
5. Other Food Products	0.4849	2	0.1595	14
6. Textiles, Wood, Printing, Rubber and Plastic Products	0.2864	8	0.4854	8
7. Cement and Earthware Products	0.4549	3	0.9118	3
8. Other Manufacturing	0.2414	10	0.6356	6
9. Electricity, Gas and Water	0.1538	16	0.6075	7
10. Building Construction	0.4092	4	0.9973	2
11. Other Construction	0.2997	7	0.1568	15
12. Distribution	0.1877	13	0.3396	11
13. Hotels, Restaurants etc.	0.3673	5	0	18
14. Transport	0.3073	6	0.2469	12
15. Communications	0.0286	20	0.8275	4
16. Banking and Insurance	0.2094	12	0.3508	10
17. Ownership of Dwelling	0	22	0	18
18. Other Private Services	0.1479	17	0.7068	5
19. Government Services	0.1746	14	0.0083	16
20. Education	0.0778	18	0	18
21. Health	0.0753	19	0	18
22. Private Non-Profit Institutions	0.0153	21	0	18

$$U_j = \frac{\sum_i X_{ij}}{X_j}$$

$$W_i = \frac{\sum_j X_{ij}}{Z_i}$$

TABLE 4.3
INDICES OF INTER-INDUSTRY USE

$$(\bar{U} = \bar{W} = .21)$$

High W_i		Low W_i		
I	Primary Production for Intermediate Use	IV	Primary Production for Final Use	
	W_i U_j		W_i U_j	
Low U_j	Other Agriculture	.4532 .1600	Ownership of Dwelling	0 0
	Electricity, Gas & Water	.6075 .1538	Government Services	.0083 .1746
	Distribution	.3396 .1877	Education	0 .0778
	Communications	.8275 .0286	Health	0 .0753
	Banking and Insurance	.3508 .2094	Private Non-Profit Institutions	0 .0153
	Other Private Services	.7068 .1478		
II	Secondary Production for Intermediate Use	III	Secondary Production for Final Use	
	W_i U_j		W_i U_j	
High U_j	Sugar Cane	1 .2393	Other Food Manufacturing	.1595 .4849
	Mining and Quarrying	.2197 .2501	Other Construction	.1568 .2997
	Textiles, Wood, Printing etc.	.4854 .2864	Sugar Manufacturing	.0074 .6976
	Cement	.9118 .4549	Hotels, Restaurants, etc.	0 .3673
	Other Manufacturing	.6356 .2414		
	Building Construction	.9973 .4092		
	Transport	.3469 .3073		

high backward linkage) would have a greater impact on the economy (following an expansion or contraction of their output) than would primary sectors included in quadrants I and IV.

Similarly, the sectors in quadrants I and II, with high values of forward linkage, would be affected to a greater extent by changes in the general level of economic activity than those in quadrants III and IV. Taking a general measure of interdependence, sectors in quadrant II possess the most extensive linkages having high values for both forward and backward linkages. Changes in the output of these sectors will have greater repercussions on the rest of the economy than industry in general. Also, these sectors will be more responsive to changes in the overall level of economic activity in the economy.

Sectors in quadrant IV, with low values of forward and backward linkages, are relatively independent of other production sectors in the economy for their input requirements and for the disposition of their output. In broad terms, quadrants I, II and III may be thought of as successive stages of production, but the nature of industries in quadrant II complicates this pattern.

4.2 Direct and Indirect Interdependence in the Fijian Economy

The above analysis of structural interdependence has been based on the direct input-output (technical) coefficients (a_{ij} 's). The linkages calculated show only the direct interdependence between the productive sectors of the economy, i.e. only the first round of the backward and forward interactions among industries. However, an increase in the output of sector j will require not only an increase in the output of sectors producing inputs to sector j (assessed from the coefficients, a_{ij} , or

their sum which is the measure of backward linkage) but also increases in the outputs of the sectors contributing inputs to these sectors. That is, an increase in output of sector j will generate a more than proportional increase in the output for the economy as a whole. Thus additional increases in output of the different sectors are induced in the second, third, fourth ---- rounds of this process until additional outputs induced approach zero. The increases accumulated over all rounds can be calculated from the inverse of the Leontief $(I-A)$ matrix. The elements of this inverse matrix, as shown earlier, represent the output required, directly and indirectly, from all productive sectors to sustain a one unit increase in the final demand of a given sector. Hence, the sum of the interdependence coefficients in either the row or column vectors of the inverse matrix provide a measure of the direct and indirect interdependence between sectors in the economy, corresponding to U_j and W_i above.

The direct and indirect backward linkage¹, K_j , is defined as:

$$K_j = \sum_{i=1}^n C_{ij} \quad \text{eq (4.3)}$$

where $C_{ij} = (I-A)^{-1}$

Correspondingly the direct and indirect forward linkage, L_i , is defined as:

$$L_i = \sum_{j=1}^n C_{ij} \quad \text{eq (4.4)}$$

where $C_{ij} = (I-A)^{-1}$

1 The direct and indirect backward linkage index captures not only backward linkages but also some forward linkages. Since $(I-A)^{-1} \approx I+A+A^2+A^3+\dots$, the multiplication of A matrices involves forward linkage to the extent that going backward ad infinitum in a closed system captures also forward aspects.

Table 4.5 shows the direct and indirect backward and forward linkages of all sectors identified in inter-industry transactions table. Other Agriculture sector, for example, has direct and indirect backward linkage of 1.2200 indicating that a \$1 increase in final demand of that sector would generate an increase in total output of \$1.22. A detailed breakdown of the total effect (1.2200) on all production sectors resulting from a unit increase in the final demand of 'Other Agriculture' sector can be obtained by reference to the column elements of that sector in the original inverse matrix (Table 4.4). A unit increase in the final demand for 'Other Agriculture' would induce an increase of \$1.0188 of output from that sector itself, \$0.0121 from Other Manufacturing sector, \$0.058 from Distribution sector, \$0.0492 from Transport and so on. The increase of \$1.0188 worth of output from the 'Other Agriculture' itself can be shown to be the sum of three separate effects:

- a. the initial increase in output of the 'Other Agriculture' sector of \$1.00;
- b. the direct input of 'Other Agriculture' of \$0.0068 required to meet the initial output increase of \$1.00. This is given by the direct input coefficient in Table 4.1;
- c. the sum of the indirect inputs of 'Other Agriculture' required by the total increase in output of the Other Agriculture sector given in a. and b. above.

Sugar Manufacturing, Cement Products, Other Food Manufacturing, Building Construction, Hotels and Restaurants have high direct and indirect

TABLE 4.5
INDICES OF TOTAL STRUCTURAL INTERDEPENDENCE
IN THE FIJI ECONOMY, 1972

Sectors	K_j	Ranking	L_i	Ranking
1. Sugar Cane	1.2994	11	1.6538	3
2. Other Agriculture	1.2200	15	1.4248	6
3. Mining and Quarrying	1.3217	9	1.2749	10
4. Sugar Manufacturing	1.9057	1	1.0136	17
5. Other Food Manufacturing	1.6124	3	1.2247	11
6. Textiles, Wood, Printing, Rubber and Plastic Products	1.3725	8	1.4385	5
7. Cement Products	1.6219	2	1.4233	7
8. Other Manufacturing	1.3039	10	1.4216	8
9. Electricity, Water and Gas	1.1920	16	1.3174	9
10. Building Construction	1.5717	4	1.1787	14
11. Other Construction	1.4200	6	1.1329	15
12. Distribution	1.2396	13	2.5177	1
13. Hotels, Restaurants, etc.	1.4821	5	1	18
14. Transport	1.3863	7	1.5247	4
15. Communications	1.0381	20	1.2197	12
16. Banking and Insurance	1.2559	12	1.1976	13
17. Ownership of Dwelling	1	22	1	18
18. Other Private Services	1.1839	17	1.8344	2
19. Government Services	1.2375	14	1.0167	16
20. Education	1.1003	19	1	18
21. Health	1.1035	18	1	18
22. Private Non-Profit Institutions	1.0189	21	1	18

$$K_j = \sum_{i=1}^n (I-A)^{-1}$$

$$L_i = \sum_{j=1}^n (I-A)^{-1}$$

backward linkages. Hence any changes in the final demand for the output of these sectors would have significantly greater impact on the economy than industry in general. Sectors registering low values for backward linkages are Private Non-Profit Institutions, Ownership of Dwelling, Communications, Health, Education, Other Private Services, Electricity, Water and Gas. Changes in the final demand for the output of these sectors would be expected to have very little impact on the economic system (unless inducing further investment).

For any one row the sum of the elements in the inverse matrix expresses the direct and indirect forward linkage and shows the output required from the particular sector to satisfy a unit change in the final demand of all sectors in the economy. The 'Distribution' sector, for example, shows the forward linkage to be 2.5977 indicating that this sector would have to increase its output by \$2.5977 to satisfy a \$1.00 change in the final demand of all sectors in the economy. Other sectors which are heavily dependent, both directly and indirectly, on the rest of the sectors for the disposition of their output are Other Private Services, Sugar Cane, Transport, Textiles etc., Other Agriculture, Cement Products and Other Manufacturing. The sectors with low levels of indirect forward linkage are Education, Health, Government Services, Private Non-Profit Institutions, Hotels and Restaurants, Sugar Manufacturing and Ownership of Dwelling. This implies that these sectors are relatively unaffected by changes in final demand and the production levels of the rest of the economy. All are final demand oriented sectors.

4.3 Power and Sensitivity of Dispersion

The foregoing linkage effects were expressed in terms of per unit

of output. However, a sector that has only weak linkages per unit of output may contribute a significant share to total production. Consequently, the sectoral composition of total production has to be taken into consideration. Using the Leontief inverted matrix the total (direct and indirect) production effects can be taken into account. The sum, $C.j$ of the interdependence coefficient for any column will show the increase in output from the whole system of industries needed to cope with a unit increase in the final demand for the products of industry j . The sum over all column totals when divided by the number of sectors ($\frac{1}{n} C.j$) denotes the average rise in output, in a sector chosen at random, due to the increase in the observed sector j . In order to make inter-industry comparisons $\frac{1}{n} C.j$ can be normalised by relating it to the overall average (i.e. the average of all elements of the inverse, $\frac{1}{n^2} \sum_{j=1}^n \sum_{i=1}^n C_{ij}$).

The measure P thus obtained is termed the power of dispersion, (Rasmussen 1956):

$$P_j = \frac{\frac{1}{n} \sum_{i=1}^n C_{ij}}{\frac{1}{n^2} \sum_{j=1}^n \sum_{i=1}^n C_{ij}} \quad \text{eq (4.5)}$$

where $(i, j = 1, 2, 3, \dots, n)$.

P is the measure of the effects of increased output in one sector relative to those of all sectors. Alternatively, this index describes the relative extent to which an increase in final demand for the products of industry j is dispersed throughout the system of industries. Column 1 of Table 4.6 shows the 'power of dispersion' of all productive sectors in the economy. If the value of $P > 1$, the sector in question draws heavily (i.e. compared

TABLE 4.6

POWER AND SENSITIVITY OF DISPERSION

Sectors	P_j	Ranking	α_i	Ranking
1. Sugar Cane	0.9891	11	1.2591	3
2. Other Agriculture	0.9288	15	1.0847	6
3. Mining and Quarrying	1.0062	9	0.9706	10
4. Sugar Manufacturing	1.4508	1	0.7717	17
5. Other Food Manufactures	1.2276	3	0.9324	11
6. Textiles, Wood, Printing, Rubber and Plastic Products	1.0449	8	1.0950	5
7. Cement Products	1.2348	2	1.0836	7
8. Other Manufacturing	0.9927	10	1.0823	8
9. Electricity, Gas and Water	0.9075	16	1.0030	9
10. Building Construction	1.2026	4	0.8974	14
11. Other Construction	1.0811	6	0.8625	15
12. Distribution	0.9437	13	1.9771	1
13. Hotels, Restaurants, etc.	1.1284	5	0.7613	18
14. Transport	1.0554	7	1.1608	4
15. Communications	0.7903	20	0.9286	12
16. Banking and Insurance	0.9563	12	0.9118	13
17. Ownership of Dwellings	0.7163	22	0.7613	19
18. Other Private Services	0.9013	17	1.3966	2
19. Government Services	0.9422	14	0.7740	16
20. Education	0.8376	19	0.7613	19
21. Health	0.8415	18	0.7613	19
22. Private Non-Profit Institutions	0.7757	21	0.7613	19

$$P_j = \frac{\frac{1}{n} \sum_{i=1}^n C_{ij}}{\frac{1}{n^2} \sum_{i=1}^n \sum_{j=1}^n C_{ij}}$$

$$\alpha_i = \frac{\frac{1}{n} \sum_{j=1}^n C_{ij}}{\frac{1}{n^2} \sum_{i=1}^n \sum_{j=1}^n C_{ij}}$$

to the industries in general) on the system of industries. That is, it is likely to transmit above-average impulses to others via its intermediate input requirement. Conversely if $P < 1$, the sector in question draws weakly on the system of industries. That is, it transmits only weak output stimuli to the remainder of the economy. Sugar Manufacturing, Cement Products, Other Food Manufacturing, Building Construction, Hotels and Restaurants, Other Construction, Transport, Textiles, Wood, Printing and Plastic Products and Mining and Quarrying transmit above average impulses to other sectors. Relatively strong intersectoral impulses are emitted by the various components of secondary industry in the Fijian economy. As far as primary and tertiary sectors are concerned, the values of $P > 1$ are few, are comparatively low, with the exception of Hotels and Restaurants and Transport.

Similar operations on the row totals of the Leontief inverse matrix can derive an index of the 'sensitivity of dispersion'. This is defined as:

$$\alpha_i = \frac{\frac{1}{n} \sum_{j=1}^n C_{ij}}{\frac{1}{n^2} \sum_{i=1}^n \sum_{j=1}^n C_{ij}} \quad \text{eq (4.6)}$$

where $C_{ij} = (I-A)^{-1}$

n = No. of sectors.

($i, j = 1, 2, \dots, n$)

This index expresses the extent to which the system of industries draws upon industry i , or, in other words, the extent to which industry i is affected by an expansion in the system of industries. If $\alpha_i > 1$, this means that sector i generally (i.e. relative to the system of industries

in general) will have to increase its output more than other industries for a given increase in demand and vice versa for sectors with $\alpha_i < 1$.¹ Column 2 of Table 4.6 shows the 'sensitivity of dispersion' of the various sectors of the Fiji economy. Sugar Cane, Other Agriculture, Textiles, Cement Products, Other Manufacturing, Electricity, Water and Gas, Transport and Other Private Services sectors registered values of $\alpha > 1$. The ranking of sectors according to 'power of dispersion' and 'sensitivity of dispersion' as compared to that obtained by references to direct and indirect backward and forward linkages respectively is not altered. Both the indices of power and the sensitivity of dispersion are derived by normalizing the backward and forward linkages by three constants (i.e. the number of sectors, the sum of the column (or row) totals and the average of all elements of the inverse matrix).

4.4 Coefficient of Variation

The above analyses rely upon indices based upon averages. However, it may be that a certain sector has a high index of the power of dispersion, yet most industries will be left virtually unchanged if the final demand for the products of that sector is increased. This will be the case where the sector concerned draws heavily on one or a few industries. Similarly a sector which has a high index in terms of the sensitivity of dispersion may be severely affected by the expansion of very few industries. Consequently, the coefficient of variation of the sectoral inducements should be taken into consideration.

For the total linkage effect of sector j , the coefficient of

1 For the weighted version of these indices see Rasmussen, P.N. (1956) Studies in Inter-Sectoral Relations, North-Holland Publishing Company, Amsterdam, pp.136.

variation of the sectoral inducements V_j is defined as:

$$V_j = \sqrt{\frac{\frac{1}{n-1} \sum_{i=1}^n [C_{ij} - (\frac{1}{n}) C.j]^2}{(\frac{1}{n}) C.j}} \quad (j = 1, 2, \dots, n)$$

$$\text{where } C.j = \sum_{i=1}^n C_{ij}$$

$$C_{ij} = (I-A)^{-1}$$

A similar coefficient of variation for inducements received in sector i is defined by (Rasmussen, op.cit):

$$V_i = \sqrt{\frac{\frac{1}{n-1} \sum_{j=1}^n [C_{ij} - (\frac{1}{n}) C.i]^2}{(\frac{1}{n}) C.i}} \quad (i = 1, 2, \dots, n)$$

$$\text{where } C.i = \sum_{j=1}^n C_{ij}$$

$$C_{ij} = (I-A)^{-1}$$

The index V_j indicates to what extent industry j draws evenly on the system of industries or - in the case of a relatively high value of the index - whether industry j draws one sidedly on the system of industries.

Similarly, index V_i is interpreted as indicating the extent to which the system of industries draws evenly on industry i or - in the case of a relatively high value of the index - whether the system of industries draws one sidedly on industry i . Table 4.7 shows variances of indices of power and sensitivity of dispersion, i.e. V_j and V_i . The divergencies in index V_j are less than in the case of the index V_i , indicating that the sectoral inducements of sector j are more uniformly dispersed than those of sector i . However, divergencies are also apparent among sectors

TABLE 4.7

MEASURES OF VARIANCES OF INDICES OF POWER
AND SENSITIVITY OF DISPERSION

Sectors	V_j	Ranking	V_i	Ranking
1. Sugar Cane	3.5917	9	3.2989	4
2. Other Agriculture	3.8896	14	3.4117	6
3. Mining and Quarrying	3.5514	8	3.7219	10
4. Sugar Manufacturing	2.8360	1	4.6230	17
5. Other Food Manufactures	3.0031	2	3.8714	13
6. Textiles, Wood, Printing, Rubber and Plastic Products	3.5964	10	3.4331	7
7. Cement Products	3.2578	5	3.7211	9
8. Other Manufacturing	3.7508	12	3.4082	5
9. Electricity, Gas and Water	3.9351	15	3.5304	8
10. Building Construction	3.0325	3	4.3067	15
11. Other Construction	3.3758	6	4.2491	14
12. Distribution	3.9721	16	1.8136	1
13. Hotels, Restaurants etc.	3.1233	4	4.6857	18
14. Transport	3.5309	7	3.1717	3
15. Communications	4.5180	20	3.8177	11
16. Banking and Insurance	3.7435	11	3.8440	12
17. Ownership of Dwellings	4.6856	22	4.6857	18
18. Other Private Services	4.1010	17	2.5865	2
19. Government Services	3.7534	13	4.6142	16
20. Education	4.2289	19	4.6857	18
21. Health	4.2283	18	4.6857	18
22. Private Non-Profit Institutions	4.6008	21	4.6857	18

for both indices. The sectoral rankings in Table 4.7 differ only slightly from those to rankings obtained by reference to direct and indirect backward and forward linkages and those involving power and sensitivity of dispersion. Generally speaking, sectors with large total linkage effects (direct and indirect) have relatively smaller coefficients of variation. Sectors with small linkages have their inducements relatively more concentrated on a few sectors or unevenly spread over the different sectors.

4.5 Structure of Linkages

From the estimates of the various linkages, it is observed that the agricultural sectors receive low rankings as far as the input requirements are concerned, i.e. their input dependence is low, compared to that of the other sectors of the economy. With advancements in the use of modern technology, fertilizers and the like the ranking of agriculture is likely to go up.

Table 4.8 shows the rank correlations among different linkage coefficients. The correlation between direct forward linkage and direct backward linkage are low and positive. This is consistent with the view that sectors that have relatively large input dependence are not large input suppliers to the other input using industries. In point of fact, these sectors cater largely to final demand. Examples are Sugar Manufacturing, Other Food Products, Hotels and Restaurants, Textiles, Wood, Printing, Rubber and Plastic Products which cater largely to the consumer demand, and Building Construction, Cement and Earthware Products, Mining and Quarrying, Other Manufacturing, Other Construction etc., which cater largely to capital formation (as part of final demand). Similarly the

TABLE 4.8
RANK CORRELATIONS AMONG LINKAGE INDICES

Index	U_j	W_i	K_j	L_i	P_j	α_i	V_j	V_i
U_j	1	0.2050	0.9966	0.2039	0.9966	0.2039	-0.9797	-0.1470
W_i		1	0.2141	0.7407	0.2141	0.7407	-0.1880	-0.7259
K_j			1	0.1959	1.0000	0.1959	-0.9780	-0.1391
L_i				1	0.1959	1.0000	-0.1330	-0.9840
P_j					1	0.1959	-0.9785	-0.1390
α_i						1	-0.1334	-0.9840
V_j							1	0.0778
V_i								1

correlations with the direct and indirect version of forward and backward linkages are low suggesting that the sectors that have large direct and indirect input dependence are not large direct and indirect input suppliers to other input using industries. Hence, one would favour the use of backward linkages, with indirect effects included, since development strategies can more effectively rely on the stimulus that industry j provides by utilizing as intermediate products the output of other industries, than on the stimulus of the mere availability of output that can be used as input by other sectors (Hirschman 1958, pp.98-119).

Rank correlations between direct backward linkage and indirect backward linkage and the power of dispersion are very large and positive. Thus the total backward linkage and the power of dispersion reflect the backward linkages derived from direct inter-industry flows. Rank correlation between indirect backward linkage, power of dispersion and the sensitivity of dispersion are positive. This implies that the larger the linkages induced elsewhere by a sector, the larger the linkage inducements within that sector. However, this correspondence is poor since the positive rank correlation is only +0.1959.¹

Rank correlations between power of dispersion and its coefficient of variation, i.e. $R(P_j, V_j)$ and the sensitivity of dispersion and its coefficient of variation, i.e. $R(\alpha_1, V_1)$ are large and negative. Thus the larger the linkage inducement, the smaller the internal variability of the structure of inducements over the different sectors. The sectors that have large power of dispersion and sensitivity of dispersion (total

1 Where those values are high and positive, a clear-cut pattern of input interdependence would emerge among high-ranking industries (to the exclusion of low ranking agriculture). Where they are large and negative an asymmetry in the pattern of sectoral development would be indicated.

linkage coefficients) have these inducements spread over the different sectors that receive the inducements. Sectors with small linkages have their inducements relatively more concentrated on a few sectors or unevenly spread over the different sectors. Therefore, if the sectors with larger linkages are chosen for an expansion in output, many other sectors are likely to get more uniform inducements than if the sectors with smaller linkages are chosen.

4.6 Linkage Measurements and Intersectoral Growth Impulses: Some Limitations

While it is useful to employ the input-output technique to map the forward, backward and total linkages in the structure of production, care must be exercised in interpretation because of inherent limitations in the construction of the model. Since the limitations of input-output analysis also apply in the case of linkage measurements and since some of the limitations have important implications they warrant explicit comment.

First, the input coefficients of input-output tables are generally specified in value terms and hence relative prices can distort the picture of the linkages in physical terms. Intersectoral inducements may be more meaningful where the physical interrelations are given consideration. Second, if the analysis is used for intertemporal comparisons then the differences in the measured input coefficient may be due to differences in the product mix rather than in the technology. Thirdly, the use of fixed input coefficients implies constant returns to scale in transforming basic inputs into final output. That is, input coefficients imply a linear homogeneous production function whereas linkages may lead to economies of scale through vertical or horizontal

integration of production activities. Finally, the linkage coefficients are sensitive to the level of aggregation at which the sectors are specified in the input-output table.

If a sector with a high linkage effect is given priority for expanded output then the implication is that it will generate growth impulses in many other sectors, relative to a sector with low linkages. But do linkages imply growth inducements or not? If the supply and demand pressures induced by linkages are to be transformed into domestic growth inducements, then certain conditions have to be met. Demand and supply pressures are necessary, but not sufficient, conditions for this conversion. Demand and supply pressures have to be supplemented by the availability of such resources as appropriately skilled manpower, land, raw materials and access to capital to establish a new firm or expanding an existing one. Last but not the least, government policies towards industries with high linkages and towards industries induced by high linkages should be conducive to growth of these industries. Institutional and policy factors dictate, to a large extent, the realization of the linkages. In island economies like Fiji, these factors play an important role in determining whether apparent linkages are converted into growth impulses.

If productive activity, due to institutional and other impediments, were not able to respond to demand and supply pressures, then linkage effects could lead to increased imports and higher prices of commodities whose domestic output is now expanded. The sector that induced linkages that could not be realised could experience slow growth and under-utilization of its own capacity (due to the shortages of input supplies).

In the above analysis, inter-industry linkages have been used to

determine the degree of interdependence between sectors in the Fijian economy. The inter-industry linkages as discussed above concentrate only on the intersectoral flows. While the coefficients of these inter-industry linkages give the linkage effects per unit of final demand, the realization of linkage for domestic production depends heavily on the level and structure of final demand. The next chapter examines the sectoral dependence on final demand and the relationship between primary inputs and final demand.

CHAPTER 5

ANALYSIS OF THE PRIMARY INPUTS AND THE
DEPENDENCE ON FINAL DEMAND

The interdependence (or total) coefficients in the inverse matrix, $(I-A)^{-1}$, provide a relationship between a given set of final demands and the levels of output required to meet these demands. Primary inputs are directly related to production levels in the inter-industry table. Hence the inverse matrix can be used to establish the relationship between final demands and primary inputs for each sector.

5.1 The Primary Input Content of Final Demand

The total (direct and indirect) primary input requirements per unit of final demand can be calculated by premultiplying the inverse matrix by the row vector of each of the direct primary input coefficients.¹ The direct and indirect amount of primary input 'h' required per unit of final demand for the output of sector 'j' is calculated using the following expression (Parker 1973):

$$\tau_{hj} = \sum_i f_{hj} \tau_{ij} \quad \text{eq (5.1)}$$

where τ_{hj} = the direct and indirect amount of primary input 'h' required per unit of final demand for the output of sector 'j'.

1 Alternatively, the same results can be obtained by post-multiplying the primary input matrix by the transpose of the inverse matrix, i.e. the column elements in the inverse are converted to row elements which are then multiplied by the row vectors of the primary input-matrix to form the new matrix of total input coefficients. The elements of the row vectors of the primary input matrix are transposed into column elements.

f_{hj} = the amount of primary input 'h' absorbed per unit of output sector 'j'.

τ_{ij} = the inverse matrix $(I-A)^{-1}$

The findings consistent with the above expression are tabulated in Table 5.1.

Taking the Electricity, Gas and Water sector as an example, the total value added content (of the total primary input content) per unit of final demand shows that each unit of final demand for the output of the sector would have a wage and salary content of 0.2873; gross income of unincorporated enterprises content of 0.0402; gross operating surplus (government) content of 0.3342; gross operating surplus (companies) content of 0.0401; and indirect tax content of 0.0455. The remaining 0.2516 is the direct and indirect import content (see Table 5.2). In other words, a \$1 million increase in final expenditure on Electricity, Gas and Water would generate in all sectors of the economy a total of \$287,000 in wages and salaries; \$40,000 of income of unincorporated enterprises; \$334,000 gross operating surplus of government; \$40,000 of gross operating surplus of companies; \$45,000 indirect tax and \$242,000 in direct and indirect imports.

5.2 Direct and Indirect Primary Input Requirements

Tables 5.1 and 5.2 show the primary input requirements of final demand in terms of total (direct and indirect) primary input coefficients. However, to get a better insight into the primary input requirements of final demand, it is worthwhile to analyse the direct as against the indirect component of total primary input requirement. The direct primary

TABLE 5.1

TOTAL (DIRECT AND INDIRECT) VALUE ADDED CONTENT PER
UNIT OF FINAL DEMAND

	Indirect Taxes	Wages and Salaries	Gross Income Unin- corporated Enterprises	Gross Operating Surplus: Government	Gross Operating Surplus: Companies	Total
1. Sugar Cane	0.0408	0.3959	0.3089	0.0170	0.0377	0.8003
2. Other Agriculture	0.0391	0.5088	0.2851	0.0042	0.0249	0.8621
3. Mining & Quarrying	0.0418	0.4443	0.0397	0.0300	0.2312	0.7870
4. Sugar Manufacturing	0.0431	0.4159	0.2115	0.0134	0.1097	0.7936
5. Other Food Products	0.0664	0.2877	0.1396	0.0103	0.1549	0.6589
6. Textiles, Wood, Printing, Rubber & Plastic Products	0.0522	0.3256	0.0881	0.0138	0.2344	0.7141
7. Cement & Earthware Products	0.0463	0.3136	0.0486	0.0319	0.3280	0.7684
8. Other Manufacturing	0.0711	0.2952	0.0696	0.0102	0.1515	0.5976
9. Electricity, Water & Gas	0.0455	0.2873	0.0402	0.3342	0.0401	0.7473
10. Building Construction	0.0425	0.4760	0.0635	0.0120	0.1743	0.7683
11. Other Construction	0.0455	0.5801	0.0382	0.0175	0.0770	0.7583
12. Distribution	0.0345	0.2600	0.3211	0.0162	0.2261	0.8579
13. Hotels, Restaurants etc.	0.0529	0.2934	0.1295	0.0277	0.1852	0.6887
14. Transport	0.0582	0.3524	0.1656	0.0239	0.1368	0.7369
15. Communications	0.0014	0.3511	0.0043	0.4531	0.0048	0.8147
16. Banking and Insurance	0.1092	0.3817	0.0758	0.0247	0.1635	0.7549
17. Ownership of Dwelling	0	0	1	0	0	1
18. Other Private Services	0.0393	0.1993	0.3134	0.1268	0.1452	0.8240
19. Government Services	0.0085	0.6777	0.0187	0.0108	0.0219	0.7374
20. Education	0.0119	0.7932	0.0119	0.0110	0.0109	0.8389
21. Health	0.0083	0.7231	0.0759	0.0084	0.0102	0.8259
22. Private Non-Profit Institutions	0.0036	0.9731	0.0030	0.0022	0.0022	0.9841

$$\tau_{hj} = \sum_i f_{hj} \tau_{ij}$$

TABLE 5.2

VALUE ADDED AND IMPORT CONTENT PER \$1 OF FINAL
PRODUCT OF EACH INDUSTRY IN 1972

	Import Content	Ranking ¹	Value Added Content	Total ²
1. Sugar Cane	0.1996	9	0.8003	1
2. Other Agriculture	0.1379	3	0.8621	1
3. Mining and Quarrying	0.2128	11	0.7870	1
4. Sugar Manufacturing	0.2064	10	0.7936	1
5. Other Food Products	0.3410	21	0.6589	1
6. Textiles, Wood, Printing, Rubber & Plastic Products	0.2858	19	0.7141	1
7. Cement and Earthware Products	0.2315	12	0.7684	1
8. Other Manufacturing	0.4022	22	0.5976	1
9. Electricity, Water & Gas	0.2516	16	0.7473	1
10. Building Construction	0.2317	13	0.7683	1
11. Other Construction	0.2416	14	0.7583	1
12. Distribution	0.1419	4	0.8579	1
13. Hotels, Restaurants etc.	0.3113	20	0.6887	1
14. Transport	0.2630	18	0.7369	1
15. Communications	0.1852	8	0.8147	1
16. Banking and Insurance	0.2450	15	0.7549	1
17. Ownership of Dwelling	-	1	1	1
18. Other Private Services	0.1760	7	0.8240	1
19. Government Services	0.2624	17	0.7374	1
20. Education	0.1612	5	0.8389	1
21. Health	0.1742	6	0.8259	1
22. Private Non-Profit Institutions	0.0175	2	0.9841	1

Notes: 1 The ranking is in the ascending order.

2 Some values are slightly less than one due to 'rounding' errors.

input component is given by (UN 1966):

$$f_{hj} = \frac{H_{ij}}{X_j} \quad \text{eq (5.2)}$$

where H_{ij} = total amount of primary input 'h' absorbed by industry 'j'.

X_j = total input of sector 'j'.

Therefore the indirect primary input component can be derived by subtracting the direct primary input coefficient from the direct and indirect (total) primary input requirement, i.e.:

$$\sum_i f_{hj} \tau_{ij} - f_{hj} \quad \text{eq (5.3)}$$

This is shown in Table 5.3.

In all sectors except Sugar Manufacturing, the direct import content is higher than the indirect import content. Sugar Manufacturing has a direct import content of 0.0679 and an indirect import content of 0.1385, reflecting the high import content of domestic intermediate inputs absorbed by this sector. Other sectors with relatively high indirect import content are Cement and Earthware Products, Building Construction, Other Construction and Hotels and Restaurants. For these sectors any analysis based only on direct import requirements could be misleading. Their contribution to gross domestic product, or their income generating effects will be lower than would appear from a direct examination of their production costs. Thus the inter-industry approach has a worthwhile contribution to make in that the import content of intermediate domestic inputs can be taken into account in ascertaining the total dependence of each sector on imports.

TABLE 5.3
DIRECT AND INDIRECT PRIMARY INPUT CONTENT
PER UNIT OF FINAL DEMAND

	Direct Net Income Taxes	Indirect Net Income Taxes	Total Indirect Taxes	Direct Wages and Salaries	Indirect Wages and Salaries	Total Wages and Salaries
1. Sugar Cane	0.0303	0.0105	0.0408	0.3300	0.0659	0.3959
2. Other Agriculture	0.0309	0.0082	0.0391	0.4571	0.0517	0.5088
3. Mining & Quarrying	0.0301	0.0117	0.0418	0.3640	0.0803	0.4443
4. Sugar Manufacturing	0.0144	0.0287	0.0431	0.1446	0.2713	0.4159
5. Other Food Products	0.0459	0.0205	0.0664	0.0869	0.2008	0.2877
6. Textiles, Wood, Printing, Rubber & Plastic Products	0.0391	0.0131	0.0522	0.2347	0.0909	0.3256
7. Cement & Earthware Products	0.0258	0.0205	0.0463	0.1577	0.1559	0.3136
8. Other Manufacturing	0.0604	0.0107	0.0711	0.2282	0.0670	0.2952
9. Electricity, Water and Gas	0.0394	0.0061	0.0455	0.2455	0.0418	0.2873
10. Building Construction	0.0226	0.0199	0.0425	0.3405	0.1355	0.4760
11. Other Construction	0.0310	0.0145	0.0455	0.4793	0.1008	0.5801
12. Distribution	0.0255	0.0090	0.0345	0.2080	0.0520	0.2600
13. Hotels, Restaurants etc.	0.0340	0.0189	0.0529	0.1786	0.1148	0.2934
14. Transport	0.0433	0.0149	0.0582	0.2656	0.0868	0.3524
15. Communications	-	0.0014	0.0014	0.3420	0.0091	0.3511
16. Banking & Insurance	0.1019	0.0073	0.1092	0.3223	0.0594	0.3817
17. Ownership of Dwelling	-	-	-	-	-	0
18. Other Private Services	0.0334	0.0059	0.0393	0.1570	0.0423	0.1993
19. Government Services	-	0.0083	0.0083	0.6055	0.0722	0.6777
20. Education	0.0091	0.0028	0.0119	0.7663	0.0269	0.7932
21. Health	0.0046	0.0037	0.0083	0.7016	0.0215	0.7231
22. Private Non-Profit Institutions	0.0031	0.0005	0.0036	0.9667	0.0064	0.9731

TABLE 5.3 (Cont'd)

	Direct Gross Income of Unincor- porated Enterprises	Indirect Gross Income of Unincor- porated Enter- prises	Total Gross Income of Unincor- porated Enter- prises	Direct Gross Operat- ing Surplus: Gov't	Indirect Gross Operat- ing Surplus: Gov't	Total Gross Operat- ing Surplus: Gov't
1. Sugar Cane	0.2500	0.0589	0.3089	0	0.0170	0.0170
2. Other Agriculture	0.2538	0.0313	0.2851	0	0.0042	0.0042
3. Mining & Quarrying	0.0038	0.0359	0.0397	0	0.0300	0.0300
4. Sugar Manufacturing	0	0.2115	0.2115	0	0.0134	0.0134
5. Other Food Products	0.0141	0.1255	0.1396	0	0.0103	0.0103
6. Textiles, Wood, Printing, Rubber & Plastic Products	0.0290	0.0591	0.0881	0.0008	0.0130	0.0138
7. Cement and Earth- ware Products	0	0.0486	0.0486	0.0023	0.0296	0.0319
8. Other Manufacturing	0.0125	0.0571	0.0696	0	0.0102	0.0102
9. Electricity, Water and Gas	0	0.0402	0.0402	0.3259	0.0083	0.3342
10. Building Construct- ion	0.0192	0.0443	0.0635	0.0006	0.0114	0.0120
11. Other Construction	0.0004	0.0378	0.0382	0.0082	0.0093	0.0175
12. Distribution	0.2840	0.0371	0.3211	0	0.0162	0.0162
13. Hotels, Restaurants etc.	0.0620	0.0675	0.1295	0	0.0277	0.0277
14. Transport	0.1014	0.0642	0.1656	0	0.0239	0.0239
15. Communications	0	0.0043	0.0043	0.4515	0.0016	0.4531
16. Banking & Insurance	0.0304	0.0454	0.0758	0	0.0247	0.0247
17. Ownership of Dwelling	1	0	1	0	0	0
18. Other Private Services	0.2813	0.0321	0.3134	0.1117	0.0151	0.1268
19. Government Services	0	0.0187	0.0187	0	0.0108	0.0108
20. Education	0.0019	0.0100	0.0119	0	0.0110	0.0110
21. Health	0.0638	0.0121	0.0759	0	0.0084	0.0084
22. Private Non-Profit Institutions	0	0.0030	0.0030	0	0.0022	0.0022

TABLE 5.3 (Cont'd)

	Direct Gross Operating Surplus: Companies	Indirect Gross Operating Surplus: Companies	Total Gross Operating Surplus: Companies	Direct Import	Indirect Import	Total Import
1. Sugar Cane	0	0.0377	0.0377	0.1504	0.0492	0.1996
2. Other Agriculture	0	0.0249	0.0249	0.0982	0.0397	0.1379
3. Mining & Quarrying	0.1966	0.0346	0.2312	0.1554	0.0574	0.2128
4. Sugar Manufacturing	0.0755	0.0342	0.1097	0.0679	0.1385	0.2064
5. Other Food Products	0.1091	0.0458	0.1549	0.2591	0.0819	0.3410
6. Textiles, Wood, Printing, Rubber & Plastic Products	0.1833	0.0511	0.2344	0.2267	0.0591	0.2858
7. Cement and Earth- ware Products	0.2280	0.1000	0.3280	0.1313	0.1002	0.2315
8. Other Manufacturing	0.1054	0.0461	0.1515	0.3521	0.0501	0.4022
9. Electricity, Water and Gas	0.0113	0.0288	0.0401	0.2241	0.0275	0.2516
10. Building Construction	0.0785	0.0958	0.1743	0.1294	0.1023	0.2317
11. Other Construction	0.0109	0.0661	0.0770	0.1705	0.0711	0.2416
12. Distribution	0.1961	0.0300	0.2261	0.0987	0.0432	0.1419
13. Hotels, Restaurants etc	0.1347	0.0505	0.1852	0.2234	0.0879	0.3113
14. Transport	0.0864	0.0504	0.1368	0.1960	0.0670	0.2630
15. Communications	0	0.0048	0.0048	0.1779	0.0073	0.1852
16. Banking & Insurance	0.1290	0.0345	0.1635	0.2070	0.0380	0.2450
17. Ownership of Dwelling	0	0	0	0	0	0
18. Other Private Services	0.1209	0.0243	0.1452	0.1478	0.0282	0.1760
19. Government Services	0	0.0219	0.0219	0.2199	0.0425	0.2624
20. Education	0	0.0109	0.0109	0.1449	0.0163	0.1612
21. Health	0	0.0102	0.0102	0.1547	0.0195	0.1742
22. Private Non-Profit Institutions	0	0.0022	0.0022	0.0147	0.0028	0.0175

Similarly, analysing the direct as against indirect wage and salary content provides some interesting insights on the total employment creation effects of final expenditures in the different production sectors. Table 5.3 shows that Sugar Manufacturing and Other Food Products have indirect wage and salary content that exceed the direct wage and salary content. Also the indirect wage and salary content of Cement and Earthware Products and Hotels and Restaurants, etc. sectors are a significant proportion of total wages and salaries. These sectors are more labour intensive than would be judged from the examination of the direct wage and salary requirements. Therefore, a change (an expansion or contraction) of these sectors would have a relatively greater effect on the amount of wages generated in the rest of the economy, through their demand for wage and salary-intensive intermediate inputs. Sectors such as Government Services, Education, Health and Private Non-Profit Institutions have a very high direct wage and salary content, but a very low indirect wage and salary content.

The sectors which face no indirect tax burden but are in fact affected by such taxes through their purchases of intermediate inputs are Communications and Government Services. Sugar Manufacturing, Cement and Earthware Products, Building Construction and Other Food Products have relatively high indirect tax components. The total indirect taxes are relatively high in Banking and Insurance, Transport, Hotels and Restaurants, Other Construction, Building Construction, Electricity, Water and Gas, Other Manufacturing, Textiles, Other Food Products, Sugar Manufacturing, Mining and Quarrying and Cement and Earthware Products.

The total primary input coefficients in Tables 5.1 and 5.2 can

be used to examine a number of structural relationships in the economy. Some of these relationships are analysed in the following sections.

5.3 Analysis of Intensity of Primary Input Use

The intensity of the primary input use can be defined as the ratio of the total primary input content of each sector to the average (weighted)¹ primary input content for the economy as a whole, i.e.:

$$P_{hj} = \frac{\tau_{hj}}{\bar{\tau}_{hj}} \quad \text{eq (5.4)}$$

where P_{hj} = intensity of primary input use

τ_{hj} = total primary input content of each sector

$\bar{\tau}_{hj}$ = average primary input content of the economy as
a whole.

The value of this index is presented in Table 5.4 for each production sector. A value of $P_{hj} > 1$ indicates that a unit output of sector 'j' requires a higher proportion of factor 'h' relative to industry in general. That sector is then said to be relatively intensive in the direct and indirect use of factor 'h'. Most of the sectors have $P_{hj} > 1$ for indirect tax, wages and salaries and imports indicating that these sectors were relatively more intensive in the total (direct and indirect) use of these primary inputs than the economy in general.

Analysing the imports, it is clear that the manufacturing sectors are relatively more intensive in the total use of imports than the economy in general. Other Food Products, Other Manufacturing, Sugar Manufacturing, Textiles, Cement and Earthware Products are relatively more intensive in the total use of imports. Other sectors to fall in this

1 The average (weighted) primary input content of the economy is calculated by relating the sum of each of the primary inputs to total final demand for all production sectors.

TABLE 5.4

INDEX OF INTENSITY OF PRIMARY INPUT USE BY SECTORS

	Indirect Tax	Wages and Salaries	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies	Imports
1. Sugar Cane	1.5167	1.4339	2.3853	1.2319	0.4363	1.3718
2. Other Agriculture	1.4535	1.8428	2.8510	0.3043	0.2882	0.9478
3. Mining & Quarrying	1.5539	1.6092	0.3066	2.1739	2.6760	1.4625
4. Sugar Manufacturing	1.6022	1.5063	1.6332	0.9710	1.2696	1.4186
5. Other Food Products	2.4684	1.0420	1.0780	0.7464	1.7928	2.3436
6. Textiles, Wood, Printing, Rubber & Plastic Products	1.9405	1.1793	0.6803	1.0000	2.7130	1.9643
7. Cement & Earthware Products	1.7212	1.1358	0.0753	2.3116	3.7963	1.5912
8. Other Manufacturing	2.6431	1.0692	0.5375	0.7391	1.7535	2.7643
9. Electricity, Water and Gas	1.6914	1.0406	0.3104	2.4217	0.4641	1.7292
10. Building Construction	1.5800	1.7240	0.4903	0.8695	2.0174	1.5924
11. Other Construction	1.6914	2.1011	0.2950	1.2681	0.8912	1.6605
12. Distribution	1.2825	0.9417	2.4795	1.1739	2.6169	0.9753
13. Hotels, Restaurants etc	1.9665	1.0627	1	2.0072	2.1435	2.1395
14. Transport	2.1636	1.2763	1.2788	1.7319	1.5833	1.8076
15. Communications	0.0520	1.2716	0.0332	32.8333	0.0555	1.2729
16. Banking & Insurance	4.0595	1.3825	0.5853	1.7898	1.8924	1.6838
17. Ownership of Dwelling	-	-	7.7220	-	-	-
18. Other Private Services	1.4610	0.7218	2.4201	9.1884	1.6805	1.2096
19. Government Services	0.3086	2.4546	0.1444	0.7826	0.2535	1.8034
20. Education	0.4424	2.8729	0.0919	0.7971	0.2616	1.1079
21. Health	0.3086	2.6190	0.5861	0.6086	0.1181	1.1973
22. Private Non-Profit Institutions	0.1338	3.5244	0.0232	0.1594	0.0255	0.1203
$\bar{\tau}_{hj}$	0.0269	0.2761	0.1295	0.0138	0.0864	0.1455

$$p_{hj} = \frac{\tau_{hj}}{\bar{\tau}_{hj}}$$

category are Government Services, Transport, Banking and Insurance, Hotels and Restaurants and Electricity, Water and Gas.

Sugar Cane, Other Agriculture, Building Construction, Other Construction, Banking and Insurance, Government Services, Education, Health, Private Non-Profit Institutions, Transport, Communications, Sugar Manufacturing and Mining and Quarrying are relatively more intensive in the total use of labour.¹

5.4 Total Primary Input Content By Categories of Final Demand

The analysis of total primary input content of final demand can be extended to an assessment of the total primary input requirements of each component of final demand by multiplying the total primary input coefficients into each component of final demand expenditure (Parker 1966):

$$F_{hj} = \sum_j \tau_{hj} Y_j \quad \text{eq (5.5)}$$

where $\tau_{hj} = \sum_i f_{hj} \tau_{ij}$

Y_j = final demand expenditure of sector i.

Tables 5.5 - 5.12 show the direct and indirect primary input content of exports, re-exports, tourist consumption expenditure, final private consumers expenditure, other final private expenditure, final government consumption expenditure, gross capital formation and changes in inventories. Rounding errors apart, the sum of primary input content along the row vectors must equal the total amount of final demand of each sector on each category of final demand as given in the inter-industry

1 Wages and salaries are used here as an approximation for total use of labour.

TABLE 5.5

TOTAL PRIMARY INPUT CONTENT OF FINAL DEMAND CATEGORIES:

EXPORTS
('000)

	Wages and Salaries	Imports	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies	Indirect Taxes
1. Sugar Cane	-	-	-	-	-	-
2. Other Agriculture	373.97	101.36	209.55	3.087	18.3015	28.7385
3. Mining & Quarrying	2275.26	1089.75	203.30	153.63	1183.975	214.058
4. Sugar Manufacturing	13332.51	6616.56	6780.06	429.5638	3516.653	1381.687
5. Other Food Products	1669.81	1979.16	810.24	59.7812	899.0396	385.3856
6. Textiles, Wood, Printing, Rubber & Plastic Products	429.1408	376.68	116.12	18.1884	308.939	68.7996
7. Cement & Earthware Products	47.04	34.73	7.29	4.785	49.2	6.945
8. Other Manufacturing	62.2872	84.86	14.69	2.1522	31.967	15.0021
9. Electricity, Water and Gas	2.2984	2.0128	0.3216	2.6736	0.3208	0.364
10. Building Construction	174.69	85.03	23.30	4.404	63.968	15.5975
11. Other Construction	64.39	26.82	4.402	1.9425	8.547	5.0505
12. Distribution	55.64	30.37	68.72	3.467	48.390	7.383
13. Hotels, Restaurants etc	-	-	-	-	-	-
14. Transport	2571.11	1918.85	1208.22	174.374	998.1	424.6272
15. Communications	36.87	19.45	0.4515	47.5755	0.504	0.147
16. Banking & Insurance	876.77	562.765	174.11	56.7359	375.56	250.8324
17. Ownership of Dwelling	-	-	-	-	-	-
18. Other Private Services	121.17	107.01	190.55	77.0944	88.282	23.8944
19. Government Services	-	-	-	-	-	-
20. Education	-	-	-	-	-	-
21. Health	-	-	-	-	-	-
22. Private Non-Profit Institutions	-	-	-	-	-	-
Total	22092.9564	13035.4078	9811.3251	1039.4545	7591.0939	2812.9143

TABLE 5.6

TOTAL PRIMARY INPUT CONTENT OF FINAL DEMAND CATEGORIES :

RE-EXPORTS
('000)

	Imports	Indirect Taxes	Wages and Salaries	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies
1. Sugar Cane						
2. Other Agriculture						
3. Mining & Quarrying						
4. Sugar Manufacturing						
5. Other Food Manufacturing						
6. Textiles, Wood, Printing, Rubber & Plastic Products						
7. Cement and Earth- ware Products						
8. Other Manufacturing						
9. Electricity, Water and Gas						
10. Building Construction						
11. Other Construction						
12. Distribution	391.5021	95.1855	717.34	885.9149	44.6958	623.8099
13. Hotels, Restaurants etc.						
14. Transport						
15. Communications						
16. Banking & Insurance						
17. Ownership of Dwelling						
18. Other Private Services						
19. Government Services						
20. Education						
21. Health						
22. Private Non-Profit Institutions						

TABLE 5.7

TOTAL PRIMARY INPUT CONTENT OF FINAL DEMAND CATEGORIES :

TOURIST CONSUMPTION EXPENDITURE
('000)

	Imports	Wages and Salaries	Indirect Taxes	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies
1. Sugar Cane						
2. Other Agriculture	7.7224	28.4928	2.1896	15.9656	0.2352	1.3944
3. Mining & Quarrying						
4. Sugar Manufacturing						
5. Other Food Products	34.1	28.77	6.64	13.96	1.03	15.49
6. Textiles, Wood, Printing, Rubber & Plastic Products	199.2026	226.9432	36.3834	61.4057	9.6186	163.3768
7. Cement & Earth- ware Products						
8. Other Manufacturing						
9. Electricity, Water and Gas						
10. Building Construction						
11. Other Construction						
12. Distribution	678.5658	1243.32	164.979	1535.5002	77.4684	1081.2102
13. Hotels, Restaurants etc	4424.5069	4170.0942	751.8677	1840.5835	393.7001	2632.2476
14. Transport	1170.613	1568.5324	259.0482	737.0856	106.3789	608.8968
15. Communications	15.1864	28.7902	0.1148	0.3526	37.1542	0.3936
16. Banking and Insurance	7.105	11.0693	3.1668	2.1982	0.7163	4.7415
17. Ownership of Dwelling						
18. Other Private Services	85.008	96.219	18.9819	151.3722	61.2444	70.1316
19. Government Services						
20. Education						
21. Health						
22. Private Non-Profit Institutions						
Total	6622.0101	7402.2311	1243.3714	4358.4236	687.5461	4577.8825

TABLE 5.8

TOTAL PRIMARY INPUT CONTENT OF FINAL DEMAND CATEGORIES:

FINAL PRIVATE CONSUMERS CONSUMPTION EXPENDITURE

('000)

	Wages and Salaries	Imports	Indirect Taxes	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies
1. Sugar Cane	-	-	-	-	-	-
2. Other Agriculture	3947.7792	1069.9661	303.377	2212.0909	32.5878	193.1991
3. Mining & Quarrying	-	-	-	-	-	-
4. Sugar Manufacturing	670.1069	307.7424	62.3238	315.3465	19.9794	163.5627
5. Other Food Products	3809.148	4514.84	879.136	1848.304	136.372	2050.876
6. Textiles, Wood, Printing, Rubber & Plastic Products	1208.9528	1061.1754	193.8186	327.1153	51.2394	870.3272
7. Cement and Earth- ware Products						
8. Other Manufacturing	36.0144	49.0684	8.6742	8.4912	1.2444	18.483
9. Electricity, Water and Gas	430.95	377.4	68.25	60.3000	501.3	60.15
10. Building Construction	437.444	212.9323	39.0575	58.3565	11.028	160.1817
11. Other Construction	-	-	-	-	-	-
12. Distribution	5267.60	2874.894	698.97	6505.486	328.212	4580.786
13. Hotels, Restaurants etc.	2224.5588	2360.2766	401.0878	981.869	210.0214	1404.1864
14. Transport	2954.1692	2204.729	487.8906	1388.2248	200.3537	1146.7944
15. Communications	145.0043	76.4876	0.5782	1.7759	187.1303	1.9824
16. Banking & Insurance	217.1873	139.405	62.1348	43.1302	14.0543	93.0315
17. Ownership of Dwelling	-	-	-	-	-	-
18. Other Private Services	744.7841	657.712	146.8641	1171.1758	473.8516	542.6124
19. Government Services	243.972	94.464	3.06	6.732	3.888	7.884
20. Education	2454.954	498.914	36.8305	36.8305	34.045	33.7355
21. Health	826.5033	199.1106	9.4869	86.7537	9.6012	11.6586
22. Private Non-Profit Institutions	4960.8638	89.215	18.3528	15.294	11.2156	11.2156
Total	30529.9921	16788.3284	3419.8928	28508.2763	2226.1241	11350.6665

TABLE 5.9

TOTAL PRIMARY INPUT CONTENT OF FINAL DEMAND CATEGORIES:

OTHER FINAL PRIVATE EXPENDITURE
('000)

	Wages and Salaries	Imports	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies	Indirect Taxes
1. Sugar Cane	-	-	-	-	-	-
2. Other Agriculture	-	-	-	-	-	-
3. Mining & Quarrying	213.64	102.144	19.056	14.4	110.976	20.064
4. Sugar Manufacturing	-	-	-	-	-	-
5. Other Food Products	-	-	-	-	-	-
6. Textiles, Wood, Printing, Rubber & Plastic Products	4.2328	3.7154	1.1453	0.1794	3.0472	0.6786
7. Cement and Earth- ware Products	-	-	-	-	-	-
8. Other Manufacturing	25.6824	34.9914	6.0552	0.8874	13.1805	6.1857
9. Electricity, Water & Gas	5.4587	4.7804	0.7638	6.3498	0.7619	0.8645
10. Building Construction	-	-	-	-	-	-
11. Other Construction	8.7015	3.624	0.573	0.2625	1.155	0.6825
12. Distribution	-	-	-	-	-	-
13. Hotels, Restaurants etc	-	-	-	-	-	-
14. Transport	131.0928	97.836	61.6032	8.8908	50.8896	21.6504
15. Communications	-	-	-	-	-	-
16. Banking and Insurance	778.668	499.8	154.632	50.388	333.54	222.768
17. Ownership of Dwelling	-	-	-	-	-	-
18. Other Private Services	-	-	-	-	-	-
19. Government Services	-	-	-	-	-	-
20. Education	1451.556	294.996	21.777	20.130	19.947	21.777
21. Health	-	-	-	-	-	-
22. Private Non-Profit Institutions	3.8924	0.07	0.012	0.0088	0.0088	0.0144
Total	2622.5486	1041.9572	265.6175	101.4967	533.506	294.6851

TABLE 5.10

TOTAL PRIMARY INPUT CONTENT BY FINAL DEMAND CATEGORIES :

FINAL GOVERNMENT CONSUMPTION EXPENDITURE
('000)

	Imports	Indirect Taxes	Wages and Salaries	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies
1. Sugar Cane						
2. Other Agriculture	88.5318	25.1022	326.6496	183.0342	2.6964	15.9858
3. Mining & Quarrying	1.9152	0.3519	3.9987	0.3573	0.270	2.0808
4. Sugar Manufacturing						
5. Other Food Products						
6. Textiles, Wood, Printing, Rubber & Plastic Products	72.879	13.311	83.028	22.4655	3.519	59.772
7. Cement and Earthware Products						
8. Other Manufacturing						
9. Electricity, Water and Gas	72.2092	13.0585	82.4551	11.5374	95.9154	11.5087
10. Building Construction	218.0297	39.9925	447.916	59.7535	11.292	164.0163
11. Other Construction	582.256	109.655	1398.041	92.062	42.175	185.57
12. Distribution	47.2527	11.4885	86.58	106.9263	5.3946	75.2913
13. Hotels, Restaurants etc						
14. Transport	317.967	70.3638	426.0516	200.2104	28.8951	165.3912
15. Communications						
16. Banking & Insurance	172.725	76.986	269.0985	53.439	17.4135	115.2675
17. Ownership of Dwelling						
18. Other Private Services	16.368	3.6549	18.5349	29.1462	11.7924	13.5036
19. Government Services	5087.1488	164.7895	13138.5699	362.5369	209.3796	424.5753
20. Education	1144.0364	84.4543	5629.3404	84.4543	78.067	77.3573
21. Health	789.997	37.6405	3279.2585	344.2065	38.094	46.257
22. Private Non-Profit Institutions						
Total	8611.3158	650.8486	25189.5222	1550.1295	544.904	1356.4976

TABLE 5.11

TOTAL PRIMARY INPUT CONTENT BY FINAL DEMAND CATEGORIES :

GROSS CAPITAL FORMATION
('000)

	Imports	Indirect Taxes	Wages and Salaries	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies
1. Sugar Cane						
2. Other Agriculture						
3. Mining & Quarrying	41.496	8.151	86.6385	7.7415	5.85	45.084
4. Sugar Manufacturing	44.5824	9.3096	89.8344	45.684	2.8944	23.6952
5. Other Food Products	2.387	0.4648	2.0139	0.9772	0.0721	1.0843
6. Textiles, Wood, Printing, Rubber & Plastic Products	464.9966	84.9294	529.7512	143.3387	22.4526	381.3688
7. Cement and Earthware Products	37.2715	7.4543	50.4896	7.8246	5.1359	52.808
8. Other Manufacturing	852.2618	150.6609	625.5288	147.4824	21.6138	321.0285
9. Electricity, Water and Gas	5.7868	1.0465	6.6079	0.9246	7.6866	0.9223
10. Building Construction	4677.7913	858.0325	9609.964	1282.0015	242.268	3518.9427
11. Other Construction	2341.5872	440.986	5622.3292	370.2344	169.61	746.284
12. Distribution	483.3114	117.507	885.56	1093.6666	55.1772	770.0966
13. Hotels, Restaurants etc						
14. Transport	43.132	9.5448	57.5804	27.1584	3.9196	22.4352
15. Communications						
16. Banking & Insurance						
17. Ownership of Dwellings						
18. Other Private Services						
19. Government Services						
20. Education						
21. Health						
22. Private Non-Profit Institutions						
Total	8994.604	1688.0868	17566.2979	3127.0339	536.6802	5883.7496

TABLE 5.12

TOTAL PRIMARY INPUT CONTENT BY FINAL DEMAND CATEGORIES :

CHANGES IN STOCKS
('000)

	Imports	Wages and Salaries	Indirect Taxes	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies
1. Sugar Cane						
2. Other Agriculture						
3. Mining & Quarrying	51.072	106.632	10.032	9.528	7.2000	55.488
4. Sugar Manufacturing	70.5888	142.2378	14.7402	72.333	4.5828	37.5174
5. Other Food Products	33.077	27.9069	6.4408	13.5412	0.9991	15.0253
6. Textiles, Wood, Printing, Rubber & Plastic Products	91.7418	114.5176	16.7562	28.2801	4.4298	75.2424
7. Cement and Earth- ware Products	35.4195	47.9808	7.0839	7.4358	4.8807	50.184
8. Other Manufacturing	376.8614	276.6024	66.6207	65.2152	9.5574	141.9555
9. Electricity, Water and Gas	96.6144	110.3232	17.472	15.4368	128.3328	15.3984
10. Building Construction	258.8089	531.692	47.4725	70.9295	13.404	194.6931
11. Other Construction	-249.0896	-598.0831	-46.9105	-39.3842	-18.0425	-79.387
12. Distribution	981.6642	1798.68	238.671	2221.3698	112.0716	1564.1598
13. Hotels, Restaurants etc.	28.3283	26.6994	4.8139	11.7845	2.5207	16.8532
14. Transport	-18.41	-24.668	-4.074	-11.592	-1.673	-0.576
15. Communications						
16. Banking & Insurance	0.49	0.7634	0.2184	0.1516	0.0494	0.327
17. Ownership of Dwelling						
18. Other Private Services	1.408	1.5944	0.3144	2.5072	1.0144	1.1616
19. Government Services						
20. Education						
21. Health	-9.4068	-39.0474	-0.4482	-4.0986	-0.4536	-0.5508
22. Private Non-Profit Institutions						
Total	1749.1679	2513.8313	379.2033	2463.4379	268.8736	2078.4853

table (Table 2.1). As an illustration, the second row of Table 5.5 shows that exports of \$735,000 of Other Agriculture in 1972 required, directly and indirectly, \$374,000 of wages and salaries, \$101,000 of imports, \$210,000 of gross income of unincorporated enterprises, \$3,000 of the gross operating surplus of government, \$18,000 of the gross operating surplus of companies and \$29,000 of indirect taxes.

The last rows of Tables 5.5 - 5.12 show the total primary input content of each category of final demand for the economy as a whole. They are summarised in Table 5.13. The column elements of Table 5.13 show the total primary inputs absorbed by each category of final demand and the row elements indicate the dependence of each primary input on the various categories of final demand. The intensity with which each category of final demand uses primary inputs can be obtained from Table 5.13 by expressing the primary input requirements by each of the final demand categories in percentage terms. This is given in Table 5.14.

An examination of Table 5.14 indicates that the wages and salaries content of all categories of final demand are higher than the rest of the primary input contents. Final government consumption expenditure, other final consumption expenditure, gross capital formation and exports have a relatively higher wage and salary content than the rest of the final demand categories. The high wage and salary content of government consumption reflects the high wages and salaries component of the government's recurrent expenditure. The 40 per cent wage and salary content of exports would indicate that the export industries are relatively labour intensive. Sugar manufacturing and sugar cane production are very labour intensive in Fiji and the inflow of foreign

TABLE 5.13
TOTAL PRIMARY INPUT REQUIREMENT BY FINAL DEMAND CATEGORIES *
('000)

	Exports	Re-exports	Tourist Consumption Expenditure	Final Private Consumer's Consumption Expenditure	Other Final Private Consumption Expenditure	Final Government Consumption Expenditure	Gross Capital Formation	Changes in Stocks
Imports	13055.4078	391.5021	6622.0101	16788.3284	1041.9572	8611.3158	8994.604	1749.1679
Indirect Taxes	2812.9143	95.1855	1243.3714	3419.8928	294.6851	650.8486	1688.0868	379.2033
Wages and Salaries	22092.9564	717.34	7402.2311	30529.9921	2622.5486	25189.5222	17566.2979	2513.8313
Gross Income of Unincorporated Enterprises	9811.3251	885.9149	4358.4236	28508.2763	265.6175	1550.1295	3127.0359	2463.4379
Gross Operating Surplus: Government	1039.4545	44.6958	687.5461	2226.1241	101.4967	544.904	536.6802	268.8736
Gross Operating Surplus: Companies	7591.0939	623.8099	4577.8825	11350.6665	533.506	1356.4976	5883.7496	2078.4853
Total Final Demand	56403.152	2758.4482	24891.4648	92823.2802	4859.8111	37903.2177	37796.4544	9452.9993

* Direct factor purchases are excluded from the calculations.

investment into the export-oriented manufacturing industries is to a considerable extent due to relatively low wage rates.

The value added or the GDP content of each of the final demand categories is more than 70 per cent (Table 5.15).

By transposing the column and row vectors of Table 5.13 and expressing final demand of each category as a percentage of each primary input, the total dependence of imports, indirect taxes, wages and salaries, gross income of unincorporated enterprises, and gross operating surplus of companies on the different categories of final demand expenditures can be derived. This is given in Table 5.16. This dependence can be used to indicate the extent to which changes in the composition of total final demand will affect imports, wages and salaries, indirect taxes etc.

An examination of Table 5.16 indicates that all primary inputs are more dependent on final private consumption expenditure than on any other final demand category. Therefore, a change in final consumption expenditure would have a relatively greater impact on primary inputs than a change in any other category of final demand. A change in final private consumption expenditure would have the greatest effect on gross income of unincorporated enterprises, followed by gross operating surplus of government, gross operating surplus of companies, indirect taxes, imports and wages and salaries. Any changes in exports and final private consumption expenditure would have relatively greater impact on government revenue. The dependence of each primary input on exports is fairly even - lowest 19.1 per cent and highest 26.6 per cent. Similarly, imports, indirect taxes, wages and salaries and gross operating

TABLE 5.15

DOMESTIC PRIMARY INPUT CONTENT OF FINAL DEMAND EXPENDITURE

(in Percentages)

[illegible]

TABLE 5.16

THE DEPENDENCE OF PRIMARY INPUTS ON FINAL
DEMAND CATEGORIES
(in Percentages)

	Imports	Indirect Taxes	Wages and Salaries	Gross Income of Unincor- porated Enterprises	Gross Operating Surplus: Gov't	Gross Operating Surplus: Companies
Exports	22.8	26.6	20.3	19.3	19.1	22.3
Re-exports	0.7	0.9	0.7	1.8	0.8	1.8
Tourist Consump- tion Expenditure	11.6	11.7	6.8	8.6	12.6	13.5
Final Private Consumption Expenditure	29.3	32.3	28.1	55.9	40.9	33.4
Other Final Private Consump- tion Expenditure	1.8	2.8	2.4	0.5	1.9	1.6
Final Government Consumption Expenditure	15.1	6.1	23.2	3.0	10.0	4.0
Gross Capital Formation	15.7	16.0	16.2	6.1	9.8	17.3
Changes in Stock	3.0	3.6	2.3	4.8	4.9	6.1
Total	100	100	100	100	100	100

surplus of companies are evenly dependent on gross capital formation. Wages and salaries depend relatively more on exports (employment in export-oriented industries), final private consumption expenditure and on final government consumption expenditure (because of high employment in government services, education, health, etc.).

5.5 Price-Cost Analysis

In the inter-industry model, total production costs are made up of intermediate and primary inputs (the latter consisting of wages, operating surplus, net indirect taxes and imports). It is possible to calculate the total unit cost expressed in terms of these primary units. The calculation in turn can be used to ascertain the effects which a uniform change in cost of primary inputs would have on product prices. If the unit price of the output of any industry is defined to be equal to the total unit cost, then the total primary input coefficients can be translated into cost components of the unit price of each sector's output. This price-cost relationship can be derived from the expression (Parker 1973):

$$P_j = \sum_i a_{ji} P_i + F_j \quad \text{eq (5.6)}$$

where P_j = price per unit of output of sector j

a_{ji} = the elements of the transpose of the direct input-output coefficients matrix

F_j = the sum of primary inputs absorbed directly by sector j .

The general solution to this price cost equation corresponding to

the general input-output solution is given by:¹

$$P_j = \sum_j \tau_{ji} F_j \quad \text{eq (5.7)}$$

where τ_{ji} = the elements of the transpose of inverse matrix

$$(I-A)^{-1}$$

Instead of using the original values of F , it is possible to repeat the calculation assuming that the F values for each sector are uniformly increased by, say, 10 per cent. Alternatively, the F value can be increased by the amount which would follow from, say, a 10 per cent increase in any one primary input factor (wages, imports or indirect taxes, etc.). In Table 5.17 the 22 - sector inter-industry table has been used to calculate the effects on sectoral prices of a uniform 10 per cent increase in wages and salaries, and (separately) a 10 per cent increase in the cost of imports. The effects of a 10 per cent increase simultaneously in both wages and salaries and cost of imports was also calculated.² Taking row 2 of Table 5.17 as an illustration, it shows

1 This equation is identical to equation 5.1 expressing the direct and indirect primary cost component $\sum_j \tau_{ji} F_j$ in terms of Y_j ; instead of P_j .

In equation 5.1 we have pre-multiplied the direct input coefficients by the elements of the inverse matrix. This is equivalent to post-multiplying the elements of the transpose of the inverse matrix by the direct primary coefficients as in the price cost equation above, i.e.:

$$\sum_j \tau_{ji} F_j = \sum_j F_j \cdot \tau_{ij}$$

2 The cost-price analysis is based on the rather restrictive assumption that all cost increases are passed on in full to consumers in the form of higher prices. However, the results are helpful in illustrating the relative sensitivity of each sector to changes in the cost of primary inputs.

TABLE 5.17

THE EFFECT OF INCREASES IN WAGES AND SALARIES
AND IMPORT PRICES ON COMMODITY PRICES AND THE COST OF LIVING
(in Percentages)

	$\frac{P_n^1}{P_n^0}$	$\frac{P_n^2}{P_n^0}$	$\frac{P_n^3}{P_n^0}$		$\frac{P_n^1}{P_n^0} C_i$	$\frac{P_n^2}{P_n^0} C_i$
	Changes in Sectoral Prices Arising From a 10% Increase in Wages and Salaries	Changes in Sectoral Prices Arising From a 10% Increase in Import Prices	Changes in Sectoral Prices Arising From a 10% Increase in Wages and Salaries and Imports	C_i	%	%
1. Sugar Cane	3.97	1.99	5.96	-	-	-
2. Other Agriculture	5.09	1.38	6.47	8.3587	0.4255	0.1154
3. Mining and Quarrying	4.47	2.13	6.6			
4. Sugar Manufacturing	4.17	2.07	6.24	1.6062	0.06699	0.0332
5. Other Food Products	2.88	3.4	6.28	14.2634	0.4108	0.4850
6. Textiles, Wood, Printing, Rubber & Plas- tic Products	3.31	2.86	6.17	4.6000	0.1324	0.1144
7. Cement & Earth- ware Products	5.54	2.31	7.85			
8. Other Manufacturing	2.96	4.02	6.98	0.1314	0.0039	0.0053
9. Electricity, Water & Gas	2.88	2.51	5.39	1.6159	0.0465	0.0406
10. Building Construction	5.01	2.31	7.32	0.9900	0.0496	0.0229
11. Other Construction	6.04	2.42	8.46			
12. Distribution	2.6	1.42	4.02	21.8260	0.5675	0.3099
13. Hotels, Restaur- ants etc.	2.93	3.11	6.04	8.1681	0.2393	0.2540
14. Transport	3.54	2.63	6.17	9.0310	0.3197	0.2375
15. Communications	3.51	1.86	5.37	0.4449	0.0156	0.0083
16. Banking and Insurance	3.81	2.45	6.26	0.6130	0.0234	0.0150
17. Ownership of Dwelling	-	-	-	14.480	-	-
18. Other Private Services	2.00	1.76	3.76	4.0258	0.08516	0.0709
19. Government Services	6.80	2.63	9.43	0.3878	0.0264	0.0102
20. Education	7.93	1.61	9.54	3.3342	0.2644	0.0537
21. Health	7.23	1.74	8.97	1.2313	0.0902	0.0214
22. Private Non- Profit Institutions	9.53	0.18	9.71	5.4921	0.5234	0.0099
Effect on Cost of Living Index	3.29%	1.81%	5.1%	100	3.29076	1.8076

that a 10 per cent increase in wages and salaries could have lead to an increase of approximately 5.1 per cent in the price of the Other Agriculture sector's products. A 10 per cent increase in the cost of imports could lead to an increase in prices of Other Agriculture sector's products of the order of 1.4 per cent. Similarly a 10 per cent increase in both wages and salaries and imports simultaneously would increase the cost of the products of Other Agriculture by some 6.5 per cent.

An examination of Table 5.17 indicates that the effects (on sectoral prices) of an increase in wages and salaries are relatively greater than an increase in import prices. The effects of an increase in wages and salaries are highest in government, social welfare and community services sectors, followed by the construction and manufacturing sectors. The estimated changes in the sectoral prices arising from a 10 per cent increase in import prices are relatively highest in the manufacturing sectors, the order being Other Manufacturing, Other Food Products, Textiles, Mining and Quarrying, Cement and Earthware Products, Construction, Electricity, Water and Gas. Some tertiary sectors like Transport, Hotels and Restaurants and Banking and Insurance also register greater impact. Obviously, these sectors have a considerable import content.

The assessed effect of a combined wage and import price increase of 10 per cent is the sum of their separate effects. This is shown in column 3 of Table 5.17. With a few exceptions (Government Services, Education, Health and Private Non-Profit Institutions) the price increases stimulated by a 10 per cent increase would be spread fairly evenly throughout the economy.

The likely effect of factor price increases on the cost of living can be obtained by multiplying the consumption expenditure of sector i (expressed as a fraction of total consumption expenditure) by the corresponding price in that sector. This is expressed as (Rasmussen 1956):

$$P_i = \sum_i \frac{P_i^1}{P_i^0} \cdot C_i \quad \text{eq (5.8)}$$

where P_i^1 = price of the output of sector i in period 1

P_i^0 = price of the output of sector i in period 0

C_i = the consumption expenditure of sector i expressed as a fraction of total consumption expenditure.

Columns 5 and 6 of Table 5.17 assess the possible effect on the cost of living of a 10 per cent increase in wages and salaries and import prices, respectively. The increase in wages and salaries would raise the cost of living by some 3.3 per cent, whereas a 10 per cent increase in the price of imports would result in a 1.8 per cent increase in the cost of living. The combined effect (an increase in wages, salaries and imports) would raise the cost of living by 5.1 per cent. From the analysis it is evident that any change in wages and salaries would have a relatively greater effect on the cost of living than would a similar change in imports.

5.6 Total Dependence on Final Demand

Given the interdependence between production sectors in the economy, the direct dependence of each sector on the various categories of final demand alone will not fully show the part played by each of the

final demand components in determining the output levels of the different production sectors. In order to assess the total dependence, the indirect as well as the direct dependence of each production sector on final demand must be taken into account. (The indirect dependence arises from the sale of the output of sector j to other production sectors (intermediate sales) which ultimately find their way towards satisfying one or more of the categories of final demand expenditures.) The total dependence can be obtained by multiplying the rows of the inverse matrix into the column vectors of the final demand components. This is given by the expression (Parker 1973):

$$H_j = \sum_{j=1}^n \tau_{ij} Y_j \quad \text{eq (5.9)}$$

where H_j = total dependence of sector j on final demand

τ_{ij} = inverse matrix, $(I-A)^{-1}$

Y_j = final demand categories

Table 5.18 shows the total dependence of each sector on the various categories of final demand. This dependence, in percentage terms, is shown in Table 5.19 and is derived by pre-multiplying the $\tau_{ij} Y_j$ into the inverse of a diagonal matrix (whose elements are the output of the production sectors) and summing over j to form the equation:

$$H_j^* = \sum_{j=1}^n \hat{X}^{-1} \tau_{ij} Y_j \quad \text{eq (5.10)}$$

Examination of Tables 5.18 and 5.19 shows, for example, that \$2.725m of sugar cane (or 93.5 per cent of total supplies) is eventually used to satisfy exports although there is no direct sale of sugar cane to

TABLE 5.18

TOTAL DEPENDENCE ON FINAL DEMAND

('000)

	Exports	Re-exports	Tourist Consumption Expenditure	Final Private Consumer's Consumption Expenditure	Other Final Private Expenditure	Final Government Consumption Expenditure
1. Sugar Cane	20725.3389	0.2759	8.3912	1066.0658	0.0015	1.1584
2. Other Agriculture	2454.2755	16.2781	980.6787	12292.5345	4.3517	743.3483
3. Mining & Quarrying	5258.3975	0.2759	8.1948	68.8384	489.7990	217.1344
4. Sugar Manufacturing	32128.3779	0.5518	13.5345	1652.9735	0.0030	1.7736
5. Other Food Products	6109.7331	52.4210	1222.4339	14857.8358	6.6921	232.2035
6. Textiles, Wood, Printing, Rubber & Plastic Products	2041.1516	65.6642	1203.6464	5346.8821	74.4115	992.8971
7. Cement and Earth- ware Products	450.0163	1.9313	41.0285	273.9072	28.1357	600.8543
8. Other Manufacturing	1417.7228	56.5595	856.6417	1663.6569	27.3179	578.0730
9. Electricity, Water and Gas	707.0459	25.3828	787.9488	2481.5836	164.6326	598.1389
10. Building Construction	725.0834	4.9662	76.0242	1255.0621	78.9383	1659.1863
11. Other Construction	625.9650	0	1.5005	56.6170	0.8218	3654.0853
12. Distribution	5406.5557	2912.6763	7241.7509	26572.2708	340.6856	1514.8563
13. Hotels, Restaurants etc	0	0	14213.000	7582.000	0	0
14. Transport	9082.9934	49.6620	5447.7268	10982.0283	51.6453	1829.9965
15. Communications	662.5224	40.8332	478.4879	1355.4394	108.5881	405.8534
16. Banking and Insurance	2959.7178	32.0044	547.1624	1553.0907	2067.6777	1015.5337
17. Ownership of Dwelling	0	0	0	13441.00	-	-
18. Other Private Services	4487.2429	160.5738	1908.2634	7164.8292	107.4517	1202.0158
19. Government Services	39.9458	0	6.4227	436.8874	2.3182	19405.6714
20. Education	0	0	-	3095.000	1830.0000	7097.000
21. Health	0	0	-	1143.0000	-	4535.000
22. Private Non-Profit Institutions	0	0	-	5098.000	4.000	0

TABLE 5.18 (Cont'd)

	Gross Fixed Capital Formation	Changes in Stocks
1. Sugar Cane	139.9169	228.7619
2. Other Agriculture	218.8212	571.1636
3. Mining and Quarrying	1427.6117	723.4414
4. Sugar Manufacturing	216.9648	357.7412
5. Other Food Products	175.8344	1520.4044
6. Textiles, Wood, Printing, Rubber and Plastic Products	5010.6954	3748.6699
7. Cement and Earthware Products	3674.1151	1539.3775
8. Other Manufacturing	3694.4641	2932.6274
9. Electricity, Water & Gas	452.9053	1239.6147
10. Building Construction	21166.4321	11827.5116
11. Other Construction	9981.7467	7.0359
12. Distribution	6926.1312	74446.5391
13. Hotels, Restaurants etc.	-	91.0000
14. Transport	1014.6367	1563.4867
15. Communications	320.3923	1147.3033
16. Banking and Insurance	405.1655	981.7744
17. Ownership of Dwelling	-	-
18. Other Private Services	1226.6098	4526.4721
19. Government Services	15.3849	4.6021
20. Education	0	0
21. Health	0	0
22. Private Non-Profit Institutions	0	0

TABLE 5.19
TOTAL (DIRECT AND INDIRECT) DEPENDENCE
OF EACH SECTOR ON THE DIFFERENT CATEGORIES OF FINAL DEMAND
(in Percentages)

	Exports	Re-exports	Tourist Consumption Expenditure	Final Private Consumers Consumption Expenditure	Other Final Private Expenditure	Final Government Consumption Expenditure
1. Sugar Cane	93.8	0.0012	0.04	4.8	0	0.0052
2. Other Agriculture	14.6	0.1	5.8	73.1	0.03	4.4
3. Mining & Quarrying	67.9	0.003	0.11	0.89	6.3	2.8
4. Sugar Manufacturing	93.5	0.002	0.04	4.8	0.00009	0.0052
5. Other Food Products	26.7	0.23	5.3	64.9	0.03	1.01
6. Textiles, Wood, Printing, Rubber & Plastic Products	13.2	0.42	7.8	34.6	0.48	6.4
7. Cement and Earth- ware Products	8.5	0.04	0.78	5.2	0.53	11.4
8. Other Manufacturing	14.9	0.59	9.0	17.4	0.29	6.1
9. Electricity, Water and Gas	12.5	0.45	13.9	43.9	2.9	10.6
10. Building Construction	2.8	0.02	0.29	4.8	0.30	6.3
11. Other Construction	4.7	-	0.01	0.43	0.006	27.5
12. Distribution	9.2	5.0	12.4	45.4	0.58	2.6
13. Hotels, Restaurants etc	-	-	64.9	34.6	-	-
14. Transport	31.4	0.17	18.8	37.9	0.18	6.3
15. Communications	18.9	1.2	13.7	38.8	3.1	11.6
16. Banking and Insurance	34.1	0.37	6.3	17.9	23.8	11.7
17. Ownership of Dwelling	-	-	-	100.0	-	-
18. Other Private Services	26.7	0.96	11.4	42.6	0.64	7.2
19. Government Services	0.20	-	0.03	2.2	0.012	97.5
20. Education	-	-	-	25.7	15.1	59.03
21. Health	-	-	-	20.3	-	80.7
22. Private Non-Profit Institutions	-	-	-	99.9	0.1	-

TABLE 5.19 (Cont'd)

	Gross Fixed Capital Formation	Changes in Stock
1. Sugar Cane	0.63	1.0
2. Other Agriculture	1.3	3.4
3. Mining and Quarrying	18.4	9.3
4. Sugar Manufacturing	0.63	1.04
5. Other Food Products	0.78	6.6
6. Textiles, Wood, Printing, Rubber and Plastic Products	32.4	24.3
7. Cement and Earthware Products	69.8	29.2
8. Other Manufacturing	38.7	30.7
9. Electricity, Water & Gas	8.0	21.9
10. Building Construction	81.0	45.2
11. Other Construction	75.2	0.05
12. Distribution	11.8	
13. Hotels, Restaurants etc.	-	.0042
14. Transport	3.5	5.4
15. Communications	9.2	32.8
16. Banking and Insurance	4.7	11.3
17. Ownership of Dwelling	-	-
18. Other Private Services	7.3	26.9
19. Government Services	0.08	0.023
20. Education	-	-
21. Health	-	-
22. Private Non-Profit Institutions	-	-

export. In general, the total dependence on exports and on final private consumption expenditure is relatively higher than for other categories of final demand. However, industries such as Textiles, Wood, Printing, Rubber and Plastic Products, Cement and Earthware Products, Other Manufacturing, Building Construction, and Other Construction depend heavily on gross capital formation.

Table 5.20 indicates the direct and indirect dependence on important categories of final demand, separately. In the export category, Sugar Cane, Other Agriculture, Cement and Earthware Products, Other Manufacturing, Electricity, Water and Gas, Distribution, Communications and Other Private Services have greater indirect dependence on exports than direct dependence - illustrating that these sectors contribute (intermediate sales) to other sectors which are export oriented. With few exceptions, the direct dependence on final private consumption is relatively higher than indirect dependence. There is a relatively high degree of indirect dependence of manufacturing industries, mining and quarrying and construction industries on gross fixed capital formation. This is a reflection of the predominance of building materials in the output of these sectors (except construction).

5.7 Market Analysis

Given the interdependence coefficients (τ_{ij}), the row vectors of this inverse matrix which trace the marketing flows of each sector's output can be used in analysing the final (direct and indirect) markets for the output of each production sector. The final market analysis attempts to trace the direct and indirect markets for the output of each sector by tracing the flow and ultimate use of that sector's intermediate

TABLE 5.20
DIRECT AND INDIRECT DEPENDENCE ON SELECTED
FINAL DEMAND CATEGORIES
(in Percentages)

	Exports		Final Private Consumption Expenditure		Gross Capital Formation		Government Consumption Expenditure	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
1. Sugar Cane	-	93.5	-	4.8	-	0.63	-	0.0052
2. Other Agriculture	4.4	10.2	46.2	26.9	-	1.3	3.8	0.6
3. Mining & Quarrying	66.1	1.8	-	0.89	2.5	15.9	0.12	2.68
4. Sugar Manufacturing	93.3	0.2	4.3	0.5	0.62	0.01	-	0.0052
5. Other Food Products	25.3	1.4	57.8	7.1	0.03	0.75	-	1.01
6. Textiles, Wood, Printing, Rubber & Plastic Products	8.5	4.7	24.0	10.6	10.5	21.9	1.6	4.8
7. Cement and Earth- ware Products	2.8	5.7	-	5.2	3.1	66.7	-	11.4
8. Other Manufacturing	2.2	12.7	1.3	16.1	22.2	16.5	-	6.1
9. Electricity, Water and Gas	0.14	12.36	26.5	17.4	0.41	7.59	5.0	5.6
10. Building Construction	1.4	1.4	5.7	0.9	77.2	3.8	3.6	2.7
11. Other Construction	0.84	3.86	-	0.43	73.0	2.2	18.1	9.4
12. Distribution	0.37	8.83	34.6	10.8	5.8	6.0	0.57	2.03
13. Hotels, Restaurants etc	-	-	34.6	0.0	-	-	-	-
14. Transport	25.2	6.2	28.9	9.0	0.57	2.93	4.2	2.1
15. Communications	3.0	15.9	11.8	27.0	-	9.2	-	11.6
16. Banking and Insurance	26.4	7.7	6.5	11.4	-	4.7	8.1	3.6
17. Ownership of Dwelling	-	-	100	0.0	-	-	-	-
18. Other Private Services	3.6	23.1	22.2	20.4	-	7.3	0.55	6.65
19. Government Services	-	0.20	1.8	0.4	-	0.08	97.4	0.01
20. Education	-	-	25.7	-	-	-	59.0	0.03
21. Health	-	-	20.3	-	-	-	80.6	0.01
22. Private Non-Profit Institutions	-	-	99.9	-	-	-	-	-

and final sales. The direct market for sector j is the sales made by sector j to final demand, whereas the indirect market for the output of sector j represents the ultimate destination of the intermediate sales of sector j (which is incorporated in the final output of other production sectors).

Denoting R_j for the diagonal matrix formed from the row elements of sector j in the inverse matrix $(I-A)^{-1}$, the final market (D) for the output of the j^{th} sector is given, in the matrix form, as:

$$D = RY$$

or

$$\begin{bmatrix} D_{11} & D_{12} & \cdots & D_{18} \\ D_{21} & D_{22} & \cdots & D_{28} \\ \vdots & \vdots & \ddots & \vdots \\ D_{n1} & D_{n2} & \cdots & D_{n8} \end{bmatrix} = \begin{bmatrix} \tau_{11} & 0 & \cdots & 0 \\ 0 & \tau_{12} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \tau_{nn} \end{bmatrix} \begin{bmatrix} Y_{11} & Y_{12} & \cdots & Y_{18} \\ Y_{21} & Y_{22} & \cdots & Y_{28} \\ \vdots & \vdots & \ddots & \vdots \\ Y_{n1} & Y_{n2} & \cdots & Y_{n8} \end{bmatrix}$$

The above formula allows the calculations of the final market for the output of the various production sectors to be carried out only one at a time. The final markets of the selected sectors are shown in Tables 5.21a, b, c, d, e, f and g.

TABLE 5.21(a)

FINAL MARKETS FOR OTHER AGRICULTURE, 1972

('000)

	Exports	Re- exports	Tourist Consump- tion Expend- iture	Final Private Consump- tion Expend- iture	Other Final Consump- tion Expend- iture	Gov't Consump- tion Expend- iture	Gross Capital Format- ion	Changes in Stock
1. Sugar Cane	-		-	-	-	-	-	-
2. Other Agriculture	749		57	7905	-	654	-	-
3. Mining & Quarrying	4		-	-	0.034	0.006	0.14	0.17
4. Sugar Manufacturing	35		-	2	-	-	0.24	0.38
5. Other Food Products	1596		28	3640	-	-	2	27
6. Textiles, Wood, Printing, Rubber & Plastic Products	52		27	146	0.5122	10	64	13
7. Cement and Earth- ware Products	0.12		-	-	-	-	0.11	0.12
8. Other Manufacturing	0.30			0.17	0.1218	-	3	1.3
9. Electricity, Water and Gas	0.0048			0.9	0.0114	0.17	0.01	0.23
10. Building Construction	2.24			6	-	6	123	7
11. Other Construction	0.07			-	0.009	2	6	-0.62
12. Distribution	1.26	16	28	119	-	2	20	41
13. Hotels, Restaurants etc	-		833	444	-	-	-	5.3
14. Transport	12		7	13	0.60	2	0.26	-0.11
15. Communications	0.042		0.03	0.165	-	-	-	-
16. Banking and Insurance	3		0.04	0.74	3	1	-	0.003
17. Ownership of Dwelling	0		-	-	-	-	-	-
18. Other Private Services	0.49		0.39	3	-	0.07	-	0.0064
19. Government Services	-		-	0.43	-	23	-	-
20. Education	-		-	2	1.1	4	-	-
21. Health	-		-	0.23	-	1	-	-0.011
22. Private Non-Profit Institutions	-		-	-	-	0	-	-

TABLE 5.21(b)

FINAL MARKETS FOR ELECTRICITY, WATER AND GAS, 1972

('000)

	Exports	Tourist Consump- tion Expend- iture	Final Private Consump- tion Expend- iture	Other Final Consump- tion Expend- iture	Gov't Consump- tion Expend- iture	Gross Capital Format- ion	Changes in Stock	Re- exports
1. Sugar Cane	-	-	-	-	-	-		
2. Other Agriculture	1.25	0.10	13.19	-	1.1	-		
3. Mining & Quarrying	385.6	-	-	4	0.68	14.6	18.1	
4. Sugar Manufacturing	70.5	-	3.3	-	-	0.48	0.75	
5. Other Food Products	73.1	1.26	167	-	-	0.09	1.2	
6. Textiles, Wood, Printing, Rubber & Plastic Products	15.4	8.2	43.4	0.15	3	19.0	3.8	
7. Cement and Earth- ware Products	8.8	-	-	-	-	9	9	
8. Other Manufacturing	1.9	-	1.1	0.79	-	19.3	8.5	
9. Electricity, Water and Gas	8.0	-	1506	19.1	288.2	23.1	386	
10. Building Construction	4.37	-	11	-	11.2	240.2	13.3	
11. Other Construction	1.06	-	-	0.14	23.1	93.0	-10	
12. Distribution	1.97	44	186.4	-	3.1	31.3	64	25.4
13. Hotels, Restaurants etc	-	671	357.8	-	-	-	4.3	
14. Transport	96.3	59	110.6	4.9	16	2.2	-1	
15. Communications	0.032	0.025	0.123	-	-	-	-	
16. Banking and Insurance	33	0.42	8.2	29.37	10.2	-	0.03	
17. Ownership of Dwelling	-	-	-	-	-	-	-	
18. Other Private Services	5.5	4.3	34.0	-	0.85	-	0.07	
19. Government Services	-	-	3	-	157.0	-	-	
20. Education	-	-	18	10.6	41.2	-	-	
21. Health	-	-	11	-	42.6	-	-0.5	
22. Private Non-Profit Institutions	-	-	8	0.006	-	-	0	

TABLE 5.21(c)

FINAL MARKETS FOR DISTRIBUTION, 1972

('000)

	Exports	Re- exports	Tourist Consump- tion Expend- iture	Final Private Consump- tion Expend- iture	Other Final Consump- tion Expend- iture	Gov't Consump- tion Expend- iture	Gross Capital Format- opm	Changes in Stock
1. Sugar Cane	-		-	-	-	-	-	-
2. Other Agriculture	42.6		3.25	450		37.2	16.3	
3. Mining & Quarrying	428.6		-		4.0	0.75	17.7	20
4. Sugar Manufacturing	2635		-	124.8	-	-	0.94	28
5. Other Food Products	781.8		13.4	1783	-	-	181.5	13
6. Textiles, Wood, Printing, Rubber & Plastic Products	147.1		77.8	414.4	1.5	28.5	14.7	35.8
7. Cement and Earth- ware Products	13.7			-	-	-	332.0	14
8. Other Manufacturing	33.1			19.1	13.6	-	2.1	147
9. Electricity, Water and Gas	0.78			147.5	1.9	28	1829.1	37.7
10. Building Construction	33			83.3	-	85	918.8	101.2
11. Other Construction	10.5			-	1.4	228.4	3595.7	-97.7
12. Distribution	225.9	2913	5048.3	21388	-	351.5	-	7303.3
13. Hotels, Restaurants etc	-		1604.6	856.0	-	-	16.87	10.2
14. Transport	750.7		458.0	862.6	38.3	124.4	-	-7.2
15. Communications	0.294		0.22	1.2	-	-	-	-
16. Banking and Insurance	261.8		3.3	64.9	232.6	80.4		0.23
17. Ownership of Dwelling	-		-	-	-	-		-
18. Other Private Services	41.2		32.7	252.9	-	6.3		0.54
19. Government Services	-		-	5.9	-	316		-
20. Education	-		-	68.7	40.6	157.6		-
21. Health	-		-	17.8	-	70.3		-0.84
22. Private Non-Profit Institutions	-		-	33.6	0.03	-		-

TABLE 5.21(d)

FINAL MARKETS FOR OTHER MANUFACTURING, 1972

('000)

	Exports	Re- exports	Tourist Consump- tion Expend- iture	Final Private Consump- tion Expend- iture	Other Final Consump- tion Expend- iture	Gov't Consump- tion Expend- iture	Gross Capital Formation	Changes in Stock
1. Sugar Cane	-		-	-	-	-	-	-
2. Other Agriculture	8.8935		0.6776	93.8839		7.7682		
3. Mining & Quarrying	110.1015		-	-	1.032	0.1935	4.1925	5.16
4. Sugar Manufacturing	657.1685		-	30.5655			4.428	7.011
5. Other Food Products	112.5976		1.94	256.856			0.1386	1.8818
6. Textiles, Wood, Printing, Rubber & Plastic Products	13.3118		7.0397	37.5013	0.1313	2.5755	16.4327	3.2421
7. Cement and Earth- ware Products	3.96						4.2504	4.0392
8. Other Manufacturing	220.2629			127.3558	90.8193		2212.0241	978.1343
9. Electricity, Water and Gas	0.0888			16.65	0.2109	3.1887	0.2553	4.2624
10. Building Construction	15.5241			38.8737	0	39.8043	853.9947	47.2491
11. Other Construction	5.994				0.81	130.140	523.368	-55.674
12. Distribution	11.556	56.5595	98.031	415.33		6.8265	69.823	141.819
13. Hotels, Restaurants etc			594.1034	316.9276				3.8038
14. Transport	247.3344		150.8889	284.1837	12.6108	40.9851	5.5596	-2.373
15. Communications	.0945		.0738	0.3717		0		
16. Banking and Insurance	13.3226		.1682	3.3002	11.832	0.4089		0.0116
17. Ownership of Dwelling	-							
18. Other Private Services	4.6816		3.7191	28.7749		0.7161		0.0616
19. Government Services				6.048		325.7016		
20. Education				4.6425	2.745	10.6455		
21. Health				1.374		5.442		-0.0648
22. Private Non-Profit Institutions				1.0196	0.0008	0		

TABLE 5.21(e)

FINAL MARKETS FOR OTHER FOOD MANUFACTURING, 1972

('000)

	Exports	Re- exports	Tourist Consump- tion Expend- iture	Final Private Consump- tion Expend- iture	Other Final Private Consump- tion Expend- iture	Gov't Consump- tion Expend- iture	Gross Capital Formation	Changes in Stock
1. Sugar Cane	-	-	-	-	-	-	-	-
2. Other Agriculture	32.193		2.4528	339.8442		28.1196		
3. Mining & Quarrying	8.1936			0	0.0768	0.0144	0.312	0.384
4. Sugar Manufacturing	118.6109			5.5167			0.7992	1.2654
5. Other Food Products	5907.8916		101.79	13476.996			7.1253	98.7363
6. Textiles, Wood, Printing, Rubber & Plastic Products	115.4206		8.1549	43.4421	0.1521	2.9835	19.0359	3.7557
7. Cement and Earth- ware Products	0.255						0.2737	0.2601
8. Other Manufacturing	0.6119			0.3538	0.2523		6.1451	2.7173
9. Electricity, Water and Gas	0.0144			2.7	0.0342	0.5166	0.0414	0.6912
10. Building Construction	1.101			2.757	0	2.823	60.567	3.351
11. Other Construction	0.1887			0	0.0255	4.097	16.4764	-1.7527
12. Distribution	4.066	52.421	90.858	384.94		6.327	64.714	131.442
13. Hotels, Restaurants etc	0		241.621	530.74				6.461
14. Transport	15.3216		9.3471	17.6043	0.7812	2.5389	0.3444	-0.147
15. Communications	0.21		0.164	0.826				
16. Banking and Insurance	5.0534		0.0638	1.2518	4.488	1.551		0.0044
17. Ownership of Dwelling	0		0	0				
18. Other Private Services	0.7904		0.6278	4.8581		0.1209		0.0104
19. Government Services				0.648		34.8966		
20. Education				1.5475	0.915	3.5485		
21. Health				36.5255		144.6665		-1.7226
22. Private Non-Profit Institutions				0.5098	0.0004			

TABLE 5.21(f)

FINAL MARKETS FOR BUILDING CONSTRUCTION, 1972

('000)

	Exports	Re- exports	Tourist Consump- tion Expend- iture	Final Private Consump- tion Expend- iture	Gov't Consump- tion Expend- iture	Gross Capital Formation	Other Final Consump- tion Expend- iture	Changes in Stock
1. Sugar Cane	-	-	-	-	-	-	-	-
2. Other Agriculture	0.5145	0.0392	0.0392	5.4313	0.4494			
3. Mining & Quarrying	101.3958				0.1782	3.861	0.9504	4.752
4. Sugar Manufacturing	153.8736			7.1568		1.0368		1.6416
5. Other Food Products	14.51	0.25	0.25	33.1		0.0175		0.2425
6. Textiles, Wood, Printing, Rubber & Plastic Products	0.36	1.6728	1.6728	8.9112	0.612	3.9048	0.0312	0.7704
7. Cement and Earth- ware Products	1.095					1.1753		1.1169
8. Other Manufacturing	0.7174			0.4148		7.2046	0.2958	3.1858
9. Electricity, Water and Gas	0.0792			14.85	2.8413	0.2277	0.1881	3.8016
10. Building Construction	383.9187			961.3659	984.3801	21119.712		1168.494
11. Other Construction	0.2553				5.543	22.2916	0.0345	-2.3713
12. Distribution	0.3852	8	8.6076	36.468	0.5994	6.1308		12.4524
13. Hotels, Restaurants etc			35.5325	18.955				0.2275
14. Transport	38.6688		23.5909	44.4299	6.4077	0.8692	1.9716	-0.371
15. Communications	0.0105		0.0082	0.0413				
16. Banking and Insurance	18.8354		0.2378	4.6658	5.781		16.728	0.0164
17. Ownership of Dwelling	-							
18. Other Private Services	7.6608		6.0858	47.0862	1.1718			0.1008
19. Government Services				9.648	519.5716			
20. Education				53.853	123.4878		31.842	
21. Health				2.061	8.163			-0.0972
22. Private Non-Profit Institutions				6.6274	-		0.0052	

TABLE 5.21(g)

FINAL MARKETS FOR CEMENT AND EARTHWARE PRODUCTS, 1972

('000)

	Exports	Re- exports	Tourist Consump- tion Expend- iture	Final Private Consumer's Consump- tion Expend- iture	Other Final Consump- tion Expend- iture	Gov't Consump- tion Expend- iture	Gross Capital Formation	Changes in Stock
1. Sugar Cane	-	-	-	-	-	-	-	-
2. Other Agriculture	0.2205		0.0168	2.3277		0.1926		
3. Mining & Quarrying	44.0406				0.4128	0.0774	1.677	2.064
4. Sugar Manufacturing	121.8166			5.6658			0.8208	1.2996
5. Other Food Products	6.3844		0.110	14.564			0.0077	0.1077
6. Textiles, Wood, Printing, Rubber & Plastic Products	28.7324		15.1946	80.9434	0.2834	5.559	35.469	6.998
7. Cement and Earth- ware Products	169.86			0			182.3164	173.257
8. Other Manufacturing	0.2532			0.1464	0.1044		2.543	1.1244
9. Electricity, Water and Gas	0.016			3	0.038	0.574	0.046	0.768
10. Building Construction	42.8656			107.3392		109.909	2358.075	130.466
11. Other Construction	12.4875			0	1.6875	271.125	1090.35	-115.99
12. Distribution	0.1498	1.9313	3.3474	14.182	0	0.2331	2.3842	4.8426
13. Hotels, Restaurants etc	0		9.9491	5.3074	0	0	0	0.0637
14. Transport	18.9696		11.5726	21.7958	0.9672	3.1434	0.4264	-0.182
15. Communications	0.0315		0.0246	0.1239	0	0		
16. Banking and Insurance	3.2158		0.0406	0.7966	2.856	0.987		0.0028
17. Ownership of Dwelling	0		0	0		0		
18. Other Private Services	0.9728		0.7728	5.9792		0.149		0.0128
19. Government Services				3.564		191.931		
20. Education				6.809	4.026	15.614		
21. Health				0.3435	0	1.361		-0.0162
22. Private Non-Profit Institutions				1.0196	0.0008	0		

CHAPTER 6

INCOME AND EMPLOYMENT MULTIPLIERS

The input-output model can be used to derive sets of multipliers which are disaggregated, acknowledging that the total impact on income, output or employment will vary according to which sector experiences the initial expenditure change. By manipulating the input-output table, it is possible to calculate income, output and employment multipliers. The output multiplier was dealt with in Chapter 4.

6.1 Income Multipliers

In the foregoing analysis of inter-industry linkages, it was assumed that income is independent of the structure of production and therefore exogenous to the system. This assumption, however, is rather restrictive. Employment is partially determined by the inter-industry structure, therefore wage payments determine endogenously household income. Given the household's marginal propensities to consume different commodities, the structure of final demand is also affected. This induced household demand further stimulates a sector's demand for intermediate products and for labour, with the indirect effects again being reflected on household income. This process describes the income multiplier effect. The conventional manner of accounting for these effects is by 'closing' the input-output model with respect to households. In this way, the table of inter-industry input coefficient is augmented by one row and one column vector.

The closure of the model with respect to households creates some

conceptual problems. For the purpose of this study, output of the Household row is taken to be 'wages and salaries' (i.e. the compensation to employees). However, some proportion of 'Gross Income of Unincorporated Enterprises' and 'Gross Operating Surplus' should also be considered as income accruing to households. These additional primary inputs were not incorporated into the row because of the difficulty of accurate estimation and because not all payments to households will be spent on personal consumption (portions go to taxation and savings).

The column for 'Private Consumers' Consumption Expenditure' was taken as the input column for Households. In moving the Household row and column into the inter-industry transactions matrix, it was first necessary to reconcile the row and column totals by adjusting each of the column entries. Their values were scaled by assuming that the marginal propensity (on the part of households) to consume each industry's output was equal to the average propensity to consume. Thus each entry of the 'Private Consumers' Consumption Expenditure' column was scaled down to the point where the total for all column entries was equated to the total of 'wages and salaries' (compensation of employees). Incorporating the Household column in this manner implies that the consumption function is linear and homogeneous. However, studies have been done by using different types of consumption function (Moore and Petersen 1955).

By 'closing' the matrix with respect to households we have a new matrix, D_{ij} which is an $(n+1) \times (n+1)$ matrix. The inverse of this matrix:

$$Z^* = (I-D)^{-1}$$

shows, (in the non-household columns) direct, indirect and induced output

changes from each sector i per unit of increase in final demand of sector j , while the entries in the Household row provide a measure of direct, indirect and induced income changes in the economy. The direct income change for each sector is given by the Household row of the technical coefficient matrix, A_{ij}^* , of the augmented matrix D_{ij} . The indirect income change is calculated by multiplying the column elements in the Z matrix (i.e. inverse matrix of the original table) by the supplying industry's corresponding Household row coefficient from the A_{ij}^* matrix. Thus, the direct and indirect income change for sector j is given by:

$$\sum_{i=1}^n Z_{ij} a_{Ri}^*$$

where Z_{ij} = the inverse matrix $(I-A)^{-1}$

a_{Ri}^* = the appropriate entry in the household row of the matrix A_{ij}^*

From the direct, indirect and induced effects Type I and Type II multipliers can be calculated (see W.Z. Hirsch 1959). The Type I multiplier (sometimes referred to as a 'simple' income multiplier) takes into account only the direct and indirect changes in income resulting from a unit increase in the output of all the industries in the processing sectors. It is expressed as:

$$\text{Type I multiplier} = \frac{\text{Direct and indirect income change}}{\text{Direct income change}}$$

The Type II multiplier takes into account 'the chain reaction of inter-industry reactions in income, output and once more on consumer

expenditures' (Hirsch op. cit., p.364) i.e. income expansion due to successive 'rounds' of consumer spending. This is expressed as:¹

$$\text{Type II multiplier} = \frac{\text{Direct, indirect and induced income change}}{\text{Direct income change}}$$

The regional income multiplier measures the direct, indirect and induced income changes following an increase in final demand sales of one dollar. The households row of $Z^* = (I-A)^{-1}$ represents the regional income multiplier.

It is worthwhile to bring out the distinction between the types of multipliers discussed above. The 'regional income multiplier' measures direct, indirect and induced effects. That is, the total effects of a unit increase in sales to final demand; the Type I and Type II multipliers measure income generated, following a unit change in household payments, as a result of a change in final demand for the relevant sector. In short, the regional income multiplier measures the impact of a change in sales to final demand, and the Type I and Type II multipliers measure the impact of a change in income.

The value of the direct, indirect and induced effects of a change in sales to final demand from a particular sector are given in Table 6.1. The findings are presented graphically, ranked by total effects, in Figure 6.1. Table 6.1 and Figure 6.1 reveal that considerable differences exist between the regional income multiplier values for each sector, both with regards to the components and the magnitude of their total effect. The direct component (indicating the intensity of local labour use by each sector) gives a measure of a particular sector's

1 Given that the consumption function is linear and homogeneous, the relationship between Type I and Type II multipliers is a constant one (see Hirsch 1959). Therefore Type II multipliers can be calculated by a short cut method once the Type I multiplier is calculated. (For proof see Bradley and Gander 1969.)

FIGURE 6.1

DIRECT, INDIRECT AND INDUCED INCOME PER DOLLAR

OF SALES OF FINAL DEMAND

FIJI 1972

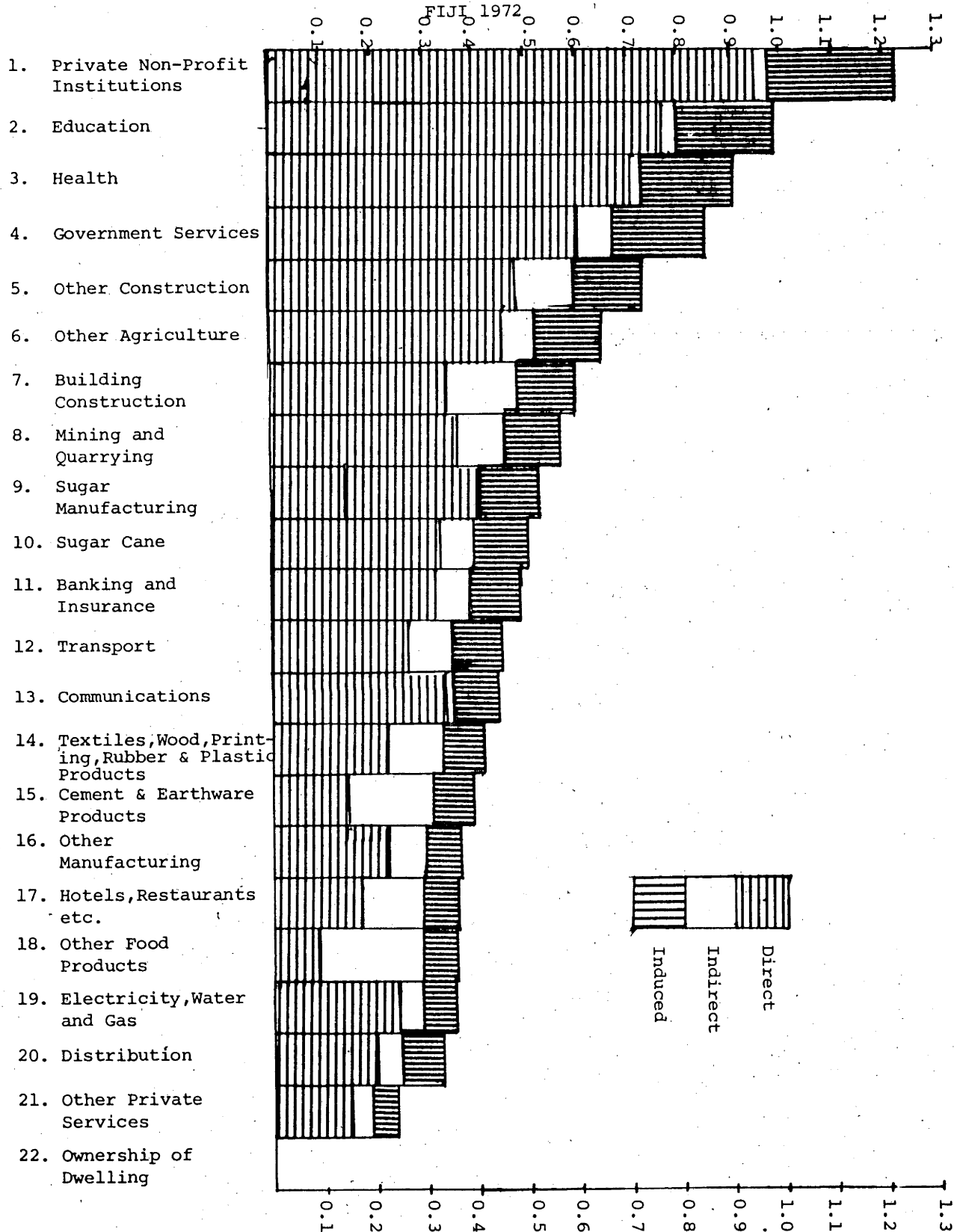


TABLE 6.1

INDUCED CONSUMPTION AND INCOME GENERATION

	Direct Income Change	Direct & Indirect Income Change	Indirect Income Change	Direct, Indirect & Induced Income Change	Induced Income Change
	(1)	(2)	(3)	(4)	(5)
1. Sugar Cane	.3300	.3959	.0659	.5001	.1042
2. Other Agriculture	.4571	.5088	.0517	.6428	.1340
3. Mining & Quarrying	.3640	.4443	.0803	.5619	.1176
4. Sugar Manufacturing	.1446	.4159	.2713	.5247	.1088
5. Other Food Products	.0869	.2877	.2008	.3629	.0752
6. Textiles, Wood, Printing, Rubber & Plastic Products	.2347	.3256	.0909	.4102	.0846
7. Cement & Earthware Products	.1577	.3136	.1559	.3954	.0818
8. Other Manufacturing	.2282	.2952	.0670	.3719	.0767
9. Electricity, Water & Gas	.2455	.2873	.0418	.3622	.0749
10. Building Construction	.3405	.4760	.1355	.5996	.1236
11. Other Construction	.4793	.5801	.1008	.7307	.1506
12. Distribution	.2080	.2600	.0520	.3276	.0676
13. Hotels, Restaurants	.1786	.2934	.1148	.3696	.0762
14. Transport	.2656	.3524	.0868	.4439	.0915
15. Communications	.3420	.3511	.0091	.4423	.0912
16. Banking & Insurance	.3223	.3817	.0594	.4808	.0991
17. Ownership of Dwelling	-	-	-	-	-
18. Other Private Services	.1570	.1993	.0423	.2511	.0518
19. Government Services	.6055	.6777	.0722	.8534	.1757
20. Education	.7663	.7932	.0269	.9989	.2057
21. Health	.7016	.7231	.0215	.9107	.1876
22. Private Non-Profit Institutions	.9667	.9713	.0046	1.2233	.2520

immediate response to a change in final demand. The indirect component reflects income generated by output adjustments by all endogenous sectors necessary directly and indirectly to support the change in final demand. Induced changes in household payments result from changes in household purchases of locally produced goods and services. The direct changes are largest in 19 of the 21 sectors (Ownership of Dwellings is excluded) and the indirect components are highest in the remaining two sectors, namely Sugar Manufacturing and Other Food Products. The latter two sectors have a relatively low direct demand for labour and a relatively high use of local inputs. The induced effects, though small in magnitude, exceed the indirect effects in 15 sectors, most of which are tertiary sectors. These include Government Services, Health, Education, Other Private Services, Private Non-Profit Institutions, Banking and Insurance, Communications, Transport, Distribution and a few manufacturing and primary sectors. The size of the induced effects is related to the size of the original direct effect, i.e. the proportion of sectoral costs devoted to wages. Those sectors with higher induced effects than indirect effects contribute more to their total multiplier effect through direct changes. For Fiji, Community Service and Social Welfare Services rank among the highest and most of the manufacturing sectors on the lower half of the scale, in terms of total effect.

By considering the Type I and Type II multipliers the relationship between direct income changes and indirect and induced changes can be identified more explicitly. Type I and Type II multipliers are shown in Table 6.2 for Fiji. They show, for example, that a dollar change in household payments, as a result of a change in final demand for the output

TABLE 6.2
INCOME MULTIPLIERS FOR FIJI, 1972

	Type I Multiplier	Ranking	Type II Multiplier	Ranking
1. Sugar Cane	1.1997	13	1.5155	13
2. Other Agriculture	1.1131	17	1.4063	17
3. Mining and Quarrying	1.2206	11	1.5437	11
4. Sugar Manufacturing	2.8762	2	3.6286	2
5. Other Food Products	3.3107	1	4.1761	1
6. Textiles, Wood, Printing, Rubber & Plastic Products	1.3873	6	1.7478	6
7. Cement & Earthware Products	1.9886	3	2.5073	3
8. Other Manufacturing	1.2936	8	1.6297	8
9. Electricity, Water & Gas	1.1703	15	1.4754	15
10. Building Construction	1.3979	5	1.7609	5
11. Other Construction	1.2103	12	1.5245	12
12. Distribution	1.2500	10	1.5750	10
13. Hotels, Restaurants	1.6428	4	2.0694	4
14. Transport	1.3268	7	1.6713	7
15. Communications	1.0266	20	1.2932	20
16. Banking and Insurance	1.1843	14	1.4918	14
17. Ownership of Dwelling	-	22	-	22
18. Other Private Services	1.2694	9	1.5994	9
19. Government Services	1.1192	16	1.4094	15
20. Education	1.0351	18	1.3035	18
21. Health	1.0306	19	1.2980	19
22. Private Non-Profit Institutions	1.0048	21	1.2658	21

of Other Food Products sector, would generate directly and indirectly a sum of \$3.3107 in local household payments and when the induced effects are added, the estimate is \$4.1761.

The high values of Type I multipliers were associated with sectors which show high indirect effects relative to direct effects, and high Type II multipliers with sectors with high indirect and induced effects, relative to direct effects. There was a tendency for the magnitude of the regional multiplier to be inversely related to the size of the Type I and Type II multipliers. For instance the regional multiplier indicates that a dollar change in output of the Health sector (sector 21) would generate \$0.9107 additional payments to households; but the Type I and Type II multipliers for Health are relatively low because a large proportion of the total income effect is direct change, with a relatively small indirect and induced effect. On the other hand, a dollar change in the output of 'Other Food Products' would generate only \$0.3629 additional household income, but Type I and Type II multipliers are large indicating large relative impacts associated with the initial direct income change. Community and welfare services type industries (with high direct effects) would be found in lower rankings of Type I and Type II multipliers (Table 6.2) than manufacturing and primary industries.

The foregoing discussion has concentrated on the income effects of a given increase in output delivered to final demand (or of a given increase in direct income as a result of additional sales to final demand). However, multiplier analysis can be extended to an assessment of the increase in output required from any sector to achieve a given level of

change in the various income categories. These estimates (calculated by using columns 1, 2 and 4 of Table 6.1¹) appear in Table 6.3. This table indicates, for example, that \$1.0m in direct income would be generated by an increase in output of the 'Other Agriculture' sector of \$3.03m (i.e. 13.7 per cent of the 1972 level of output). The magnitude of the absolute change in direct output needed to achieve this level of increase in direct income is obviously related to the direct demand of the sector for labour. The percentage increase in sectoral output required to achieve the given level of income is some guide to the feasibility of achieving this increase, and hence the implications of interdependence involving this sector.

The second and third pair of columns in Table 6.3 give measures of the direct change in output required to achieve an increase of \$1.0m in direct and indirect and total income respectively. The relationships between these columns and the first pair of columns can be expressed in terms of Type I and Type II multipliers. For example, the increase in output required in the Cement and Manufacturing sector to achieve an increase of \$1.0m in income declines substantially from \$6.341m to \$2.529m when indirect and induced affects are included.

6.2 Employment Multipliers

The workforce of each input-output industry was estimated from information in:

- 1 The Type I and Type II multipliers can be also used to get the same results, i.e.: the direct change in output required to achieve an increase of \$1.0m in direct and indirect income can be derived as:

$$\frac{\text{direct output change}}{\text{Type I multiplier}}$$

Similarly the increase in total income can be measured as:

$$\frac{\text{direct output change}}{\text{Type II multiplier}}$$

TABLE 6.3
CHANGE IN GROSS OUTPUT REQUIRED TO ACHIEVE
\$1m CHANGE IN INCOME, FIJI 1972.

	Direct Change in Gross Output to Achieve Change of \$1M in Income Type:					
	Direct (a)		Direct & Indirect (b)		Total (c)	
	Output Change (\$'000)	Per Cent	Output Change (\$'000)	Per Cent	Output Change (\$'000)	Per Cent
1. Sugar Cane	3030	13.7	2525	11.4	2000	9.0
2. Other Agriculture	2187	13.0	1965	11.7	1556	9.3
3. Mining and Quarrying	2747	35.4	2251	29.1	1780	23.0
4. Sugar Manufacturing	6915	20.1	2404	7.0	1906	5.5
5. Other Food Products	11507	50.2	3476	15.1	2756	12.0
6. Textiles, Wood, Printing Rubber & Plastic Products	4260	27.5	3071	19.8	2438	15.7
7. Cement & Earthware Products	6341	120.4	3189	60.5	2529	48.0
8. Other Manufacturing	4382	45.9	3388	35.5	2689	28.2
9. Electricity, Water & Gas	4073	71.9	3481	61.5	2761	48.8
10. Building Construction	2936	11.2	2101	8.03	1668	6.4
11. Other Construction	2086	15.7	1724	12.9	1369	10.3
12. Distribution	4807	8.2	3846	6.7	3053	5.2
13. Hotels, Restaurants	5599	25.6	3408	15.6	2706	12.4
14. Transport	3765	13.0	2838	9.8	2253	7.8
15. Communications	2924	83.6	2848	81.4	2261	64.7
16. Banking and Insurance	3103	35.7	2620	30.1	2080	23.9
17. Ownership of Dwelling	-	-	-	-	-	-
18. Other Private Services	6369	37.9	5018	29.8	3982	23.7
19. Government Services	1651	8.3	1476	7.4	1172	5.9
20. Education	1305	10.9	1261	10.5	1001	8.3
21. Health	1425	25.3	1383	24.6	1098	19.5
22. Private Non-Profit Institutions	1034	20.2	1030	20.1	817	16.0

Notes: (a) \$1.0m divided by Column 1 of Table 6.1.

(b) \$1.0m divided by Column 2 of Table 6.1 (or direct output change divided by Type I multiplier).

(c) \$1.0m divided by Column 4 of Table 6.1 (or direct output change divided by Type II multiplier).

The Nation-Wide Employment Survey,

Development Plan Seven, and

Current Economic Statistics.

In cases where labour estimates for 1972 were not available, other years' estimates were scaled by the rate of growth of employment. In some cases, for example, building construction and other construction, information on the labour force was not available separately. The joint labour force estimate for these sectors was apportioned according to the share of total output contributed by each sector.

The direct employment change for each industry was calculated as the number of workers per \$1,000 of output. This method assumes a linear homogeneous employment function. The industries 'Sugar Cane', 'Other Agriculture', 'Education', and 'Government Services' registered high direct employment effects by comparison with 'Manufacturing' industries. (See Table 6.4.) The direct and indirect employment effects have been calculated by multiplying the direct labour change coefficients by the interdependence matrix (Richardson 1972) i.e.:

$$m_j = \sum_{i=1}^n z_{ij} l_i$$

where m_j = direct and indirect employment effect

z_{ij} = interdependence coefficients, $(I-A)^{-1}$

l_i = direct labour change, i.e. number of workers per \$1,000 of output.

The direct, indirect and induced employment effect for sector j is given by:

$$b_j = \sum_{i=1}^n z_{ij}^* l_i$$

TABLE 6.4

DIRECT, INDIRECT AND INDUCED EMPLOYMENT IN FIJI, 1972

Per \$1,000 of Sales to Final Demand

	Workforce Numbers	Employment Change(a)				
		Direct (b)	Direct & Indirect	Direct Indirect and Induced	Indirect	Induced
1. Sugar Cane	24500	1.1055	1.1822	1.2859	0.0767	0.1037
2. Other Agriculture	13700	0.8150	0.8710	1.0018	0.0560	0.1308
3. Mining and Quarrying	1700	0.2194	0.2936	0.4086	0.0742	0.1150
4. Sugar Manufacturing	3480	0.1013	0.8790	0.9836	0.7777	0.1046
5. Other Food Products	1256	0.0548	0.3571	0.4307	0.3023	0.0736
6. Textiles, Wood, Printing, Rubber & Plastic Products	2311	0.1495	0.2508	0.3340	0.1013	0.0832
7. Cement Products	771	0.1465	0.2801	0.3603	0.1336	0.0802
8. Other Manufacturing	1450	0.1520	0.2177	0.2929	0.0657	0.0752
9. Electricity, Water & Gas	1400	0.2474	0.2921	0.3658	0.0447	0.0737
10. Building Construction	5412	0.2070	0.3179	0.4394	0.1109	0.1215
11. Other Construction	2788	0.2100	0.2927	0.4405	0.0827	0.1478
12. Distribution	12246	0.2091	0.2659	0.3323	0.0568	0.0664
13. Hotels, Restaurants	3104	0.1418	0.2737	0.3485	0.1319	0.0748
14. Transport	7882	0.2722	0.3642	0.4540	0.0920	0.0898
15. Communications	974	0.2785	0.2876	0.3771	0.0091	0.0895
16. Banking and Insurance	975	0.1122	0.1719	0.2692	0.0597	0.0973
17. Ownership of Dwelling	-	-	-	-	-	-
18. Other Private Services	5616	0.3341	0.3776	0.4283	0.0435	0.0507
19. Government Services	8411	0.4224	0.4755	0.6480	0.0531	0.1725
20. Education	5776	0.4805	0.5033	0.7052	0.0228	0.2019
21. Health	1941	0.3451	0.3699	0.5541	0.0248	0.1842
22. Private Non-Profit Institutions	1178	0.2301	0.2347	0.4821	0.0046	0.2474

Notes: (a) Per \$1,000 of Sales to final demand.

(b) Workers per \$1,000 of industry output.

where b_j = direct, indirect and induced employment effect
 Z_{ij}^* = the inverse of the augmented matrix D_{ij}

The Type I and Type II multipliers were calculated as:

$$\text{Type I} = \frac{\text{Direct and indirect employment change}}{\text{Direct employment change}}$$

$$\text{Type II} = \frac{\text{Direct, indirect and induced employment change}}{\text{Direct employment change}}$$

The regional employment multiplier measures the direct, indirect and induced employment change. These multipliers are summarized in Tables 6.4 and 6.5. The employment multiplier components are represented graphically, in order of total effect, in Figure 6.2.

Sugar Cane, Other Agriculture and Sugar Manufacturing exhibit relatively high regional employment multipliers. These sectors are followed by Government Services, Education, Health, Transport and Construction sectors.

Figure 6.2 gives the relationship between the components of the total employment effect. In most cases, the direct employment effect is the dominant component with the exception of Sugar Manufacturing and Other Food Products where the indirect effect is dominant, and Private Non-Profit Institutions where the induced effect is the dominant component. In five of the 21 industries (excluding ownership of dwelling) the indirect employment effect is greater than the induced effects.

The relationship between these components is expressed by the Type I and Type II multipliers (see Table 6.5). The Type I multiplier illustrates, for instance, that changes in the sales of Other Agriculture

FIGURE 6.2

DIRECT, INDIRECT AND INDUCED EMPLOYMENT

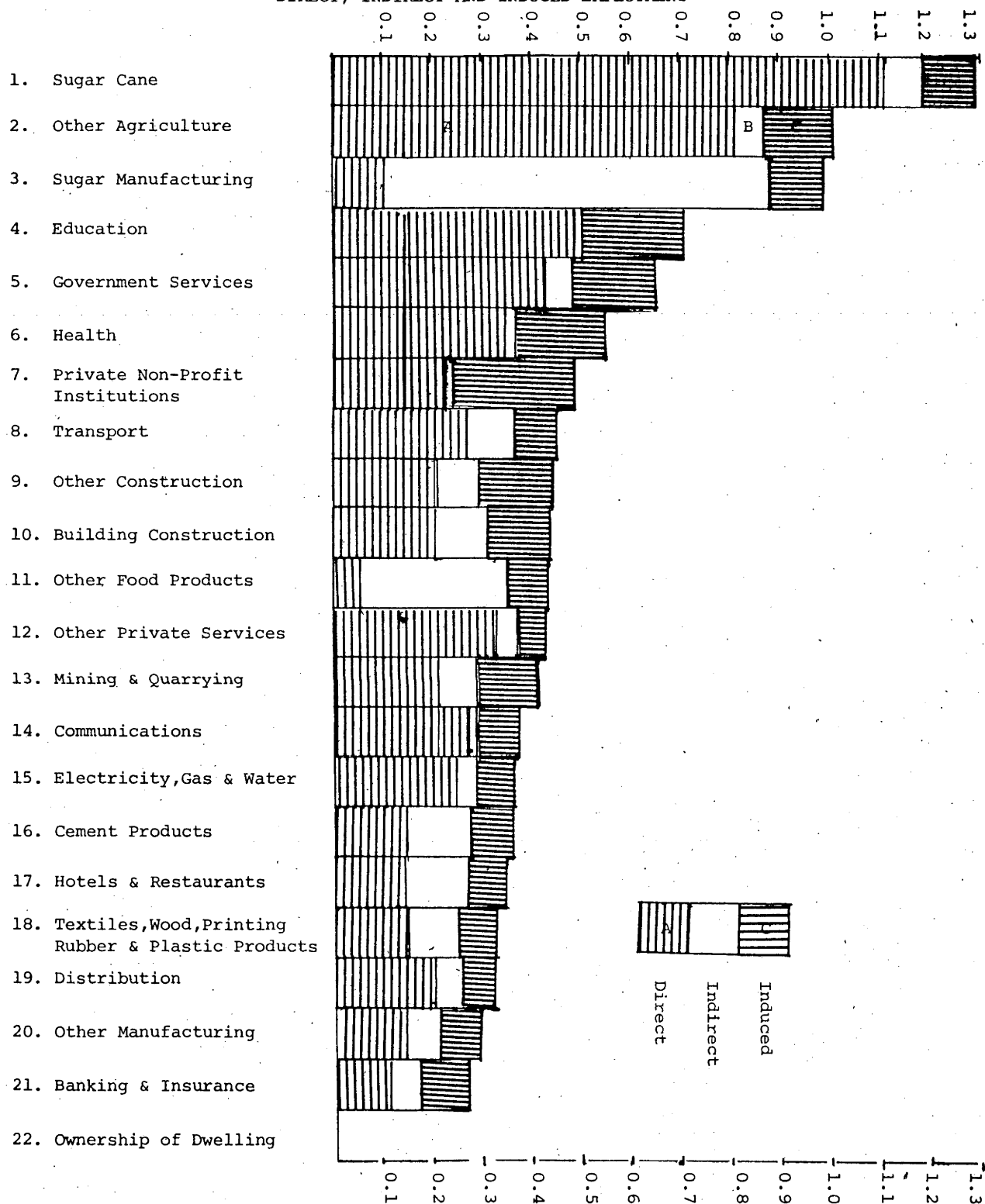


TABLE 6.5

EMPLOYMENT MULTIPLIERS FOR FIJI, 1972

	Type I Multiplier	Ranking	Type II Multiplier	Ranking
1. Sugar Cane	1.0694	17	1.1632	21
2. Other Agriculture	1.0687	18	1.2292	20
3. Mining and Quarrying	1.3382	10	1.8624	11
4. Sugar Manufacturing	8.6772	1	9.7100	1
5. Other Food Products	6.5164	2	7.8595	2
6. Textiles, Wood, Printing, Rubber & Plastic Products	1.6776	5	2.2341	6
7. Cement Products	1.9119	4	2.4594	4
8. Other Manufacturing	1.4322	8	1.9270	10
9. Electricity, Water & Gas	1.1807	13	1.4786	16
10. Building Construction	1.5357	6	2.1227	7
11. Other Construction	1.3938	9	2.0976	8
12. Distribution	1.2716	12	1.5892	14
13. Hotels, Restaurants	1.9302	3	2.4577	3
14. Transport	1.3380	11	1.6679	12
15. Communications	1.0327	20	1.3540	18
16. Banking and Insurance	1.5321	7	2.3993	5
17. Ownership of Dwelling	-	22	-	22
18. Other Private Services	1.1302	14	1.2820	19
19. Government Services	1.1257	15	1.5341	15
20. Education	1.0475	19	1.4676	17
21. Health	1.0719	16	1.6056	13
22. Private Non-Profit Institutions	1.020	21	2.0952	9

which result in a change of one unit of direct employment, create directly and indirectly approximately 1.07 units of employment. When the induced component is added the multiplier increases to 1.23 units. Sugar Manufacturing and Other Food Products have very high employment multipliers. This is because these sectors have a small direct employment effect but a large inter-industry effect. That is, they rely heavily on other sectors for their intermediate inputs. Industries that process primary products ('Sugar Manufacturing', 'Other Food Products', 'Hotels and Restaurants', 'Textiles, Wood, Printing, Rubber and Plastic Products', 'Building Construction', etc.) tend to have relatively higher employment multipliers. The ranking of Type I multipliers approximates that of the Type II multiplier.

Table 6.6 provides an indication of the change in output required of an industry to bring about a change in employment of 1,000 employees. The output change has been tabulated both in absolute and percentage terms and for direct, direct and indirect, and total (direct, indirect and induced) employment effects. When direct employment effects alone are considered, an increase of 1,000 employees would result, for instance, from a direct increase in 'Other Agriculture' of \$1.227m (or 7.3 per cent). When the direct and indirect employment effects are considered, the required increase from this sector is reduced to \$1.148m (or 6.8 per cent). When the total employment effects are considered, the required increase is further reduced to \$0.998m (or 5.9 per cent).

Table 6.6 illustrates the significant difference between absolute and relative changes in output required to achieve the given change in the employment. Hence it provides an indication of the

TABLE 6.6

CHANGE IN GROSS OUTPUT REQUIRED TO ACHIEVE CHANGE
OF 1,000 IN THE NUMBER OF EMPLOYEES: FIJI 1972

	Direct Change in Gross Output to Achieve Change of 1,000 in Employment Type:					
	Direct (a)		Direct & Indirect (b)		Total (c)	
	Output Change (\$'000)	Per Cent	Output Change (\$'000)	Per Cent	Output Change (\$'000)	Per Cent
1. Sugar Cane	905	4.1	846	3.8	778	3.5
2. Other Agriculture	1227	7.3	1148	6.8	998	5.9
3. Mining and Quarrying	4558	58.8	3406	44.0	2447	31.6
4. Sugar Manufacturing	9872	28.7	1138	3.3	1017	3.0
5. Other Food Products	18248	79.7	2800	12.2	2322	10.1
6. Textiles, Wood, Printing, Rubber & Plastic Products	6689	4.3	3987	25.8	2994	19.4
7. Cement Products	6826	127.0	3570	67.8	2775	52.7
8. Other Manufacturing	6579	69.0	4593	48.1	3414	35.8
9. Electricity, Water & Gas	4042	71.4	3423	60.5	2734	48.3
10. Building Construction	4831	18.5	3146	12.0	2276	8.7
11. Other Construction	4762	35.9	3416	25.7	2270	17.1
12. Distribution	4782	8.2	3761	6.4	3009	5.1
13. Hotels, Restaurants	7052	32.2	3654	16.7	2869	13.1
14. Transport	3674	12.7	2746	9.5	2203	7.6
15. Communications	3591	103.0	3477	99.4	2652	75.8
16. Banking and Insurance	8913	103.0	5817	66.9	3715	42.7
17. Ownership of Dwelling	-	-	-	-	-	-
18. Other Private Services	2993	17.8	2648	15.8	2335	13.9
19. Government Services	2367	11.9	2103	10.7	1543	7.7
20. Education	2081	17.3	1987	16.5	1418	11.8
21. Health	2878	51.2	2703	48.1	1805	32.1
22. Private Non-Profit Institutions	4346	85.2	4261	83.5	2074	40.7

Notes: (a) 1,000 employees divided by direct employment change.

(b) 1,000 employees divided by direct and indirect employment change.

(c) That is, direct, indirect and induced effects. 1,000 employees divided by total employment change.

feasibility of creating employment by the expansion of any sector. For example, the feasibility of generating employment by an increase in the output of 'Textiles, Wood, Printing, Rubber and Plastic Products' of 19.4 per cent may be considered to be higher than the 40.7 per cent increase required in the output of 'Private Non-Profit Institutions', although the absolute increases required are similar in magnitude. The very high dependence of 'Private Non-Profit Institutions' on final private consumers' consumption expenditure suggests that such an increase could be achieved only if there were a substantial increase in consumption, the chances of which may be remote. On the other hand, an increase in output of 'Government Services' of \$1.543m (or 7.7 per cent) might be achieved as a result of adjustments in the public sector.

The linking of consumption changes and employment changes was discussed in the beginning of this chapter. The limitations of 'closing' the matrix with respect to households, discussed in the previous section, also apply to the employment multipliers. The values attached to the income and employment multipliers are not uniquely determined but are governed by the degree of model closure. The input-output multipliers will also differ widely according to the economy's industrial structure, the extent of interdependence among its sectors, its size and the like. Consequently, it is difficult to offer firm generalisations about the size of input-output multipliers and their components. Nevertheless, from the above analysis of income and employment multipliers, some very general comments can be made with regard to Fiji. The direct income change is higher in labour-intensive sectors. The indirect income change is relatively greater in sectors which are relatively capital-

intensive (Sugar Manufacturing) and have strong links with other sectors. The service sectors have high direct income effects because a substantial proportion of their costs consists of direct payments to factors of production, rather than the purchase of materials. Similarly, the direct employment effects are relatively higher in industries which are labour intensive and the indirect effects are dominant where industries have high inter-industry effects but low direct employment effects. Both in income and employment multipliers, the Type II multipliers are considerably higher than Type I multipliers.

CHAPTER 7

SUMMARY AND CONCLUDING REMARKS

7.1 Summary

The foregoing analysis is an attempt to identify sectoral linkages in the Fijian economy which could provide guidance in economic planning and assist in the determination of priorities for sectoral allocation of resources.

The analysis is conducted within the general equilibrium framework of the Input-Output system. On the basis of the input-output table for Fiji (1972) the sectors of the economy were distinguished according to the degree of their interdependence. The intensity of inter-industry linkages was taken as an indication of a sector's basic ability to spread growth impulses to its economic environment. For this purpose, backward and forward linkages were calculated and spread effects were computed using the inverse matrix.

The results indicate no strong interdependence in the economy. This is further illustrated by the fact that more than 75 per cent of domestic production went to final consumption in 1972. In general, sectoral interdependence is uneven and tends to be concentrated on a few sectors. The linkage inducements and linkage receipts were poorly correlated. The correlation between the direct backward and forward linkages were low indicating that sectors that have relatively large input dependence are not large input suppliers to other input using industries. The sectors that have relatively large total linkages have

the inducements spread over the different sectors that receive these inducements and sectors with small total linkages have their inducements relatively more concentrated on a few sectors, or unevenly spread over the different sectors.

The concept of linkages concentrates on intersectoral flows and fails to incorporate the effects of separate responses which might arise from final demands and trade flows. The realisation of linkages involving domestic production depends heavily on the level and the structure of final demand. Hence, the total dependence of a sector on final demand, and each sector's primary input requirements per unit of final demand were also analysed. With few exceptions sectors were found to be most dependent upon 'exports' and 'final private consumers consumption expenditure'. This was also confirmed by the analysis of the final markets for the output of all sectors in the economy. The analysis of the primary input content of final demand indicates that the manufacturing, construction and 'other food products' sectors have a relatively high import content per unit of final demand. The direct import content per unit of final demand was found to be higher than the indirect import content for most sectors. However, any analysis based only on direct import content could be rather misleading. The total (direct and indirect) import content requirement of about 20 per cent for each of the major final demand categories indicates the importance of imports to the Fijian economy.

Overall, the value added content per unit of final demand of each sector was found to be over 65 per cent. The wages and salaries component of value added predominated. This was also reflected in the

total primary input content of the final demand categories. The analysis found that primary inputs were relatively more dependent on 'final private consumers consumption expenditure' and 'exports'. Any changes in these two final demand categories would be expected to have greater impact on the use of primary inputs than would changes in other final demand categories.

The effect on sectoral prices of a uniform 10 per cent increase in wages and salaries was found to be higher than that of a similar increase in import prices. Again, the assessed effect of this increase in wages and salaries on the cost of living illustrated the high wage and salary content of private consumption expenditure.

The sectoral rankings of income and employment multipliers were found to differ. In both cases, direct effects were dominant. The high values of Type I multipliers were associated with sectors which show high indirect effects, relative to direct effects. High Type II multipliers were associated with sectors exhibiting high indirect and induced effects, relative to direct effects. In both cases, the direct change in output required to achieve a specified change in income or employment decreased markedly as the indirect and induced effects were taken into account.

7.2 Implications

This paper has not examined the implications of any alternative development strategy for Fiji. However, it identified the inter-industry linkages and sectoral flows which could be of value to planners in pursuing policies which take into consideration the effect upon all sectors of the economy (rather than policies which ignore the interdependence between sectors, i.e. the shoplist approach to planning).

The sectoral rankings are not consistent for the alternative linkage indices. The rankings based on employment and income multipliers are significantly different from rankings based on inter-industry linkages. Thus the identification of 'key' sectors would vary according to the index chosen. In other words, the appropriate linkage to be utilised as a guide for development policy must be chosen with reference to a range of considerations.

The correlation between backward and forward linkages was found to be low suggesting that the two indices cannot be used in conjunction since they are largely competitive. The choice should favour the backward linkage, with indirect effects included, since development strategies can more effectively rely on the stimulus that an industry provides by utilising as intermediate products the output of other industries, than on the stimulus of the mere availability of output that might be used as the input into other sectors.

The analysis suggests that the sectors with larger total linkages should be chosen for an expansion in output. By this means, many other sectors are likely to get more uniform inducements (or receipts) than if the sectors with smaller linkages were chosen.

A further implication of the study is that any analysis based on inter-industry linkages must take into consideration not only direct but also indirect and induced effects. Any analysis based only on direct effects will certainly underestimate the linkages.

The analysis indicates that exports and private consumption expenditure are very important to the economy of Fiji. Any change, deliberate or otherwise, in these two final demand categories will not

only affect the realisation of inter-industry linkages, but also affect the use of primary inputs (especially labour and imports) and ultimately affect domestic production. Although there can be no easy reconciliation of the intersector conflicts inherent in any development strategy, planners should be aware of the policy implications of alternative linkage strategies.

7.3 Limitations and Further Development

In interpreting the results of input-output analysis for a developing country like Fiji, it must be borne in mind that the growth process involves some specific characteristics that are not satisfactorily treated by using conventional input-output procedures.

First, there are changes in the technical coefficients over time, part of which may be stochastic while another part may be induced by planned investment. In the latter case, a change in final demand can induce two different responses from the supply side: one, a change in the gross output with a constant structure of technical coefficients and the other a change in the coefficient structure itself with a constant vector of output. Conventional input-output techniques neglect the second aspect.

Second, the use of fixed input coefficients implies constant returns to scale in transforming basic inputs into final output, whereas linkages may lead to economies of scale through vertical or horizontal integration of production activities.

Third, the simple input-output model is limited by weaknesses on the supply side. It fails to account for the possibility that sectors are constrained on the supply side via their competing demands for scarce

factors of production. In a developing economy like Fiji, the conversion of demand and supply pressures into domestic growth impulses depends on various strategic factors. These include the existence of skilful entrepreneurs with the vision and foresight to respond to these pressures at the right time; availability of appropriately skilled manpower; the appropriate institutional arrangements; credit facilities and government policies that are conducive to growth. Furthermore, demand and supply pressures induced by linkages should be large enough to correspond to the minimum economic size, so that a new firm or an expanded firm will become viable.

Apart from these general limitations, the input-output table of Fiji warrants further improvement if it is to be a tool for development planning. Linkages are sensitive to the degree of aggregation, hence a more disaggregated table is to be desired.

The treatment of imports (the current table incorporates all imports as an addition to domestic production) could be improved. It would be desirable for imports to be identified as competitive and non-competitive with domestic output. The non-competitive imports could then be charged directly as inputs into domestic production or as sales to final demand, leaving competitive imports to be allocated along with locally produced supplies.

In this study, it was necessary to derive estimates of household income and expenditure, and the number of employees per sector in a rather simplistic fashion. In the absence of more reliable statistics, the findings involving these variables must be treated as purely indicative. However, the subsistence sector was excluded from the

analysis. A complete picture of the economy can only be depicted if the subsistence sector is taken into account, since a substantial portion of the economy is still subsistence.

Development planning, based on linkages, must also take into account criteria such as the availability and allocation of the limited investment funds and other resources. For this purpose, a linear programming technique could be adopted to derive an optimal strategy for resource allocation, given the objective function of maximising alternative linkage effects. The constraints would comprise the inter-industry technology, the availability of primary factors of production such as capital and labour, and the availability of foreign exchange (Lin and Yotopoulos 1975).¹

This study could be extended to study the balance - growth version of the linkage hypothesis (Yotopoulos and Nugent 1973). The balanced growth theory modified to take account of the linkage hypothesis propounds that the expected growth of a sector should be the total growth rate of the economy weighted by the appropriate linkage factor. Using the method of Yotopoulos and Nugent, the balanced growth version of the linkage hypothesis could be tested. This could well give insights into how industrialisation in Fiji and the choice of growth sectors conform to the linkage hypothesis and balanced/unbalanced growth strategies.

It may be desirable to study whether the linkage aspect alone could be the criterion for the choice of key sectors and how far the linkage criterion may conflict with the other criteria of choosing priority sectors for resource allocation.

1 Similar types of models are presented by Adelman and Sparrow (1966); Van Eijk and Sandee (1959).

Given the small size of the domestic market, the growth of the Fijian economy inevitably depends on overseas trade (including tourism). Fiji is essentially an outward looking export-oriented country.

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