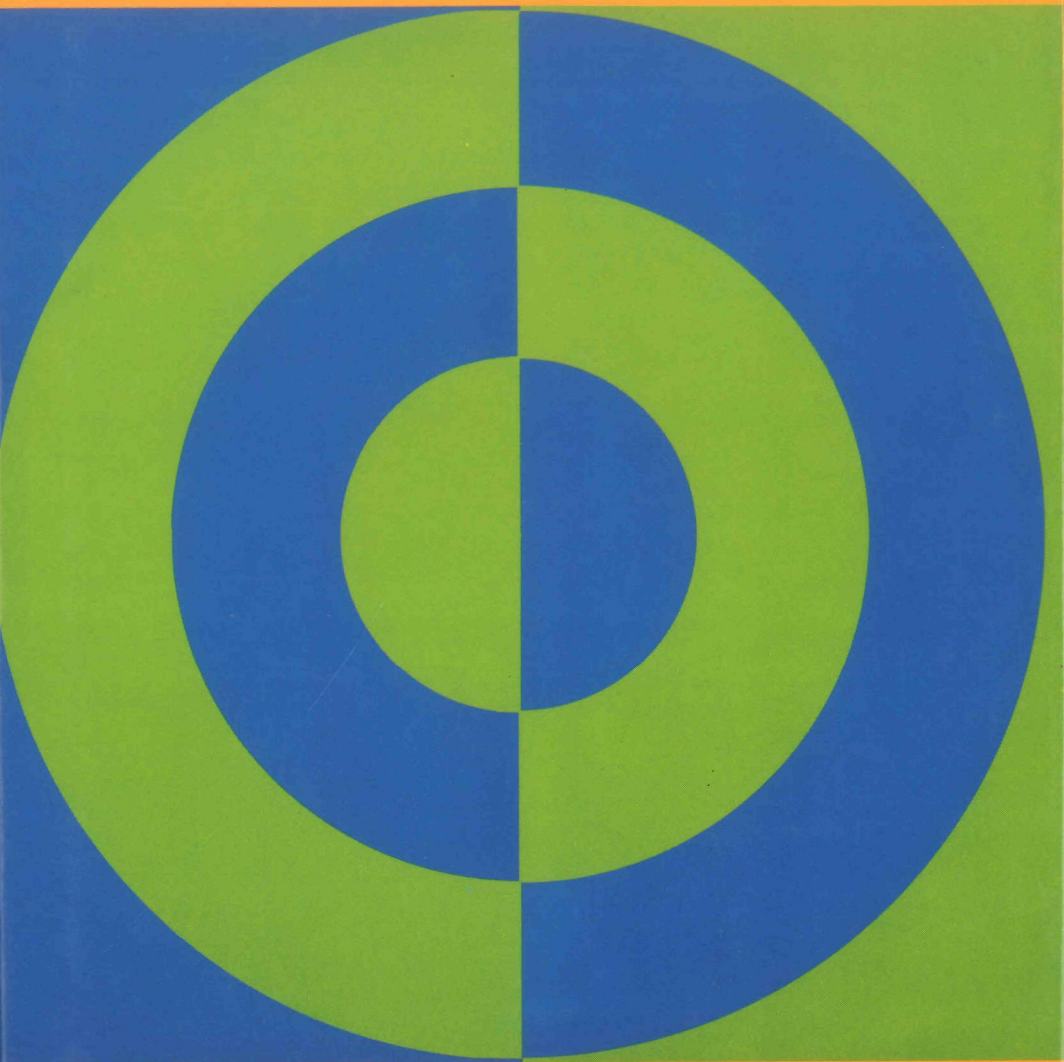
Regional Economics

An Australian Introduction



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Contents

Figures

Tables

Preface

During the past decade there has been a considerable growth of interest in regional issues in Australia. Policy-makers, especially, are looking for information on the regional implications of new industrial and mining developments, of changes in agricultural and industry assistance policies, and of changing demographic patterns. Ideas of overseas origin such as Leontief's input-output analysis have recently found fertile soil in the Australian regional context, as has the work of organizations such as the Regional Science Association in the United States and Europe.

There are many excellent books about regional economics —notably those by Harry Richardson—but as yet no one has given us a comprehensive account of the subject that is understandable to those without years of training in economics, and that relates to the Australian setting. This book attempts to fill that vacuum.

In writing this book we had two objectives in mind. First, we wished to offer a basic presentation of regional economic concepts in the light of the Australian regional and urban context. Second, in the process of outlining the various regional economic models, theories and techniques, we wished to keep the presentation as simple and jargon-free as the subject-matter would permit. Consequently, this book presupposes very little economic knowledge on the part of the reader and is suitable as a basic reference for students and practitioners not only in regional economics, but also in geography, town planning and agricultural economics. Readers interested in pursuing a particular point in greater detail are directed to certain basic references; for those desir-

ing more advanced knowledge, each chapter contains a list of further reading.

To Dr Rod Jensen of the University of Queensland we express our thanks for introducing us to the field of regional economic analysis and policy. Thanks are also due to Mr Allan Brown of the University of Queensland and to the publisher's reader for their helpful comments on an earlier draft of this book, and to Ms Margaret Cowan for her competent typing of the manuscript. A special debt is acknowledged to Dr Stuart Macdonald of the University of Queensland for his invaluable comments on several earlier drafts of this book. In connection with Chapter 8, we acknowledge an intellectual debt to the writings and teachings of Professor J. Anderson and Dr R.A. Powell of the University of New England, and to Professor A.G. Wilson of the University of Leeds.

G.J. Butler

T.D. Mandeville

Introduction

The nature of regional economics

A definition of regional economics is, not surprisingly, dependent upon what is meant by a region and what is meant by economics. A good working definition of a region is a geographic area larger than a city and smaller than a nation[1]. Economics is the study of the production, distribution and consumption of goods and services. It encompasses the social relationships or social organizations involved in allocating finite, scarce resources among all the possible human wants, which generally are regarded as infinite.

The justification for the study of regional economics derives from three fundamental aspects of human existence (Dubey 1964). First, human activity and its accompanying activities occupy space. Resources, markets and products are not located at mythical points with no length or breadth, rather they occupy identifiable spaces. It follows, then, that there is separation between the occupied spaces. Second, resources and their production and consumption are unevenly distributed over space. Third, there exists the economic problem of the allocation and augmentation of scarce resources. All of these fundamental conditions must exist together for regional economics to develop.

Dubey defined regional economics as "the study from the *viewpoint of economics* of the differentiation and interrelationship of areas in a universe of unevenly distributed and imperfectly mobile resources [our italics]" (1964, p.7). This definition is the focal point for our discussion. The essence of regional economics is the incorporation of the spatial element into economics.

It is important that "from the viewpoint of economics" is stressed, because regional economics is also part of the broader inter-

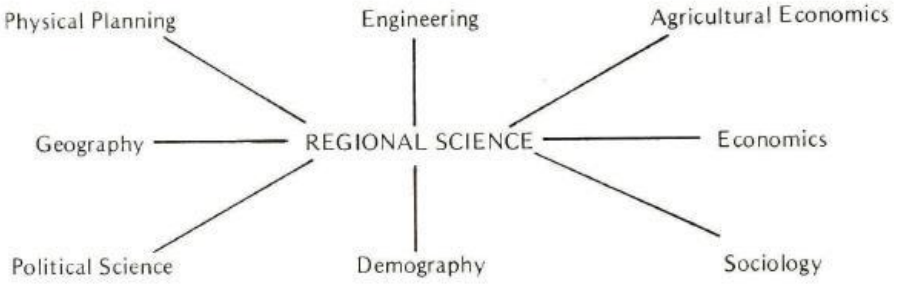

Fig. 1. Disciplines of regional science

disciplinary framework of regional science. Regional science, as figure 1 illustrates, is a problem-oriented, interdisciplinary field of study. It has come to the fore in recent years, and its success is attributable to its development and use of tools applicable to regional analysis and planning.

Economic topography

Using diagrams similar in some ways to those used by geographers to represent physical topography, it is possible to represent an economic surface—the economic topography—of a particular region, as in figure 2[2].

The vertical axis measures the level of economic activity at a particular point in space, and therefore the three-dimensional cone-shaped figures shown in figure 2 represent the total volume of economic activity for the various regions indicated.

Economic activity in a region can be indicated by a number of measures such as employment, or household income per capita, or gross regional product (GRP), which is the total value of goods and services produced in a region for a given year.

Figure 2 represents the economic topography of the State of Queensland. Cone *A* represents Brisbane, cone *B*, the Gold Coast, and cone *C*, Townsville. *D*, *E* and *F*, and other smaller cones which for the sake of simplicity are not drawn on the diagram, represent towns, ports, mines and farming areas. The volume of the three-dimensional cones taken together can be interpreted as an approximation of the state's gross regional product. Even the quickest glance at figure 2 reveals the substantial differences in economic activity at different points in the state. It is obvious also that each

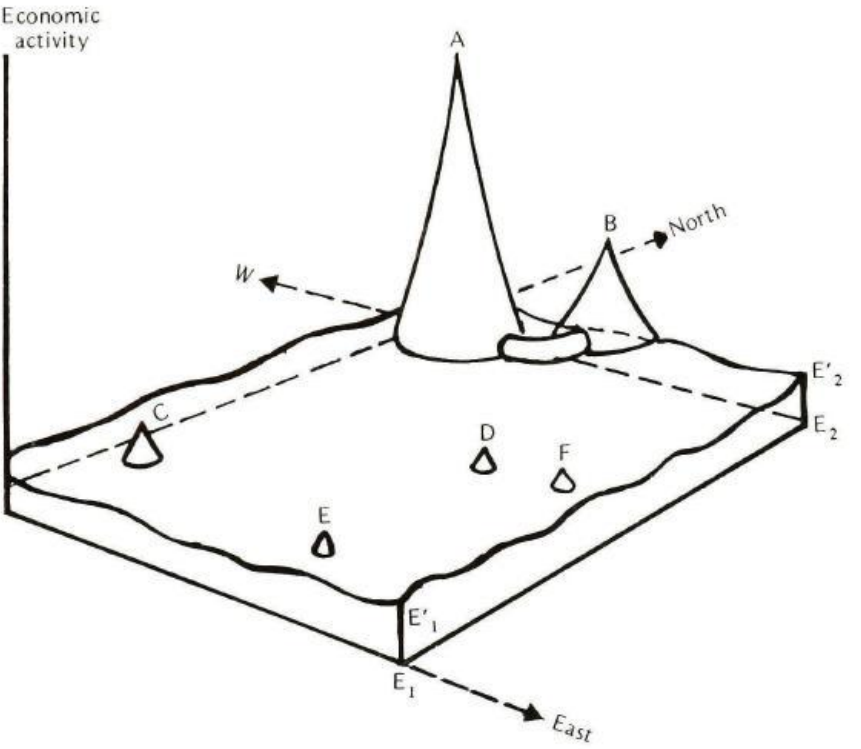

Fig. 2. Economic topography (*Source:* adapted from Jensen 1973)

point on the surface does not exist in isolation, but within an environment determined by the remainder of the surface. At each point the economic environment is constrained by the physical environment, by the strength of linkages with other points, by the height of these points, and by distances between them. The economic surface, then, exhibits definable patterns, and from this we could perhaps deduce that it would not develop (and has not developed) in a random manner.

The question of linkages and interdependencies within and between regions is considered in detail in later chapters. For our purposes here, however, figure 3 illustrates how the effects of linkages can be demonstrated in economic topography diagrams. Consider an increase in the level of economic activity at point *C* as the result of a new industry's being established there. The dotted lines indicate this increase. Not only is economic activity increased at *C*, but also it is increased at other places, *E* and *D*. If the level of

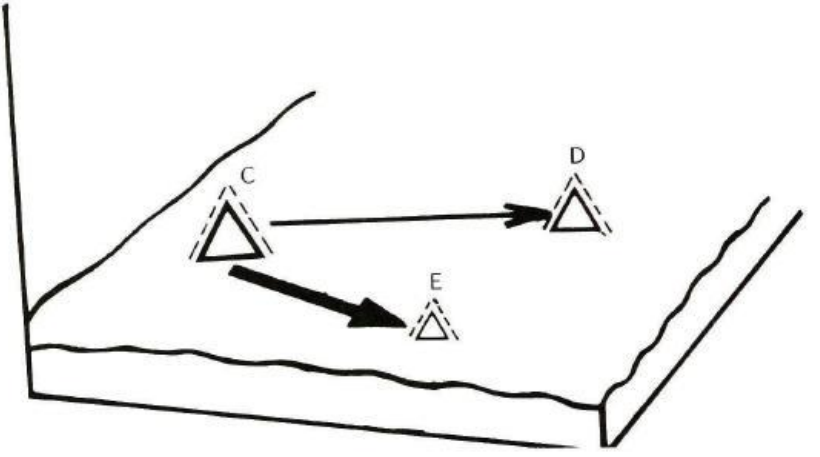

Fig. 3. Linkage effects (*Source:* adapted from Jensen 1973)

economic interaction between *C* and *E* is greater than that between *C* and *D*, then the effects (indicated by thickness of arrow) are greater at *E* than at *D*.

Economic topography, then, is important in three ways. First, it indicates the uneven distribution of economic activity over space. Second, it stresses the interdependence of economic activities over space. Third, it shows that any change in economic activity is felt to differing extents at various points.

Spatially-differentiated aggregates

Aggregates commonly used in a macro-economic context can be disaggregated spatially, as illustrated in figure 2. These economic aggregates, all of which have differential regional effects, include gross regional product, consumption, investment, savings, employment, imports and exports, and government expenditure.

Consider, for example, consumption, both individual and commercial, which can be expected to vary spatially in both a quantitative and a qualitative sense. In the case of personal consumption, the existence of regional income disparities suggests that there will be quantitative spatial disparities in levels of consumption. In the case of commercial consumption, regional business cycles will mean differing levels of employment and also of investment and savings at different stages in the cycle, with consequent effects

upon both individual and commercial consumption. The effect of business cycles on rural regions is considered in Chapter 5.

Policy measures, too, have spatial implications. For example, fiscal policies, such as those that control current and capital expenditure by governments, will vary at differing points in space. The spatial repercussions of monetary policy may be brought about in one of two ways. First, regions whose industry-mix contains higher proportions of industries which traditionally rely heavily on borrowed funds are more affected by a tightening in monetary policy than those regions where there is a lower proportion of such industries. Second, some industries may receive preferential monetary treatment and so may partly avoid the impact of a credit squeeze.

We could take further examples, but these should suffice to illustrate the importance of the spatial dimension in economics, and the regional nature of some economic aggregates.

Characteristics of a regional economy

A working definition of the regional economy is the set of individuals and organizations in the region which produce, distribute and consume goods and services.

There are many features which distinguish the regional economy from the national economy. Perhaps the most striking is that regions exhibit a greater degree of specialization and openness than do nations. Goods, labour and innovations flow freely over regional boundaries since there are no exchange rates, quotas, tariffs or immigration controls to inhibit the flow. As a result, regions specialize and trade to a much greater extent than do nations.

In general, too, distances between sub-national regions are less than the distances between nations; thus economic activities are in closer proximity in regions. Moreover, fewer planning and policy variables exist at the regional level. For example, in Australia local and state governments cannot implement monetary policies.

A region is part of a national system of regions. This, together with the increased importance of trade at the regional level, implies that regional income is determined to a large extent by external factors, such as national and overseas markets, and national government policy.

Defining and classifying regions

Three categories of regions are usually referred to in the literature: homogeneous regions, nodal regions and planning regions[3].

A homogeneous region is one whose distinguishing characteristics spread (though with some variation) throughout the entire region. Many different criteria can be used to define homogeneous regions, and there are as many potential homogeneous regions as there are criteria to define them. Such regions can be defined according to topography, or patterns of climate or vegetation, or other physical criteria. Or they can be defined by economic criteria such as similar industrial structure, or per capita incomes, or unemployment levels. Political criteria would include characteristics such as voting patterns. And homogeneous regions can be identified on social/psychological grounds, too, like a strong sense of community, or some common interest among the inhabitants (as in Tasmania or North Queensland).

In contrast to the homogeneous region, which has often been termed the static region, the nodal or functional region is often termed a dynamic region since it is defined in terms of interactions or functional linkages. This interdependence is measured in terms of flow phenomena, with the heaviest flows being to and from the dominant nodes (i.e. cities). Logan et al. (1975) do not consider nodal regions to be superior to homogeneous regions as modes of analysis, but nodal regions do allow a more direct study of the forces which seem to be most important in shaping the modern spatial economy.

Planning regions are designed for the purposes of a particular authority. Examples include Australian states, Australian Bureau of Statistics (ABS) statistical divisions, and local government areas.

Before we outline methods available for delineating regions, we need to take account of some general issues. First, there is no unambiguous method of defining an ideal region. Second, it is easier to define the central core of a region than its boundaries. Third, the boundaries of a region depend upon the purpose of the person or organization that is defining the region. And fourth, there are both quantitative and qualitative methods available for regional identification, with the trend being to the quantitative approach.

In defining homogeneous regions, the analyst groups units which have similar characteristics according to chosen criteria, but which

differ significantly from units outside the region on the basis of those same criteria. If the criteria for grouping these characteristics are physical or topographical, the problem is relatively straightforward. However, if the criteria are economic, social or demographic, such as unemployment rates, economic activity rates, migration trends or industrial change, the delineation problem becomes more complicated.

The most commonly-used method of identifying nodal regions is by flow analysis. Flow analysis tries to identify actual (in the real world) flows of activity, and progressively delineates a region on the basis of the direction and intensity of these flows between the main centre(s) and the surrounding hinterland. The nodal region is defined on the basis of the strongest flows emanating from, or moving to, each of the unit areas in the vicinity of the main centre.

There are many types of flows that can be used to delineate a nodal region. Movements of energy, commuting patterns, shopping patterns and suchlike are examples of economic criteria. Social criteria would include patterns of movement between people's homes and amenities they use, such as centrally-placed cultural activities. Informational flows would identify telegram, telex, data and telephone traffic, newspaper circulation, and television and radio reception.

Flows may be identified empirically or by the use of gravity models, which measure the potential force of attraction between centres rather than actual flows. These are concerned with expected interaction, and have an obvious link with probability theory. The basic concept of the gravity model is that flows are assumed to be directly proportional to the attraction at each destination and inversely proportional to the travel impedence (transportation cost or time) between the origin and the destination. Gravity models are discussed further in Chapter 7.

Notes

1. In the global context a region could be defined as a group of nations, for example, South-East Asia is a region.
2. This section draws on the discussion of economic topography in Jensen (1973).
3. For a useful discussion on the theory and methodology of regionalization see Logan et al. (1975, pp.23-33).

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Further Reading

The nature of regional economics

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Needleman, L., ed. 1972. *Regional Analysis*. Harmondsworth: Penguin, pp.1-60 (general introduction to regional economics).

Defining and Classifying Regions

Richardson, H.W. 1972. *Regional Economics*. London: Weidenfeld and Nicolson, Chapters 1 and 9 (theoretical treatment of defining and classifying regions).

Department of Urban and Regional Development. 1973. *Suggested Delimitation of Regions for the Purposes of Section 17, Grants Commission Act, 1973*, Canberra: Australian Government Publishing Service, pp.32, 51 (suggests criteria for defining regions in the Australian context).

Question for Discussion

In the pursuit of overall national economic efficiency, is concern for the spatial aspect of economics relevant?

PART 1

Australian Regional Problems

1

Demographic and Economic Patterns

Australia is one of the most urbanized countries in the world (Burnley 1974). This high degree of urbanization, together with the resultant decline and instability in rural areas, is seen by regional economists as "the Australian regional problem". Such a rural and urban disparity presents a problem of great economic, social and political significance for Australia. In later chapters we shall see how the tools of regional economics can be used in regional planning and analysis in attempts to deal with the Australian regional problem. But first, let us look at the main characteristics of urbanization and rural decline up to about 1976.

Population distribution

The history of Australia's population growth has been coastal settlement and concentration of the population of each state in the capital city. Australia has no single primate city as occurs in some other countries, such as France or England.

The population distribution on a state-by-state basis is shown in table 1. There is a geographical focus of population in New South Wales and Victoria: in 1971, 63 per cent of the population (62 per cent in 1976) lived in these two states, which account for only 13.4 per cent of total land space in Australia. In addition, 40 per cent of the Australian population in 1971 was concentrated in the two cities of Melbourne and Sydney.

Table 2 and figure 4 show the distribution of population between rural and urban areas in Australia for selected years between 1947 and 1971. They show clearly the continuing urbanization through-

Table 1. Population of States and Territories, 1971 and 1976

State or Territory	Population ('000 persons)		% of total population		% of total area
	1971 (*a*)	1976 (*b*)	1971	1976	
New South Wales	4679	4955	36	35	10.4
Victoria	3520	3781	27	27	3.0
Queensland	1883	2139	15	15	22.5
South Australia	1185	1277	9	9	12.8
Western Australia	1043	1197	8	9	32.9
Tasmania	390	411	3	3	0.9
Australian Capital Territory	146	209	1.2	1.3	0.03
Northern Territory	92	106	.8	.7	17.5
Australia	12938	14075			100

Source: (*a*) Commonwealth Bureau of Census and Statistics, *Census of the Commonwealth of Australia*, 1971. (*b*) Australian Bureau of Statistics, *Population and Vital Statistics*, 1976.

Table 2. Percentage Distribution of Population in Urban and Rural Areas of Australia, 1947-71

Classification	1947	1954	1961	1966	1971
	%	%	%	%	%
Metropolitan	50	54	56	58	60
Other urban	18	24	26	25	25
Rural	32	22	18	17	15
	100	100	100	100	100

Source: Calculated from Australian Bureau of Statistics census data.

out this period. Row 3 (rural) of table 2 quite clearly indicates the large percentage decline in the rural population that occurred between 1947 and 1971. Figure 4 gives a disaggregation of the distribution of population in each state and in Australia by urban and rural areas. The proportion of population in each state's capital city (i.e. the metropolitan population) increased with each census, except for a minor shift in the opposite direction in Tasmania between 1961 and 1966.

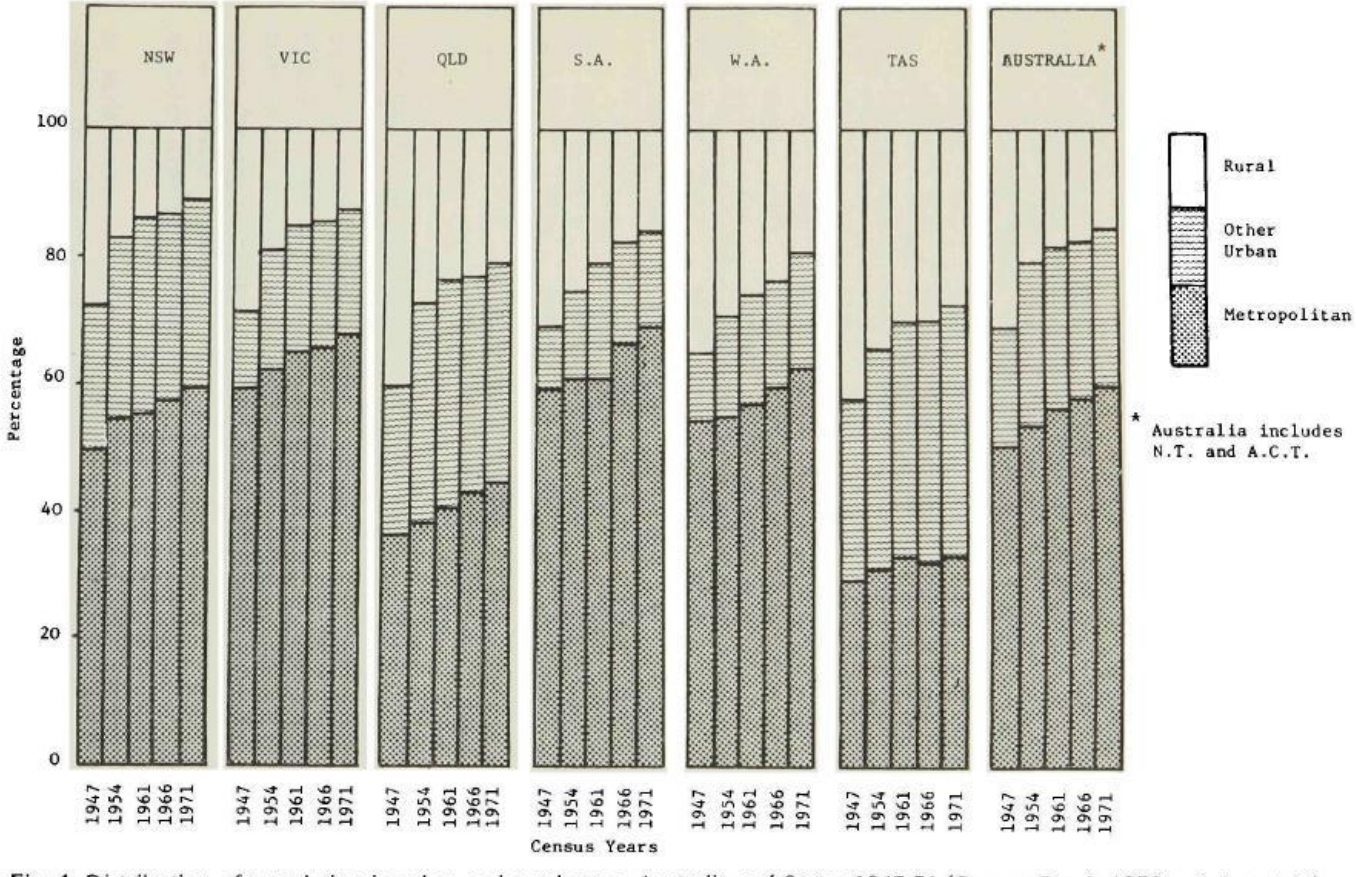

Fig. 4. Distribution of population in urban and rural areas, Australia and States, 1947-71 (*Source:* Borrie 1975, vol. 1, p. 142)

Trends in population growth

Table 3 shows population growth from 1961 to 1976. Between 1961 and 1971 there was a marked depopulation in rural areas, though this trend was reversed in most states between 1971 and 1976. In contrast, in most states non-metropolitan urban centres showed growth throughout the entire period, and in several instances this growth was rapid[1].

Table 3. Intercensal Percentage Increases in Population in Urban and Rural Areas, 1961-76

1961-66	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT
Metropolitan	11.35	13.54	22.32	25.41	17.94	8.39	–	65.59
Other urban	8.36	10.78	3.19	−2.49	12.73	12.38	50.89	–
Rural	−4.13	−4.78	−0.94	−8.77	4.40	−3.12	7.84	20.18
Total	8.15	9.95	9.55	12.94	13.63	6.09	38.51	63.21
1966-71	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT
Metropolitan	11.55	13.55	14.24	11.15	28.30	8.75	–	52.60
Other urban	11.26	5.10	13.22	4.70	39.61	12.82	83.69	–
Rural	−8.45	−7.71	−6.19	−5.79	−7.42	−8.53	17.52	−14.03
Total	8.57	8.76	9.12	7.19	21.50	5.11	52.89	50.02
1971-76	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT
Metropolitan	1.47	4.28	9.11	5.89	13.94	1.23	–	38.09
Other urban	9.2	6.86	17.31	9.04	13.20	6.73	16.29	–
Rural	2.1	3.18	7.37	4.08	−0.75	−0.05	4.83	2.94
Total	3.82	4.10	11.51	6.05	11.10	3.19	12.39	37.18

Source: Australian Bureau of Statistics census data.

Table 4 shows the growth rates of urban areas by urban size classes, and compares these with the national growth rate[2]. In the period 1971-76 there was a relative shift in population growth away from the major centres to the smaller cities (Mandeville and Butler 1979). Both tables 3 and 4 illustrate this shift. Table 4 shows that while there was a marked decline in the population growth rates in Sydney and Melbourne, at the same time in New South Wales and Victoria there was an increase in population growth rates in urban centres of 30,000 to 49,999 people.

These figures have implications for the rural-to-urban shift in population. Perhaps country people are moving to non-metropolitan urban areas rather than to the metropolitan cities,

Table 4. Average Annual Population Growth by Urban Area Size Class in 1976, States and Territories, 1961-76

State/ Territory	Year	10,000 – 19,999	20,000 – 29,999	30,000 – 49,999	50,000 – 99,999	100,000 – 499,999	500,000 +	Remainder of State/ Territory	Total (national)
		%	%	%	%	%	%	%	%
NSW	1971-76	2.2	0.8	3.3		1.0	0.6	0.8	0.8
	1966-71	2.5	1.4	2.7		1.9	2.1	-0.3	1.7
	1961-66	1.1	0.9	2.5		2.0	2.0	0.1	1.6
Vic.	1971-76	0.1	2.0	5.3	1.1	1.5	0.8	0.6	0.8
	1966-71	0.4	2.1	4.0	1.1	1.9	2.3	-0.5	1.7
	1961-66	1.6	3.2	3.2	1.1	2.3	3.4	0.3	1.9
Qld.	1971-76	5.3	0.3	2.7	2.0	6.5	2.0	1.9	2.2
	1966-71	4.5	4.0	2.1	2.3	6.9	2.2	0.1	1.8
	1961-66	5.4	2.4	2.2	2.0	8.3	2.3	0.3	1.8
SA	1971-76	1.0		1.0			1.3	0.7	1.2
	1966-71	1.0		7.7			1.8	-0.4	1.4
	1961-66	1.5		10.0			3.2	-0.1	2.4
WA	1971-76	2.0					2.8	0.3	2.1
	1966-71	4.1					4.7	2.1	4.0
	1961-66	1.3					3.3	1.2	2.6
Tas.	1971-76	0.1			0.4	1.1		0.3	0.6
	1966-71	3.1			0.6	1.6		0.0	1.0
	1961-66	3.0			1.4	1.6		0.2	1.2
NT	1971-76	4.8		3.0				1.0	2.4
	1966-71	11.8		11.0				6.5	8.9
	1961-66	5.4		7.2				6.5	6.7
ACT	1971-76					6.6		1.0	6.5
	1966-71					8.6		2.5	8.4
	1961-66					10.4		4.4	10.3
Total	1971-76	1.7	1.0	2.8	1.4	2.3	1.1	0.9	1.2
	1966-71	2.4	2.0	4.3	1.6	2.9	2.4	0.0	1.9
	1961-66	1.8	1.6	3.6	1.6	3.1	2.4	0.2	1.9

as has been the trend in the past. On the other hand, it may be that rural people are still moving to metropolitan areas, and people from metropolitan areas are moving to the smaller towns and cities. The available figures allow us to do no more than speculate on this. These internal movements (interstate and intrastate) are complex and have no simple explanation. For example, those moving into the cities are probably largely young people seeking jobs and a better education, while those moving out are often older, with incomes that allow them to select homes and properties beyond the fringes of the cities or in resort areas. Chapter 7 considers the characteristics of interregional migrants in Australia.

Though part of the so-called population turnaround can be attributed to minor changes in internal migratory habits, the decline in the growth rates experienced, in particular, by Sydney and Melbourne can be explained largely by the marked downturn in international immigration, though as discussed in Chapter 7 there have been some recent short-term changes. Net immigration for the five years 1966 to 1971 had averaged over 104,000 per year, whereas over the 1971-76 period the net gain more than halved to a yearly average of around 40,000 (Borrie 1978). An additional element in reducing metropolitan growth rates from 1971 to 1976, and by implication increasing the growth rates of small cities and rural areas by reducing the city-bound flow of internal migration, has almost certainly been the reduced employment opportunities in industries such as building and construction, and manufacturing.

Regional unemployment levels

The unemployment rate in a region is used as an approximate indicator of the level of economic activity in that region[3]. The primary aim is to find out if there are chronically depressed regions, which are a major cause of concern to the regional planner.

Table 5 presents unemployed persons by sex, as a percentage of the workforce for the six states, disaggregated by metropolitan and non-metropolitan areas for the period 1975-77. It is evident from the table that the states fall into two categories. The first consists of New South Wales, Victoria, Queensland (the eastern states) and Tasmania, where in most cases the unemployment percentage has been higher in the non-metropolitan areas; and the second, South Australia and Western Australia, where the unem-

Table 5. Unemployed Persons as a Percentage of the Workforce, 1975, 1976 and 1977

	1975			1976			1977		
	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons
Sydney	3.5	4.7	3.9	3.8	5.0	4.2	5.2	5.6	5.4
Non-metropolitan	3.4	6.2	4.2	4.6	6.7	5.3	4.8	8.5	6.0
Total NSW	3.4	5.2	4.0	4.1	5.6	4.6	5.1	6.6	5.6
Melbourne	3.3	5.7	4.2	2.5	4.5	3.2	3.4	5.4	4.1
Non-metropolitan	2.6	5.8	3.5	2.8	6.4	3.9	4.6	7.9	5.6
Total Victoria	3.1	5.7	4.1	2.5	4.9	3.4	3.7	5.9	4.5
Brisbane	4.0	4.3	4.5	3.8	5.3	4.4	4.0	5.6	4.6
Non-metropolitan	3.4	4.7	3.8	3.1	6.3	4.0	4.6	8.1	5.8
Total Queensland	3.7	4.5	3.9	3.4	5.7	4.2	4.4	6.8	5.2
Adelaide	2.5	5.0	4.8	3.3	4.0	3.6	4.0	6.5	4.9
Non-metropolitan	2.4	4.3	2.9	1.9	4.0	2.5	3.4	5.2	4.2
Total SA	2.5	4.8	3.3	2.9	4.0	3.3	3.9	6.3	4.8
Perth	4.2	5.5	5.2	3.4	7.4	5.0	3.8	7.1	5.0
Non-metropolitan	1.2	3.7	1.9	2.6	3.8	2.6	2.4	1.3	2.2
Total WA	2.8	5.0	3.5	3.0	6.6	4.3	3.3	5.8	4.2
Hobart	*	*	4.4	*	6.6	4.2	3.6	6.8	4.8
Non-metropolitan	*	*	4.8	*	8.9	5.2	3.9	11.3	5.2
Total Tasmania	2.9	6.1	3.9	3.2	7.9	4.8	3.8	9.3	5.6

Source: Australian Bureau of Statistics, *The Labour Force*.

* Figures not available.

ployment percentage has been significantly higher in the metropolitan areas. Stilwell (1974) reached similar conclusions in his examination of unemployment levels in each of the six states during the 1961-72 period. The main difference between his results and those presented here is that Stilwell found Tasmania to have a higher percentage of unemployed in metropolitan areas, whereas in table 5 it has a lower percentage.

The figures in table 5 reveal that there are no *gross* differences between unemployment levels over the three-year period for the capital cities and the non-metropolitan areas of their respective states (though there are some noticeable differences, especially in Western Australia). Thus, the figures in table 5 do not reveal any chronically depressed areas. This conclusion correlates with that of Hoy (1977), whose study, which disaggregated the unemployment rates by urban centres for the six states and two territories, indicated that there was not a large number of areas that could be considered chronically depressed.

It would be desirable to compare levels of unemployment in metropolitan areas with those in rural areas. But the data now available allow a comparison only of metropolitan and non-metropolitan areas. Since non-metropolitan areas are defined as other urban areas plus rural areas for official purposes, no valid comparison of unemployment rates in metropolitan and rural areas can be made. However, tables 2 and 3 indicated growth in 'other urban' areas, and a decrease in the number of people in rural areas. Moreover, as table 6 shows, the structure of the workforce changed between 1911 and 1971, with a steep decline in employment in primary industry, a small increase in employment in secondary industry, and a marked increase in the tertiary workforce. We

Table 6. Structure of the Australian Workforce, 1911-71

Sector	1911 %	1921 %	1933 %	1947 %	1961 %	1966 %	1971 %
Primary workforce	31.0	27.0	23.2	16.5	12.0	10.5	9.1
Secondary manufacturing workforce	27.0	27.5	30.9	31.5	33.0	33.0	31.2
Tertiary (service) workforce	42.0	45.5	45.9	52.0	55.0	56.5	59.7
	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Calculated from Australian Bureau of Statistics data.

suggest that the higher rates of unemployment in non-metropolitan areas shown in table 5 may be more a reflection of depressed economic activity in the rural sector than in the 'other urban' sector, though this is an oversimplification because other factors, such as structural change and instability, contribute to rural depopulation. Those aspects of the rural problem are considered in more detail in Chapter 5. The point here is that we consider rural areas could well be thought of as severely—perhaps even chronically—depressed. But, without an accurate disaggregation of the non-metropolitan component, a definite conclusion cannot be reached.

There are two further issues that are worth noting. First, it is striking that there is much more female unemployment than male unemployment. Figures for female unemployment are higher in the non-metropolitan areas in the eastern states and Tasmania, whereas in South Australia and Western Australia female unemployment is greater in the capital cities. But to these figures we must also add hidden unemployment, which is much higher in non-metropolitan areas for females than for males (see Jilek et al. 1979).

Second, it could be possible to categorize the regional unemployment rates in table 5 according to their structural, frictional, cyclical and seasonal components. This would give an indication of the reason for the level of unemployment existing in a region. We cannot do this here as the process is too lengthy, but such a breakdown would show that, in general, a region may be depressed because of a structural imbalance or because of an overall decline in demand.

The urbanization problem

The figures we have seen so far give substance to this chapter's opening comment on Australia's very high degree of urbanization. Stilwell (1974) points out that in 1971 Australia led the list of the world's most urbanized nations, with 88 per cent of her population in urban areas, ahead of Japan with 84 per cent, Germany with 82 per cent, Denmark and the United Kingdom with 80 per cent and the United States, in sixth place, with 75 per cent[4].

In part this urbanization is a natural outcome of a market economy, that is, people have found the economic and social rewards of the city more attractive than those of rural areas. Without going

into the reasons for urban growth, since they are dealt with in Chapter 4, let us emphasize here that the major reason for the high degree of urbanization in Australia is the substantial level of immigration since the Second World War, since most of the migrants settled in the capital cities. Of course, Australia has been highly urbanized by world standards since the last century, but this has greatly intensified since 1945. The rural-to-urban drift of population significantly reinforced, but was not the major determinant of, the level of urbanization in Australia.

Traditionally, urban growth has been considered necessary for rapid national economic development, and certainly Australia has experienced rapid development. But what have been the effects on community welfare of such a centralization of industry and people? What have been the effects on economic efficiency? What are the social implications of economic growth? These questions are fundamental to the Australian regional problem.

First, let us consider the effects on economic efficiency. Large cities still continue to attract people and economic activity for reasons beyond the obvious one of favourable natural location. From the point of view of individual firms, there are many economic advantages in centralization. Large population centres provide markets immediately to hand. Their transport costs are generally (though not necessarily) minimized by location in a large city, and this effect is felt in both the cost of delivering materials (inputs) to the firm and the cost of delivering the final products to the market. In a large city there is also the advantage of easier and cheaper—and therefore more frequent—communication with suppliers, wholesalers, merchandising people, financial organizations and, indeed, with competitors. Moreover, the greatest quantity and variety of skilled labour is found in large cities. A firm locating in a decentralized area may find that the type of labour it requires is in small supply, whereas in a large city this is unlikely to occur as the firm will have only a small impact on the total balance of supply and demand.[5]

However, decisions by firms to locate in already-large metropolitan areas may result in costs to the nation that differ greatly from the costs borne by the enterprise itself. This cost to the nation might be less if the firm could be induced to set up business in a non-metropolitan location.

Costs that are not borne by the firm itself are known as external diseconomies or negative externalities. External effects may be said to arise when relevant effects on production or welfare go wholly

or partially unpriced. Being outside the price system, such external effects are the by-products, wanted or unwanted, of other people's activities, that immediately or indirectly affect the welfare of individuals. These negative externalities may, in fact outweigh the advantage that firms find in centralization. The relevant question here is: "If the firms whose central location decisions give rise to external diseconomies had to bear the full cost of these diseconomies, would those firms still see a net advantage in centralized location?". A loss of economic efficiency may arise as a result of the very expensive infrastructure (roads, electricity, water, sewerage, public transport and communications, schools and hospitals, most of which are normally provided by government authorities) that has to be provided to service urban development initiated by the private sector.

Increases in infrastructure cost are only one example of the adverse effects of urban industrialization. However, considerable research has been carried out in comparing the public costs per capita involved in providing services in decentralized rather than centralized locations. Table 7 summarizes the results of a study which attempted to calculate the capital cost of providing government-type services for an additional 100,000 people in each of five country centres between the years 1970 and 2000. These costs were then compared with the estimated savings arising from diverting to decentralized areas 500,000 of Sydney's projected population growth for the same period. The data indicate that the metropolis has cost advantages in terms of water supply headworks, bridges and flood control, but that these are more than offset by the cost disadvantages incurred in the provision of water supply distribution, sewerage, roads and public transport. It is estimated that, in total, $120 million net savings (on 1972 values) would occur by decentralizing to the five centres.

This is important because it suggests that the infrastructure costs associated with further metropolitan growth are likely to be higher than infrastructure costs associated with the same amount of development in decentralized growth centres. In other words, an undesirable consequence of the high level of urbanization occurring in Australia is the additional cost that must be borne by the community as a whole. Thus, as cities grow larger and larger they reach a point where the original economies of scale that encouraged their growth are left behind, and further growth gives rise to diseconomies in the provision of extra infrastructure.

An understanding of the social implications of urban growth

Table 7. Estimated Future Cost of Infrastructure for an Additional Half-Million Persons in New South Wales

City	Water supply headworks	Water supply distribution	Sewerage	Roads	Bridges	Public transport	Flood control	Total	Cost per additional capita
COUNTRY CITIES COSTS SUMMARY ($ million)									
Dubbo	5.3	11.9	18.0	24.3	4.3	1.6	–	65.4	654.0
Grafton	8.7	12.0	17.2	25.6	–	1.6	1.5	66.6	666.0
Nowra	8.4	10.6	16.7	22.5	6.2	1.6	1.0	67.0	670.0
Orange	16.1	11.8	18.4	21.9	–	1.6	–	69.8	698.0
Wagga Wagga	3.7	12.1	18.2	26.6	3.9	1.6	1.0	67.1	671.0
Total	42.2	58.4	88.5	120.9	14.4	8.0	3.5	355.9	–
SYDNEY REGION EXPENDITURE DEFERRED ($ million)									
Sydney	19.5	77.5	195.7	151.5	–	11.6	–	455.8	912.0

Source: *Studies Commissioned by the Committee of Commonwealth/State Officials on Decentralisation* 1975, Book Four, pp. 209-70.

requires a study of such factors as the evenness of the distribution of income, the problems of congestion and pollution, and the lifestyle of city dwellers. Unlike the differential costs of providing infrastructure in a metropolitan area rather than in a non-metropolitan area, the social costs of urbanization are difficult to measure in a tangible, dollars-and-cents form.

Is there any relationship between equity and regional development? It has been argued that large cities are responsible for shifting resources from the poor to the rich (Stretton 1970). Tom Uren, federal minister for urban and regional development in the 1972-75 Labor government said that "the faster a city grows around a single centre, the greater will be inequalities in its population, the greater will be the segregation amongst its communities" (1973). Stilwell (1974) attempted to test the validity of propositions like these using social indices such as average number of persons per room, average weekly rents, occupational structure, educational level, crime rate, perceived social status and average number of persons per vehicle. He found a link between urbanization and inequality in Australia, and argued "that large cities provide a framework within which the inequalities inherent in the capitalist system are given a spatial dimension" (p.119).

In our view, cities per se do not create inequalities. Historically, cities have contained a greater range of humanity and consequently a wider variety of any measure of difference between human beings (such as income, intelligence, education, health, or skills) than have rural areas. Therefore, any inequalities among people will be more evident in cities.

The most often cited adverse consequences of metropolitan concentration in Australia are the problems of congestion and pollution, both of which are regarded by economists as classic examples of negative externalities. It is argued that traffic congestion arises because road users are not charged the full cost (for example, of noise and exhaust fumes) they impose on the community for driving on the road. A study on traffic congestion carried out by the New South Wales Department of Decentralization and Development, the Commonwealth Bureau of Roads and the City of Wagga Wagga compared the current and predicted cost per mile of road travel in Melbourne and Wagga Wagga. These results are presented in table 8. If traffic congestion costs can be conceived as costs per mile travelled, then table 8 indicates that costs per mile travelled by road in metropolitan cities such as Melbourne are higher than corresponding costs in provincial centres

Table 8. Results of Traffic Study, Wagga Wagga and Melbourne, base year (1969-70)

	Wagga Wagga	Melbourne
Total vehicle miles per day	195,000	18,664,000
Cost per mile	9.9 cents	10.2 cents
Population	28,000	2,376,000
Miles per person per day	7.0 miles	7.9 miles
Cost per person per day	69 cents	89 cents
Number of vehicles	8,650	669,000
Average miles per vehicle per day	22.6 miles	27.9 miles
Cost per vehicle per day	$2.23	$2.85

Source: *Report of the Committee of Commonwealth/State Officials on Decentralisation* 1972.

such as Wagga Wagga. Thus the economic cost of congestion is higher in cities.

So far we have considered only the social costs associated with urbanization; however, urbanization also brings social benefits. People may find the quality of life in large cities more to their liking than the quieter life in small towns. The reasons are manifold: superior educational and cultural facilities, better sporting and recreation centres, large department stores and a wide variety of specialized shops, better community services such as health centres and transport, and so on. We shall return to these non-economic factors in Chapter 7. As with the social costs of urbanization, the measurement of benefits is difficult, almost impossible, but no realistic appraisal of the costs and benefits of urbanization can avoid making some assessment of them.

Rural regional decline

As we saw in the introduction to this chapter, rural decline is "the other half" of the Australian regional problem. The declining regions are for the most part farming communities, particularly small country towns which service an agricultural area. In total, the number of people directly affected by regional decline is probably not very great. However, this does not mean that regional decline should be ignored.

There are a number of reasons for decline in rural areas. In recent years Australian agriculture has been faced with increasingly adverse terms of trade, characterized by rapid increases in the prices of inputs, as a result of inflation, but only marginal increases in the prices of agricultural products at the market. The relatively higher profitability of many non-rural industries in the economy has given rise to a flow of resources away from agriculture. Moreover, partly as a result of increasing costs, there has been a progressive change in the technology of rural industries, with a substantial substitution of capital for labour. This has resulted in labour being released from primary production, and to the extent that a decrease in population provides an indication of regional decline, then rural decline has resulted.

Advances in transportation have to some extent removed the need for a comprehensive range of supportive industries in each town. People are now willing to travel greater distances to larger and more efficient retail and wholesale outlets. This trend has been particularly noticeable for the larger budget items such as cars, household appliances and recreational goods. Because services once provided in small towns are no longer required, employment opportunities are reduced, causing the population to decline. The younger age groups are virtually being forced out and are moving towards the major urban centres. Thus we can see that rural decline is occurring for both economic and sociological reasons.

It could be argued that regional decline is a manifestation of market forces operating at a particular point in time: certain regions are growing, while others are stagnating and others are declining. From an academic viewpoint, we should ask the question "Is the process of regional decline simply the *reverse* of the regional growth process?". This question will be dealt with in Chapter 5.

Finally, although not many people are affected, should society allow these people to bear the full cost of decline? On equity, welfare and possibly economic efficiency grounds, there is reason for society to intervene.

Notes

1. Firm conclusions cannot be drawn from these figures as they are based upon the preliminary 1976 census, which is reckoned to have undercounted the national population by some 2.7 per cent, with variable errors between different geographical regions.
2. See the work on urban growth by Hill and Foster (1977). Hill and Foster define an urban centre as an area in which any census since 1961 has recorded a popu-

lation of 10,000 or more, whereas the Australian Bureau of Statistics defines an urban centre as one with a population of 1000 or more.

3. Differences in the level of regional economic activity are quite marked in the United Kingdom. There, unemployment rates have routinely been used as the key indicator of regional imbalance. The value of output, the level of income, the level of employment, and net migration are other indicators which theoretically could be used to assess a region's level of economic activity. However, unemployment rates are used in this section because such data are readily available at a regional level.
4. Urban areas are defined as centres with populations of 1000 and over.
5. We shall take up these points again later. Chapter 6 deals with factors affecting the location of individual firms, while Chapter 4 considers various economic and non-economic determinants of urban growth. See *Report of the Committee of Commonwealth/State Officials on Decentralisation* (1972, pp.21-26) for a more complete discussion.

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Further Reading

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Mumford, L. 1961. *The City in History*. London: Secker and Warburg (outlines reasons for the development of the city as an economic, social and cultural centre).
Jacobs, J. 1972. *The Economy of Cities*. Harmondsworth: Penguin (considers why some cities decline and die while others live and grow).

Externalities

Mishan, E. J. 1971. *Cost-Benefit Analysis*. London: George Allen and Unwin (an excellent introduction to the theory of externalities).

Rural

Anderson, R. 1972. *Crisis on the Land*. Melbourne: Sun Books (non-technical introduction to Australia's farm problem).

Questions for Discussion

1. Does the pattern of Australian regional development provide opportunities for people to live in a manner consistent with their own preferences and aspirations?
2. Is it realistic to suggest that the centralization trend can be slowed down? Can you suggest ways in which this might be done?
3. Do we need to concern ourselves with regional decline (for economic or welfare reasons)? If so, suggest policies for alleviating the consequences and altering the process of decline.

2

Regional Problems: Australia and Selected Other Countries

Much of the literature on regional planning and policy has focused on the United Kingdom, France and other OECD countries. It is useful to consider the differences and similarities between the regional problems of Australia and others countries, as this can help to clarify our understanding of the Australian problem. Before turning to this comparison, however, we need to identify Australia's regions.

It is very difficult to picture Australia as a combination of a large number of regions, and some would argue that Australia is therefore a "region-less" country. However, there is one broad, overriding pattern of economic activity in this country: Australia is a vast land mass, mostly thinly populated, but with clusters of population in six major cities—the state capitals. Two smaller clusters, in the Australian Capital Territory and the Northern Territory, also follow the same pattern of one major centre of economic activity within a politically-defined region. Thus Australia can be said to have eight regions. In all but the ACT (which comprises such a small land area) it is easy to see the urban-rural dichotomy, which we have already identified as the Australian regional problem.

When we turn to consider the regional problems of the United Kingdom, Finland, Norway, France and Canada, we find many differences from the Australian pattern, and some similarities[1]. The brief overview that follows does not give a complete picture of regional problems in those countries, rather it focuses on the features which are useful for a comparison with Australia—the size of the country, the distribution of population, internal population movements and inequalities between regions.

The United Kingdom

The regional problems of the United Kingdom include persistent disparities in unemployment levels and concomitant decline in regions such as Northern Ireland, Scotland, Wales and the three regions of northern England, together with smaller areas in the far south-west and in the northern Midlands. Regional inequalities are mainly due to the outdated industrial structure of these regions. The growth of modern industries has been accompanied by a progressive decline in demand for many of the products of the older industries. Therefore, reductions in employment in these industries, and relatively high levels of unemployment, have occurred in the lagging industrial regions. At the same time, employment in service industries has increased considerably, but due to the nature of this source of employment, a large number of these services have been concentrated in London.

As a result of the marked difference in regional employment opportunities, population movements have been considerable in certain parts of Britain. For example, there has been a rural-to-urban drift of population (as in Australia), and, more importantly, a considerable out-migration from most of the depressed industrial regions. On the other hand, the Midlands and the south have increased their share of the total population.

Regional problems in the United Kingdom differ considerably from those in Australia. First, there is London, the one major city. Historically, London has been a magnet attracting population and industry, though its rapid post-war growth rate was beginning to decline in the 1970s. Australia has no such focal city. Second, unlike Australia, a significant proportion of regions in the United Kingdom are economically depressed.

Finland

As in Britain, population growth and distribution in Finland are heavily biased towards the southern regions. The degree of urbanization in Finland (where 58 per cent of the population was living in areas classed as urban by 1975) is lower than that occurring in Australia (where the comparable figure was 88 per cent). Nearly 20 per cent of the Finnish population is concentrated in the three major southern cities of Helsinki, Tampere and Turku.

Regional inequalities have been greater in Finland than in many

other countries. Unemployment rates are high in the underdeveloped regions—the north and east—and there is migration from these areas to the south, where jobs are clustered. Congestion in the capital city area of Helsinki has become a problem. The southern regions of Urisimaa province produced 65 per cent of the gross domestic product in 1975 and nearly three-quarters of the industrial output. The share of the population of these regions at the same time was only about 50 per cent.

Norway

Like Australia, until the turn of the century Norway was mainly a primary producing country. Norway's population distribution is uneven, with almost half of the population living in the eastern region centred on Oslo, in an area comprising 29 per cent of the total land area. The proportion of people living within urban areas increased from 61 per cent in 1950 to 67 per cent in 1972. In the most urbanized region, the east, the rise was from 77 per cent to 81 per cent. The driving force behind this migration to the capital city and other urban areas has been twofold: first, the substitution of capital for labour in the primary sector, and second, the growth of the service sectors. Similar reasons were suggested in Chapter 1 for part of the high level of urbanization occurring in Australia. Norway is also similar to Australia in that it lacks any serious problem areas, though some regions are growing faster than others.

France

The regional problem in France is often expressed in terms of the disparities in the standard of living between the regions in the north and east and those in the south and west. In the south the regional problem is essentially the need for the redevelopment of areas whose economies are based mainly on heavy industries and textiles. These industries have been facing decline in demand similar to that in the United Kingdom. In the west the problem is one of the need to introduce manufacturing industry and services to compensate for a shrinking and rapidly modernizing agricultural sector. Also it is argued that any attempt to reduce these disparities must in part involve some reduction in the "gravitation pull" that Paris has on resources[2].

French regional problems are thus considerably different from those of Australia. There are great disparities between regions, and there is one primate city, Paris, which attracts resources away from other, mainly depressed, regions of the country. An examination of population trends among the French planning regions indicates a substantial increase in the total population of the Paris region as a percentage of total population. The regions of the west and south-west rank low in terms of population increase, which is a consequence of large out-migration. In terms of employment changes, the west and south are again disadvantaged compared with the rest of the country, particularly Paris. Data on income differentials indicate a disparity between income levels in the Paris region and those in the rest of France[3].

Canada

Canada, like Australia, is a vast country with much of its area unfavourable to dense settlement. About two-thirds of the population is located in the central Canadian provinces of Quebec and Ontario, similar to the concentration of population in New South Wales and Victoria. Canada also has a federal system of government with capital cities in each province attracting population and economic activity. However, unlike Australia, there are larger economic disparities between provinces. The most disadvantaged part of the country is the Atlantic region, whereas the central and western areas are the most prosperous. The Atlantic region has an income per capita level almost half of that in other regions. Value added per capita in manufacturing industries, levels of investment and employment are also considerably less in this region. The degree of urbanization varies notably between the provinces, the Atlantic region having the highest percentage of rural non-farm population. Thus Canada is a country of very marked regional differences.

Conclusions

In Chapter 1 we saw that demographic and economic patterns seem to indicate few major inequalities between Australian regions. Australia does not have a large number of depressed areas. Of the countries we have briefly looked at, only Norway shares this characteristic.

Certain aspects of regional problems can be defined in terms of internal population movements. While Australia is the most urbanized country in the world, all the other countries we have reviewed are highly urbanized. Some causes of urbanization, such as employment in the growing service industries, Australia shares with all the countries reviewed. But Australia has to contend neither with the problems of historically-backward areas, nor with the imbalance posed by primary cities like Paris and London, nor with the decline in old-established industrial areas. Australia's high urban growth rates are due more to international migration than to any internal migratory trends.

Table 9 summarizes the similarities and differences between Australia and the five countries surveyed.

Table 9. Summary of Similarities and Differences in Spatial Features, Australia and Selected Other Countries

	Similar features			Different features		
	Land mass	Existence of regional inequalities	Geographical population distribution	Land mass	Existence of regional inequalities	Geographical population distribution
United Kingdom				√	√	√
Finland			√	√	√	
Norway		√	√	√		
France				√	√	√
Canada	√		√		√	

Notes

1. This section draws upon OECD (1976) and Hansen (1976).
2. France has often been described as "Paris and the French Desert".
3. See Hansen (1976, p.37).

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Questions for Discussion

1. Australia is unique in the type of regional problems that it experiences. Discuss.
2. There is a suggestion that regional inequalities in Australia will become more prominent. Can we learn from countries, such as the United Kingdom, which already have regional inequalities?

3

Regional Planning, Data and Accounts

Having identified the main characteristics of the Australian regional problem, we now need to consider whether some form of regional planning should be initiated in order to overcome the problem, or whether it should be left to *laissez-faire*. In this chapter we shall consider the justification for, and nature of regional planning by government agencies, and then go on to look at the kinds of information required for regional analysis and planning, and at regional accounting.

Why plan?

Economists in the eighteenth century like Adam Smith (1776) and Bernard de Mandeville (1714) thought there was no need for government intervention; they were proponents of *laissez-faire*. They argued that each individual pursuing his or her self-interest contributed to the overall public good, guided by the invisible hand of free competition. In terms of regional economics, the *laissez-faire* argument runs this way (to quote Richardson (1972, p.390)):

> The *laissez-faire* case rests on the view that increased national efficiency should be the primary objective of regional development, and that the price system in a market economy is the best available regulatory mechanism for achieving this objective, by inducing the optimal spatial allocation of resources.

Some people still accept this argument unequivocally, but over the last hundred years there has been a rapid increase in planning, so that now in all countries state intervention is accepted in many aspects of everyday life. Why has this come about?

There are many problems with the *laissez-faire* argument. To quote Richardson again: "Even if equilibrating tendencies are strong the path of adjustment may be difficult and have harmful consequences" (1972, p.392). Market imperfections are a major reason for government intervention, and planning to facilitate intervention.

Market imperfections exist when the unrestrained interplay of private action and market forces result in intolerable situations. Examples of market imperfections are monopoly, externalities and inadequate provision of public goods. Monopolies are characterized by levels of production that are less than optimum, and artificially high prices. In response, governments might take action such as taxation or restrictions on takeover. Externalities, as defined in Chapter 1, occur when effects on production or welfare go wholly or partially unpriced. For example, if a company pollutes a river, the costs of this action are borne by society, not by the firm. Governments can make firms aware of social costs and benefits by the imposition of taxes on pollution and the provision of subsidies. In the case of certain public goods, for example defence, government intervention is necessary, as these goods would not normally be provided by the operation of the market system.

Regional planning

Planning can be defined as a sequence of actions designed to achieve selected objectives. There are probably as many blueprints of the planning process or the stages of planning as there are planners. Figure 5 shows one possible system.

Regional planning has been defined as planning with a spatial component. In Australia regional planning is undertaken by regional planning bodies, state governments, the federal government, statutory authorities, and groups of local government areas acting in cooperation. These bodies apply regional planning to public investment infrastructure such as roads, railways and schools. They have the power to encourage or discourage initiatives from the private sector for physical development, through, for example, their zoning and decentralization policies (decentralization policy is dealt with further in Chapter 6). They are concerned also with the coordination of activities such as construction, and the collection and dissemination of such information as changes in population levels,

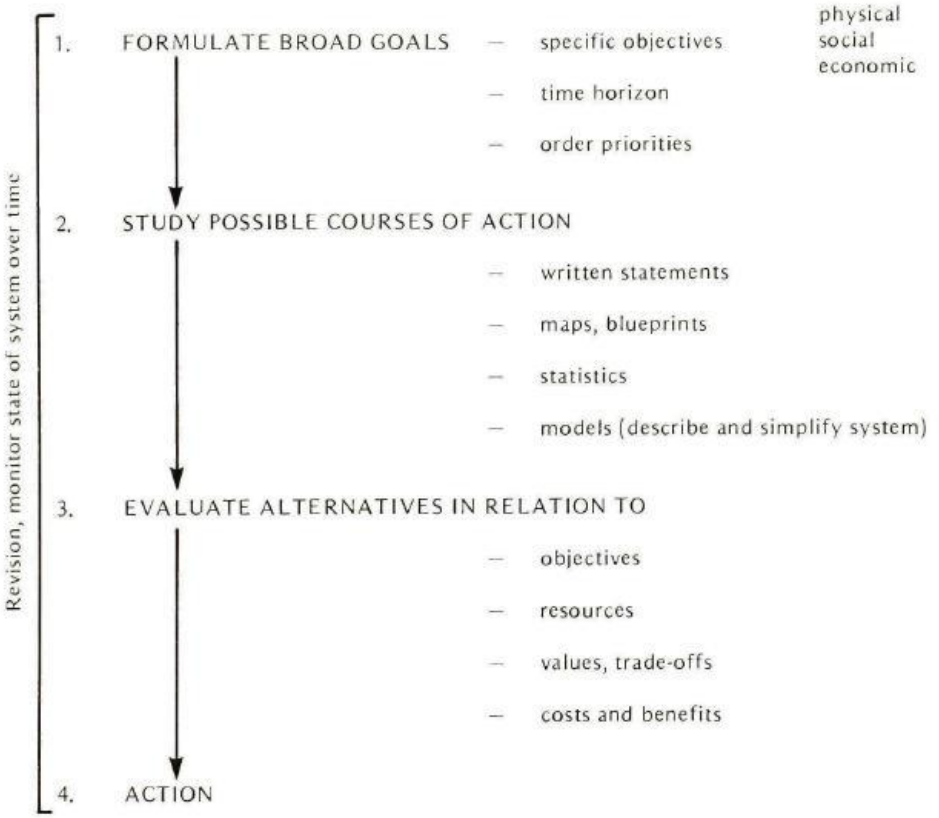

Fig. 5. The planning process (*Source:* adapted from Hall 1974)

incentives for development and various planning rules and regulations.

The main reason for regional planning is to provide a detailed spatial perspective in national and state planning. This would cover considerations such as the regional implications of national and state plans, and the potential contribution of regions to national and state, social, and economic objectives. Regional policy should, as part of its function, help to promote growth in the national economy. In some instances, the pursuit of regional planning policies may have detrimental effects on national economic activity. Or alternatively, a national policy may perpetuate regional inequalities and problems but add to national growth considerably. The point here is that planners need to be aware of the interaction and trade-offs between national and regional objectives.

Regional planning is of two types—economic planning and physical planning—though each has implications for the other.

Economic planning is usually concerned with an area's overall level of prosperity and industry structure. The regional economic planner faces a number of different tasks. For example, it might be necessary to assess the economic impact that a proposed project will have on a region. This would require knowledge of regional impact techniques; a discussion of these is undertaken in Chapter 9. The level of unemployment in a region might considerably exceed the national average due, for example, to the region having an industrial mix too sensitive to the ups and downs of national and world business, or one composed too heavily of old, slow-growing or declining industries. Shift and share analysis (see Chapter 4) measures the extent to which a region specializes in nationally fast- or slow-growing industries. Other tasks confronting the regional economic planner would also include an identification of industries which can operate efficiently and profitably in a region, and the planning of industrial development in a region as part of a national system of regions.

Physical planning is concerned with the coordination and control of alternative land uses and with the provision of infrastructure. Regional physical planners are involved in such tasks as reducing the cost of interactions between activities in a region, improving the environment for activities in regions, and determining the spatial consequences of uncontrolled urban growth.

Regional data

Regional planning requires information—data that explain the how, where and what of the regional situation. Since knowledge about the economic structure of a region and activities therein is often required, regional data such as the following are necessary: levels and types of economic activities, industrial linkages, local versus export orientation, productivity, sales, value added, gross regional product, industry mix characteristics, farm characteristics, firm size, capital/output ratios, employment and wages by industry, labour/capital ratios. The physical planner needs information which includes physical characteristics and uses of land, physical resources, community facilities, transportation and communication data, quality of the environment, and development constraints. All of the above, particularly if data are collected over time so as to indicate

trends, would produce a comprehensive profile of a region and help in the understanding, description and monitoring of the regional system.

When assembling and collecting data, it is necessary to decide at the outset what objectives are being pursued and why information is required. Then the availability of data needs to be assessed in conjunction with the resources available for assembly and collection. The sources of regional data are the Australian Bureau of Statistics (ABS), other secondary sources and direct surveys.

In most regional planning analysis the ABS is the main source of data. The advantages of ABS data are that they are free, available, generally reliable, and consistent definitions are employed. ABS data are available geographically for Australia, for states and territories, for statistical divisions (each state is divided into several statistical divisions which also serve as planning regions for most states)[1], for local government areas, and for census collection districts. Regional data from the ABS include demographic statistics; production statistics for rural, manufacturing, mining and building and construction industries; wholesale and retail trade figures; some information on transport and communication; local government statistics such as revenue and expenditure details; and social indicators such as health, education and welfare statistics.

The frequency of collection by the ABS varies from every five years for the population census to annual collections for most other information. Most ABS data are published, but much is unpublished and available on request subject to confidentiality restrictions. Confidentiality, i.e. the promise that information provided by individual respondents will not be disclosed in any way, presents growing problems as regions chosen for analysis or planning get smaller.

Apart from the ABS, other secondary sources of data are government documents, annual reports of companies and authorities, and research findings.

There is an obvious gap between the availability of secondary data and the requirements of regional planning outlined above. Direct surveys are often the only way to obtain needed data. However, they are expensive, time-consuming and require the often reluctant cooperation of respondents.

Though the paucity of data does affect the quality and kind of regional analysis and planning undertaken, this aspect is improving. Various planning techniques have been, and are being developed (for example, hybrid input-output techniques discussed

in the appendix) which make more efficient use of limited data. Also more spatially–disaggregated data are becoming available as the needs of the regional planner are being recognised.

Regional accounts

Data may be presented or displayed in a number of ways, such as statistical tables, diagrams, charts, maps and accounting frameworks. Regional accounts are a description of the region's economy in financial terms. They are spatially aggregate in that they consider the region as a whole, and conform with accounting practices that ensure consistency among variables within the account. Thus:

$$\text{INCOME} = \text{OUTLAY}$$

$$\text{DEBITS} = \text{CREDITS}$$

$$\text{INPUTS} = \text{OUTPUTS}$$

The two basic kinds of regional accounts are regional income and product accounts and regional input-output accounts.

Regional income and product accounts are similar in concept to the national accounts, but instead of gross national product (GNP) being the major aggregate, gross regional product (GRP) or the total value, at market prices, of final goods and services produced in the region for a given year, is the aggregate measure of economic activity in the region. Gross regional product is defined as follows:

$$\text{GRP} = C + I + G + X - M$$

where C is the total personal consumption in the region, I is total investment in the region, G is total regional government expenditure, X is total exports from the region, and M is total imports into the region. Other useful measures derived from regional income and product accounts are regional personal income (which is wages and salaries plus all payments to individuals) and regional disposable income (which is regional personal income minus taxes). Regional per capita income is obtained by dividing total income by total population in the region.

Input-output accounts present the economic interrelationships between the major sectors of the economy–households, firms, state

and federal governments and the rest of the world. The relationships or flows between sectors are presented in matrix form. Input-output accounting is discussed in detail in Chapter 9, but it should be pointed out here that its advantage, in an accounting sense, over income and product accounting is that it presents a disaggregated view of the economic structure of a region.

Notes

1. See the various state yearbooks.

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(Glasson, Glikson and Richardson (1972, see the list of references) discuss planning in the regional context. In particular, Glasson evaluates regional planning policies and instruments in some OECD countries.)

Questions for Discussion

1. Planning should be treated as a process and not an end in itself. Discuss.
2. What reasons can you think of for economic and physical planning in Australia?
3. What is the main constraint facing regional planners?
4. The pursuit of certain regional objectives might result in a decrease in overall nationai economic efficiency. Discuss.

PART 2

Reasons for Australian Regional Problems

4

Regional Growth

Urbanization and its associated effects have constituted a major portion of the Australian regional problem. Before considering regional policies to deal with these problems, an understanding of long-run regional and urban growth processes is required. In this chapter we shall outline some of the regional growth theories that have been developed, and then discuss the determinants of urban growth.

Regional growth theories

Economic growth implies an increase in the total real value of goods and services produced, which in turn means an increase in other economic aggregates such as consumption, employment, income and capital. At present there is no comprehensive general theory of regional growth. There are, however, a number of partial theories and concepts which focus on the major determinants of regional growth[1].

The various theories focus on one or more of the factors likely to influence regional growth. The sum of all of these factors is regional growth, which can be expressed thus:

REGIONAL GROWTH $= F$ natural resources, labour, capital investment, transport and communication facilities, technology, industrial composition, size, export market, national and world economy, central government spending, socio-political system.

Neoclassical models

Neoclassical models have been used widely in regional analysis. However, the background assumptions of neoclassical growth are inapplicable to the regional economy since they do not allow the spatial dimension to be introduced. The neoclassical models have attracted the attention of regional economists for two reasons: first, because the models contain a theory of factor mobility as well as a theory of growth, and, second, because the models yield some predictions.

For equilibrium to exist in the neoclassical models, capital must flow from high-wage to low-wage regions, since the latter offer higher returns to capital. Labour flows in the opposite direction until factor returns on capital and labour are equalized. Low-wage, low-income regions are predicted to grow faster and thus to enjoy higher rates of capital accumulation and greater increases in wages than other regions. As a result, a convergence of regional per capita incomes is suggested by these models.

Most tests of regional neoclassical models have been indirect in that they have merely investigated whether this convergence in regional per capita incomes does in fact occur. The results of such tests have in most cases been inconclusive. Moreover, there are important theoretical objections to the neoclassical models since they really tell us nothing about the characteristics of regional economies. The *raison d'être* of regional economic analysis indicates that certain phenomena are of major importance: transport costs, interdependence of location decisions, agglomeration economies in location and urbanization, and metropolitan-regional relationships. These important factors have no role to play in the neoclassical system.

Export base models

Export base (economic base) models have been used to explain short-run movements in regional income, and to argue that there is a long-run relationship between a region's exports and its overall growth. In its simplest form, export base theory states that the growth of a region depends upon the growth of its export industries, implying that expansion in demand outside the region is the crucial determinant initiating growth within the region.

There are a number of important implications of the export base theory. First, exports are regarded as the sole exogenous influence on aggregate demand, and all other autonomous influences (dom-

estic investment, changes in the level of government spending, or shifts in consumption) are not considered in the analysis. Second, the theory pays no attention to the source of the increase in export demand. The economy is disaggregated into only two components—the region and the rest of the world. It is a matter of indifference whether the expansion in exports originates in a neighbouring region or at the other side of the world. Therefore the theory ignores the functional ties between regions, and consequently sheds no light on the process of interregional growth. Third, the export base theory stresses the effect that changing patterns of national demand can have on a region's growth potential. Export base theory is useful in that it emphasizes that in any attempt to understand the regional growth process, a region cannot be studied in isolation.

However, the export base theory cannot claim validity as a general theory of regional growth because it focuses on only one of the external factors, namely the export market. Though criticisms of this theory are considered in more detail in Chapter 9, one weakness should be pointed out here because it is crucial to the discussion at this point. As the size of the region analyzed increases, the relative importance of exports declines, and the significance of other growth stimuli (for example, those autonomous influences mentioned previously) will increase.

Cumulative causation models

Myrdal (1957) argues that the interplay of market forces normally tends to increase, rather than to decrease, the inequalities between regions, and predicts a divergence of regional per capita income[3]. He suggests that market forces lead to the clustering of increasing return activities in certain geographic areas, and that this build-up of economic activity becomes self-sustaining because of increasing internal and external economies at the centres of agglomeration. Thus the limited advantages of backward regions (their cheap labour) are insufficient to offset agglomeration advantages.

Growth in prosperous areas has two kinds of effect on the rate of growth of lagging regions: spread (favourable) effects and backwash (unfavourable) effects. The former include markets for the (usually primary) products of the lagging regions, and the diffusion of innovation. Usually, however, these are outweighed by backwash effects, particularly by disequilibrating flows of labour, capital, goods and services from poor to rich regions. Therefore,

according to the cumulative causation model, free trade in an inter-regional system operates to the disadvantage of poor regions, inhibits industrialization in these areas and distorts their patterns of production.

These views are difficult to translate into a formal model which can be tested. Kaldor (1970) varied Myrdal's model, and argued that the principle of cumulative causation is nothing more or less than the existence of increasing returns to scale in manufacturing[4]. When trade is opened up between industrializing and rural regions in a free trade economy, such as a system of regions, increasing returns favour the rich regions and inhibit development in the poor ones. Because of scale effects, the rich regions gain a virtual monopoly of industrial production. However, since competition in manufacturing industry is imperfect while near perfect competition prevails in agriculture, movements in terms of trade favour the rich regions. This could, in part, explain the rural-urban dichotomy that exists in Australia. As a theory of regional growth it includes both internal and external factors.

Shift and share analysis

A region's growth potential has been related to its industrial structure in a number of works which use an analytical procedure known as shift and share analysis (Stilwell 1969; Stilwell 1970; Kerr 1970). Shift and share analysis is more a method of analyzing regional growth than an actual theory. It is a technique which compares regional growth with growth in the state or nation, for each industry, and identifies the relative importance of an industry's contribution to a region's growth or decline.

Using shift and share analysis, and using employment as a measure of growth, it is possible to isolate three components of regional growth rate differences.

First is the regional share (or national growth) component, which may be regarded as the amount by which total employment in the region would have grown during the period studied if it grew at precisely the same rate as total employment in the nation as a whole.

Second is the proportionality shift (also called the industrial mix or composition effect) component, which may be thought of as the extra amount by which employment in the region has changed as a result of specializing in nationally fast-growing or slow-growing and declining industries. This shift will be positive in the former case and negative in the latter case.

Third is the differential shift (also known as the regional or growth effect) component, which reflects the extra amount of employment growth in the region resulting from employment in each industry in the region growing at a faster or slower rate than its national growth rate. A region in which employment grows faster than its industrial mix suggests, would feature a positive differential shift, while the shift would be negative in the case of a region in which employment grew more slowly than its industrial mix suggests. It is important to appreciate that proportionality and differential effects are quite distinct phenomena. To understand the proportionality effect, we need to focus on forces affecting the composition of output on the national scene. Dominant among these are productivity changes on the supply side causing resource transfer from low to high productivity sectors and income elasticities of demand on the demand side. It is then necessary to analyze the advantages of each region for the national fast-growing or slow-growing regions.

The differential effect is explained by the fact that some regions gain over time a relative advantage compared with other regions in their access to markets and/or to inputs for specific industries. In this instance a detailed analysis of local factors is required. If one argues that regional growth is solely a function of a region's industrial mix, then the proportionality shift should be of major concern.

Input-output analysis

Like shift and share analysis, input-output analysis is incomplete as a theory of regional growth. The input-output model treats regional final demand as exogenous, whereas a satisfactory theory would need to determine the growth path of final demand. Consequently, the input-output model would need to be combined with some other theory or model (one capable of projecting final demand) before it would be capable of explaining regional growth and development satisfactorily.

The input-output accounting system provides a framework for measuring the flows of current inputs and outputs between the sectors of the regional economy. Since inter-industry analysis is concerned with interrelationships arising from production, the main function of inter-industry accounts is to trace the flows of goods and services from one productive sector to another. A detailed description of input-output analysis is presented in Chapter 9.

Growth pole theory

Richardson (1973) argues that any consideration of regional growth theory must start from the explicit introduction of space and distance into the analysis, both in the sense of distance separating regions in the interregional system and of spatial differentiation within regions. To this end he uses the concept of growth poles, which are defined as spatial agglomerations of population and economic activities which are conducive to regional growth. Capital cities and provincial cities are examples of growth poles, where there is concentration of activities and services.

A number of writers have argued that growth pole theory, like the Bible, often means very different things to different people. Should the growth pole concept be applied to geographic space or to economic space? Further, regional planners in different countries with dissimilar problems of economic development have used the term growth pole to describe centres of very different size. For example, in some countries a growth pole may be defined as an urban-industrial centre with a size of half a million, but in another economy it might mean a service centre in a rural region of less than 40,000 population.

Despite these apparent shortcomings, the growth pole concept does contribute to a better understanding of the factors affecting regional growth than do the other theories. And, more importantly, it plays a crucial role in Australia's regional policy, through the emphasis it places on growth centres. A fuller discussion of growth pole theory and its implications for Australia is undertaken in Chapter 6.

Determinants of urban growth in Australia

There are five possible explanations for the patterns of urbanization that have occurred in Australia.

Economic base theory

Urban (economic) base theory postulates that the determinants of urban growth are due to demand from anywhere outside the boundaries of the urban centre. In other words, the amount of exports of goods and services from an urban area determines its growth. But the theory does recognize that some economic activities in an urban area are locally oriented. Thus, explanation of

overall urban trends requires consideration of the relationship between the growth of export and local services sectors.

However, there are a number of fundamental objections. The central theme, that exports produce growth, is objectionable because cities can grow through other expenditure injections into the local economy, such as autonomous public authority expenditure. Urban base theory also ignores some aspects of interdependence between different cities and regions. A more radical objection to urban base theory in the Australian context is that much of the export trade through the ports is composed of produce originating outside the urban areas.

City size

Another view often taken is that city size is the main determinant of the rate of urban growth. It is argued that urban growth is inhibited until a minimum threshold has been crossed, after which the growth rate accelerates and becomes self-generating. Thresholds can be measured by a number of variables, such as population, income and gross regional product. This view is similar to Myrdal's cumulative causation hypothesis.

There are a number of reasons why large cities should enjoy growth rates faster than small cities. First, large-scale economies are said to exist in the use of social overhead capital (for example, public transport, roads, sewerage, electricity), and in the size of the local market in large urban centres. Second, there are advantages of access to a metropolitan labour pool and to developed capital markets. Third, there are the benefits of initial advantage (having been established longer). All these are called localization or external economies. They should, however, be distinguished from urbanization economies, which include scale effects in the provision of urban government services, in private business services, and in social, cultural and leisure facilities.

In effect, agglomeration tendencies (i.e. indivisibilities, external and urbanization economies) are a source of urban growth through cost reductions and efficiency gains. Yet, when an attempt is made to measure the impact of agglomeration effects, problems arise because there is almost no agreement on how these are defined. Richardson (1973) considers a population measure, an industry growth rate, and rent and transport savings as ways of measuring agglomeration economies, but none of these is completely satisfactory. He concludes that the only way that a suitable measure will

be arrived at is by disaggregating agglomeration effects into social, household, and industrial agglomeration components[8].

Shift and share analysis

Stilwell (1974a) has carried out a shift and share analysis of employment growth for urban and non-urban areas in Australia between 1954 and 1966, in order to indicate some reasons for rapid urban growth. He uses demographic data to measure the degree of urbanization in the belief that there is a more direct link between many of the social problems of urbanization (for example, congestion) and population growth than between many of these social problems and economic growth. The results of Stilwell's shift and share analysis indicated the extent to which industrialization is an important economic determinant of urban growth in Australia.

Central place theory

It can be argued that a city will grow as a result of supplying goods and services to the surrounding hinterland. This is referred to as central place theory. This theory was not discussed previously because it is not strictly a regional growth theory. However, it is used to explain the spatial ordering of urban services, and consequently it may be useful in explaining urban growth. It is discussed in detail in Chapter 6. In short, central place theory postulates that the growth of an urban centre is a function of its hinterland size and income levels within that area, and that large cities do not necessarily specialize in goods with broad market areas as the theory claims. Consequently, internal growth-generating forces and interregional trade are ignored by central place theory.

But the theory may offer some insights into the differences in growth rates among the various state capitals. McCarty (1970) argues that the size and rate of growth of the capital city depends on the wealth and rate of growth of its rural hinterland (or region), and on its ability to dominate the trade, transport, finance, manufacturing, government and other urban activities within its state or nation. He attributes the rapid growth of Melbourne and Sydney to their large productive hinterlands and the absence of important urban rivals, but blames Hobart's slow growth on its small and relatively stagnant hinterland.

Although this may be a recommendation for central place theory's ability to explain urban growth, the theory has a major

failing in that it does not distinguish between causes and effects of urbanization. The growth of hinterlands may be restricted by the size and facilities of their central places, just as the growth of central places depends in part on their hinterland size. It is important to note that in Australia the establishment of urban centres actually preceded hinterland development (Glynn 1975)[3].

Attraction theory

The theories of urban growth considered so far could be termed demand-oriented. However, if it is accepted that in the long run the city's capacity for growth is determined less by export sales and more by the in-migration of labour and inflows of capital, then there is a need for a theory which relates growth of cities to their ability to attract resources from outside. Neoclassical economic theory regards resource flows as responses to price differentials. Thus the fastest-growing areas would be those in which the monetary return to capital and labour is highest. However, this cannot be determined as there is a lack of data to indicate how capital moves in Australia. Moreover, migration from rural to urban areas cannot be attributed solely to wage differentials. Migration trends will be considered in Chapter 7.

Emphasis on the neoclassical view obscures the influence of non-economic elements. For example, Richardson (1973) suggests that there is a need to develop some method of representing the influence of friends and relatives in causing people to migrate. As we saw in Chapter 1 cities also have highly-developed labour markets and wider job opportunities to attract migrant workers. The metropolis often has the variety of amenities, cultural and leisure facilities necessary to attract business people, scientists and other professional workers from other regions. Large cities are also looked on with favour by outside investors, particularly in consumer goods and service industries, where access to a large metropolitan market reduces risk (Goodall 1972)[4]. Large cities also tend to be the leading centres of innovations.

Supply theories suggest that growth in large cities tends to be self-generating, particularly because agglomeration economies give the large city a great advantage in obtaining additional growth inputs from outside.

A possible synthesis

Each of the above theories offers a partial description of the urban

growth process in Australia. In addition to the factors discussed by each theory, there are other factors, historical and institutional, which we suggest are of crucial importance in explaining urban growth in Australia. Taken together, all these factors provide a comprehensive description of the Australian urban growth process.

Urbanization in this country developed in advance of rural settlement. As a result, no other major population centres developed to rival the state capitals. Moreover, the federal political system was such that while it prevented any one capital city from becoming dominant, it reinforced the dominance of each metropolitan area within its own state. However, as mentioned in Chapter 1, certain types of non-metropolitan urban centres are now gaining an increasing share of the population.

Transportation technology has had a significant influence on urban growth in Australia. As the population was spread thinly beyond the existing metropolitan areas, those metropolitan areas became the railway nodes. Then, since the railways were the major medium of transportation, both industry and residents tended to locate around the nodes. Because of the spatial inflexibility of rail travel, this tendency to central location was reinforced.

Modern developed society is such that flows of both labour and capital resources are biased towards the major cities. This increases both the quantity and quality of labour and capital in these areas, thus enhancing the urbanization process. Part of Sydney's and Melbourne's rapid growth relative to the other capital cities and the non-urban areas can be explained by their quantity and quality of job opportunities, though the dominance of Sydney and Melbourne relative to other capitals has decreased in recent years.

The industrial specialization of the metropolitan centres has given them cumulative advantages in securing a rising share of the nation's economic growth. Myrdal's theory is appropriate for explaining the continued dominance of the industrial-oriented metropolitan centres over non-metropolitan areas. Closely associated with industrial specialization and metropolitan centres, are the agglomeration economies (indivisibilities, external and urbanization economies), which, it is argued, partly explain why cities enjoy faster growth rates. We have no reason to doubt the applicability of this argument to Australian cities. The major question that arises in this context is at what stage of the growth process do these economies turn to diseconomies?

Notes

1. See Richardson (1973, Chapters 2 and 3) for a more detailed discussion of regional growth theories.
2. Chapter 9 deals with the various ways of undertaking an impact analysis, of which economic base analysis is one method. Economic base analysis attempts to measure the change in regional income which occurs as a result of change in the economic base, i.e. in the export sector of the region.
3. Jacobs (1972) also argues that rural economies, including agricultural work, are built directly upon city economies and city work.
4. Access to markets is one of the determinants which influences the location of a firm. Location theory is discussed in Chapter 6.

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Questions for Discussion

1. Using the theories of regional and urban growth outlined in this chapter, what are the major determinants of growth in the region where you live?
2. What influence would varying rates of national economic growth have on growth rates in metropolitan and non-metropolitan areas?

5

Regional Decline and Stabilization in Rural Areas

From regional growth we now turn to regional decline. Earlier, as a first approximation, we defined decline in terms of a decrease in population. In this chapter we shall identify the main determinants in the rural regional decline process, and then examine the nature of economic instability in rural regions. It is argued here that the stabilization problem depends to some extent on the degree of interaction between the rural and non-rural sectors within a rural region.

The decline process

It is tempting to suggest that the process of decline can be expressed simply as the opposite of growth. That is, that the factors causing regional decline are similar in nature but opposite in effect to those causing regional growth. However, it is one thing to say that decline is negative growth, but is quite another to specify the two processes in terms of the same path. Furthermore, since the growth of Australian rural regions took place towards the end of the last century as a result of the expansion of primary production, it is also quite tempting to frame the concept of decline in terms of export base theory. Though this theory may well be relevant in explaining the extent and character of growth in these regions during their development stages, it may not be as useful in explaining and predicting the behaviour of declining regions.

So far the term "regional decline" has been used. However, in order fully to understand the process of decline, it is essential that it's components are stated explicitly[1]. There are both rural and urban components of decline[2]. As we saw in Chapter 1, in Australia

the places that are experiencing decline are usually agriculturally-based areas. These areas may consist of a small town (i.e. an urban area) which provides goods and services for the surrounding rural area. Almost without exception, the predominant reason for the existence of the country town in Australia is the servicing of primary industry activity such as agriculture, fishing, forestry or mining in the surrounding area. Such small country towns, dependent as they are on servicing agriculture, are likely to continue to wane as agriculture declines further in importance in the national economy. The rural component of the region produces goods which are not normally consumed in the town, but are often sold in markets situated outside the region. Farmers demand goods and services from the local town, and also from a large number of areas outside the region. In other words, a number of relationships or linkages exist between the rural and urban parts of a region. Consequently, in order to appreciate the decline process, the relationships between the urban and rural regional components must be understood.

It is also necessary to make this urban-rural distinction because a situation may exist where the rural sector of a region is experiencing an increase in agricultural output but the urban component is declining. In other instances both the rural and urban components are undergoing decline. Conversely, both components of the region might be growing. It is incorrect to assert that all agriculturally-based regions are undergoing decline. Regions producing agricultural products for which demand is high experience growth in both rural and urban components. But in regions producing an output for which demand is low, decline occurs in both components. Therefore, it is important to distinguish regions according to the type of output produced.

In our view, a model which seeks to explain the decline of small country towns should examine at least three factors: the behaviour of intersectoral linkages over time, the nature of regional consumption for these areas, and the role of capital. There are other factors that contribute to the decline process, but we consider these three determinants to be the most important.

Intersectoral linkages

Decline should be viewed in the light of the linkages that exist between the sectors (or industries) of the two spatial (rural and urban) components of the region. We can use the work of Isard and Czamanski (1955) to construct a framework for the analysis

of rural regional decline. Before we do this, however, we need to define the multiplier concept.

The multiplier is the number by which an initial independent change in spending in the nation or a region must be multiplied in order to determine the resulting change in national or regional income. For example, suppose that a $1 million project is undertaken in a region. Construction workers are hired and materials are bought; in the process the $1 million is spent. This money is income to the workers, material suppliers and others involved. These people, in turn, will purchase consumption goods and further supplies. The amount spent would become income to others. This secondary group of recipients would also make further expenditures. The amount spent would become income to a third group. This has pushed the recital far enough: the flow-on effects of the initial spending can easily be seen. In Chapter 7 we shall look in more detail at the concept and application of multiplier analysis.

Isard and Czamanski developed a model which was primarily concerned with explaining long-run urban growth. The model builds upon the postulation that economic development and population change are interdependent[3]. This model is relevant for a discussion of rural decline because it divides industries or sectors into three categories, which highlight the relationships between rural and urban components of a declining region. The three categories are geographically-oriented industry, complementary industry and urban-oriented industry.

Geographically-oriented industries are those industries whose location is strongly influenced by geographical factors. In this group fall extracting industries (those which are resource-oriented), processing industries, and industries which depend on a large supply of, say, good water, or soil. The primary producer most certainly belongs to this category. Complementary industries are those for which the main location factor is the presence of other industries. In this section are placed industries which provide goods and services for the geographically-oriented industries. This classification includes firms in the local town that supply farm inputs. Urban-oriented industries are industries for which the existence of the city or town is the main locational factor. In the case of the country town this includes establishments like cafes, service stations, clothing and food stores, and schools.

Given these three broad industry classifications, let us now look at the process of regional decline in terms of negative multiplier

or flow-on effects. We begin by assuming that there is a drop in demand for goods supplied by the region's primary producers. As a result of this, the farmers are forced to put off part of their casual labour force. Unless these employees are absorbed into the urban workforce, it will be necessary for these unemployed farm workers to leave the region, causing a fall in the population level. This initiates the process of regional decline since these workers and their families would have spent some of their income in the town. Other immediate effects include a reduction in farm expenditure on consumption goods such as food and clothing in the urban-oriented industries.

In order to attempt to decrease costs, the farmers can compensate for the reduction in demand by substituting capital for labour. Depending on whether they buy the capital goods within or from outside the region, this reduction in demand for the farmers' product could initially have a favourable effect on certain complementary industries in the town (those that provide harvesters, for example) thus increasing levels of employment and reducing outmigration.

If the level of demand for primary products in the region continues to decline, then adverse effects will start to be felt in the complementary and urban-oriented activities. In the former there will be reduction in demand for goods such as fencing wire, fertilizers and crop sprays. Some people employed in these activities will thus become unemployed, and, if they cannot find alternative employment, may be forced to leave the region[4]. This in turn will have an effect on activity in the urban-oriented industries. Firms likely to be affected first are those which sell conspicuous consumption goods such as jewellery, expensive clothing, certain automobiles, and such durable goods as colour televisions. The next type of industry to be affected in the complementary industry sector would be the firms selling such farm capital goods as tractors, farm machinery, building equipment and trucks and utilities. In turn, this too has a negative effect on employment in the town.

Thus we can see the intersectoral manner in which decline might proceed.

Regional consumption

So far it has been assumed that there has been some decline in the primary industries of the rural areas (the geographically-oriented industries) which then triggers off further decline in the

urban area of the region. But decline may, in fact, occur autonomously in the urban component of a country region. This could happen as a result of a change in the nature of regional consumption. As mentioned in Chapter 1, there appears to be a preference among consumers in rural areas to buy consumer durables and larger budget items from the major provincial cities. Many of the traditional local suppliers of goods and services have relocated towards these provincial cities. This implies that the local marginal propensity to consume is small and could be expected to fall even further over time. Consequently, even if there was an increase in economic activity in the geographically-oriented industries, very little of this could be expected to generate increased local spending. The composition of the population may also have an important bearing on the types of goods and services demanded in the region. Since a significant proportion of people leaving rural areas are teenagers, we can expect the range of goods and services demanded by these people to decline at a faster rate than the goods and services other age groups tend to demand.

The role of capital

The part played by capital fixity (i.e., immobility of capital in a spatial and functional sense) in regional decline should be mentioned briefly. Neoclassical theory suggests that capital moves across space in response to changes in regional rates of return. But capital fixity (both functional and spatial) poses a chronic and virtually insurmountable problem for declining regions. For example, a farm, a meatworks or a general store constitute highly specific and immobile capital. When the value of capital (measured either in terms of opportunity cost or discounted future earning capacity) is gradually being eroded, as happens when a region is in decline, the owners of the capital tend to become locked in. These owners of capital, under present institutional arrangements, have no option but to stay with the business in the hope that economic conditions will improve for them. The implication is that this locking-in effect is more severe and more likely to occur in rural than in metropolitan areas. Capital fixity is in the first instance a result of decline, but in later stages can actually accentuate the effects of the process of decline by making rural areas less attractive to potential investors.

Instability in rural regions

Historically, rural regions have been subject to large fluctuations in their regional business cycles. Moreover, there has been great diversity in the cyclical patterns of regions. A number of theories have been used to explain these regional cyclical differences, and these are discussed shortly.

A business cycle can be defined as a phenomenon which describes the fluctuations (ups and downs) in economic activity over time for a particular economy. Most people today are aware of the national governments attempts to stabilize the economy in the hope of minimizing some of the adverse economic and social effects of boom and slump conditions. However, there is no reason to believe that fluctuations in regional and national economic activity, as measured for example, by the unemployment rate, to be of the same magnitude or even being in the same direction at a particular instance. For example, each region has a different industrial composition which will make its sensitivity different when changes in business conditions take place in the country as a whole.

To specify clearly the variables that contribute to a region's business cycle is an almost impossible task, as a large number of factors will have a bearing upon the way in which the level of economic activity of a given region will react to a sequence of events taking place within the nation. However, the following are suggested as being of some importance: the proportion of local consumption and investment that is imported, the magnitude of the region's propensity to consume, the industrial composition of the region, and its rate of growth.

The industrial composition approach regards the business cycle as a national-industrial phenomenon, and regional cycles as the local manifestations of cyclical changes in national industries. This method imputes to each regional industry the national average change in activity in that industry. There are a number of theoretical objections to this approach, the most important of which is that the hypothesis assumes that industries are homogeneous regionally, that the characteristics of a particular industry in, say, regions 1 and 2 are carbon copies of its characteristics in the national economy—an assumption which is patently false.

Another approach assumes that cyclical stability is a function of the degree of regional diversification. It is argued that diversified regions are cyclically more stable than highly specialized ones. A

high degree of diversification implies a low marginal propensity to import, and thus to some extent the region is insulated from downturns in national demand.

A third approach argues that regional growth differentials play a major role in accounting for the diversity of the cyclical patterns of regions. Larger downturns in the cycle than expected will occur in slow-growing regions, while rapidly-growing regions will experience smaller declines than predicted on the basis of industrial composition. For example, growing regions will attract more efficient, lower-cost firms, which, having lower costs, will be better able to continue their operation when business activity declines.

Finally, the economic base concept is sometimes used as a method of regional cyclical analysis. The base, which consists of the export sectors serving national and international markets, imports outside disturbances and transmits them to the region. This phenomenon causes fluctuations in regional income payments which affect local business and service activities. The importance that exports play in fluctuations in regional economic activities becomes more significant as the size of the economy considered decreases. It is also essential to know whether or not the export sectors of a region are made up of stable or unstable industry groups. The economic base concept is further elaborated in Chapter 9.

Which, if any, of the above approaches are relevant for a discussion of rural regional instability in Australia? The export market for products of the rural sector is extremely unstable, and this accounts for the rapid fluctuations in regional business cycles. So to some extent the economic base concept is applicable. However, this is not the complete picture.

The first section of this chapter stressed the importance of intersectoral linkages in understanding the decline process. A similar understanding is essential in examining the nature of rural instability. In order to gain a broader understanding of the nature of rural regional business cycles it is also necessary to examine in some detail the linkages that exist between non-primary and primary industries in the same region.

Figure 6 illustrates the linkage effects external and internal to a rural region. Powell and Mandeville (1978) disaggregated a region's non-primary industries into twenty sectors, and measured their dependence on the level of activity in the primary industries. Their research study was of a typical Australian wheat-sheep region. They found that a significant number of industries in the

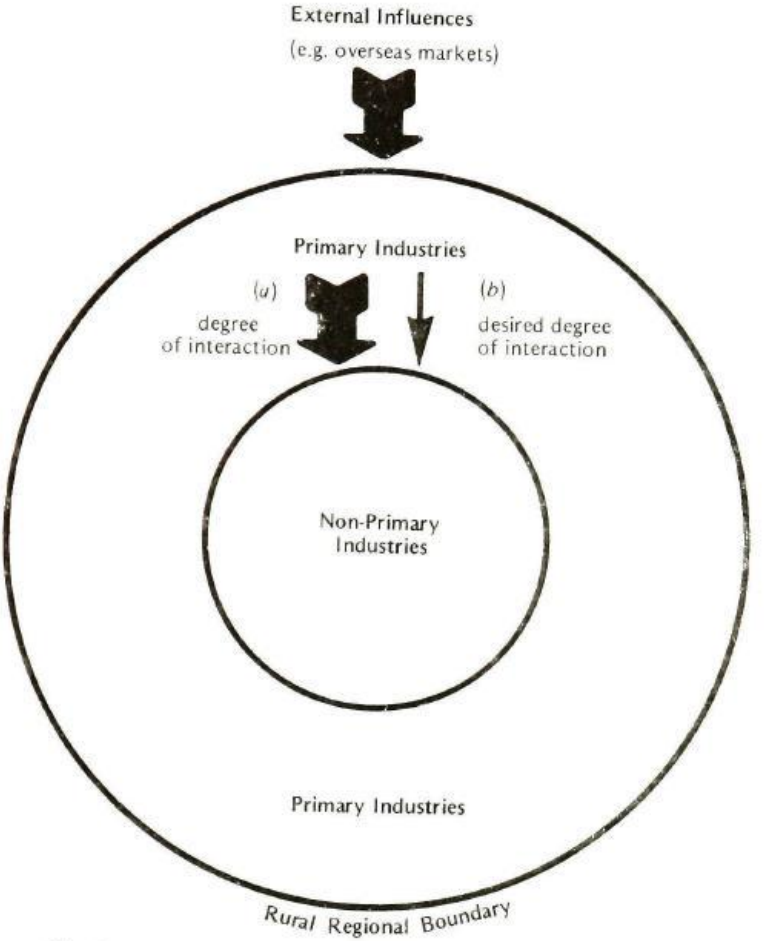

Fig. 6. Linkage effects external and internal to a rural region

non-primary sector depended to a large extent on the level of economic activity in the primary sector. The extent of this type of interaction is indicated in figure 6 by the heavy arrow (a).

From the point of view of the regional planner, the purpose of an analysis of rural regional instability is to indicate policies that can decrease the instability. The Powell and Mandeville (1978) study has implications for rural stabilization policy. It suggests that while it is perhaps desirable to attempt to develop industries in rural regions that serve the primary sector as either input suppliers or processors of outputs, this increases the susceptibility of the

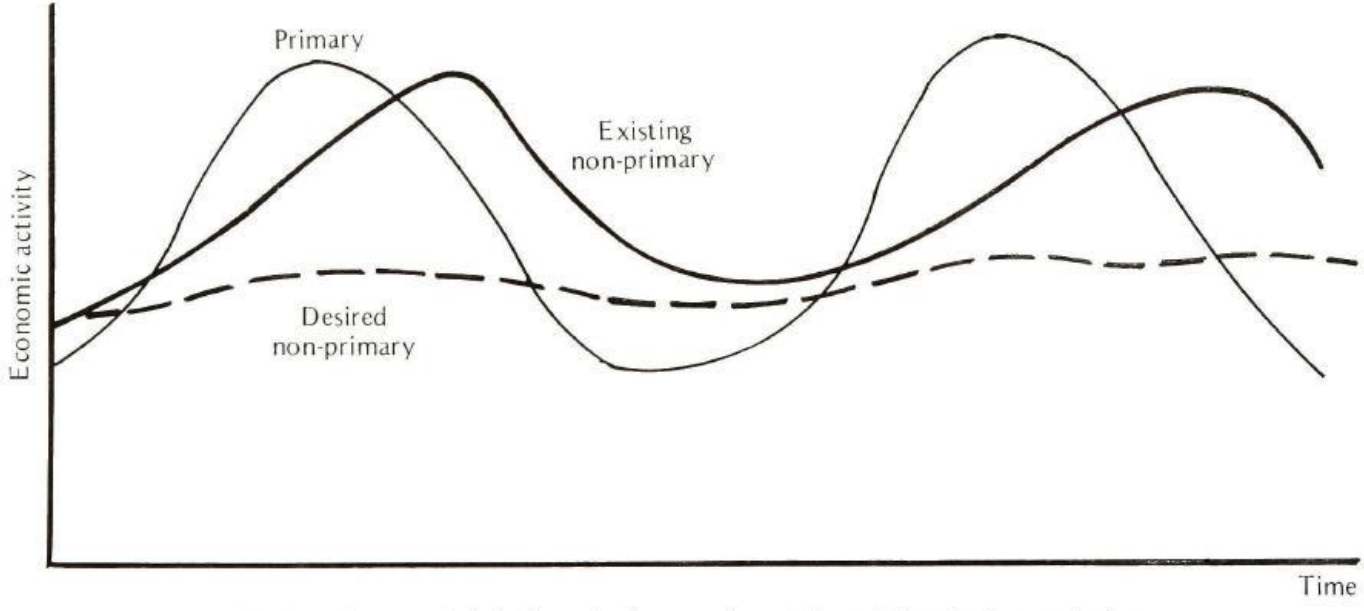

Fig. 7. Business cycle behaviour of primary and non-primary industries in a rural region

whole region to fluctuations in the primary sector. Consequently, development in the non-primary sector should be concentrated on those activities which have minimal contact with the primary sector. In the context of figure 6, the policy objective is to decrease the strength of primary–non-primary interactions, as illustrated by the thin arrow *b*. An alternative method of representing the relationship between the primary and non-primary sectors is illustrated in figure 7, where the unbroken lines represent the frequency and fluctuations of the business cycle for the primary and non-primary sectors. The primary sector, having a strong influence on the non-primary sector, causes the latter to fluctuate in a manner similar to itself. In the interest of regional stabilization, a decrease in the dependence of the non-primary sector on the primary sector should result in regional business cycle behaviour in the non-primary sector similar to that indicated by the dotted line in figure 7.

Notes

1. The decline process was first studied by Dr R. Jensen. It was he who suggested that the nature of intersectoral linkages in a declining region should be examined. At present Dr Jensen is working on a more complete examination of regional decline (Jensen, R. C. and Powell, R. A., work in preparation).
2. This is not "urban" as defined by the Australian Bureau of Statistics, where an urban centre must contain 1000 people or more. The term is used here merely to imply a distinction between the country town and the surrounding rural area.
3. Whereas it was argued previously that population change (out-migration) was the easiest measure of regional decline.
4. Though, due to strong community ties, some unemployed people may not leave the region.
5. See Richardson (1972, pp.275-81) for a more detailed discussion of these theories.
6. The method of analysis was input-output, which is considered in Chapter 9.

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Further Reading

Regional Decline

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Regional Business Cycle Behaviour

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Questions for Discussion

1. Is it correct to equate regional decline with rural decline?
2. The emphasis in this chapter has been on decline in rural areas. This decline has been associated with a decrease in the proportion of the work force employed in the agricultural sector. In fact, the structure of the Australian work force is changing over time (see Table 6). Manufacturing is now beginning to employ a smaller proportion of the total work force. Since the industries of this sector are located predominantly in certain urban areas, decline may become more widespread and complex than it has been in the past. Discuss.

PART 3

Towards Analyzing and Solving the Problems

6

Moving the Work

Recent debate has suggested that depressed areas are likely to become more common in Australia (Holmes 1977). In other words, there may in future be a greater incidence of regions with above average unemployment rates. Thus there is greater urgency than ever for planners to find ways of dealing with the problems of such regions.

There are two broad approaches to planning for areas with widespread unemployment—either the unemployed people can be encouraged to migrate to more prosperous regions where labour is in demand, or employment opportunities can be encouraged in depressed regions.There are a number of criticisms of migration policies, the most serious of which is social rather than economic (Hoover 1971). Is it better to move work to the people or people to the work? This is commonly referred to as the work-to-workers or workers-to-work debate. Of course, in reality the two are interrelated, but for the moment they can be treated as separate issues. For the present we are concerned with moving work to the workers, while chapter 7 considers factors affecting migration.

Before we can consider ways in which economic activity can be encouraged in depressed regions, we need to understand the main factors that affect the location of business and industry. In this chapter we shall first consider this, the micro aspect of location theory, before turning to the broader, macro aspect, which considers whether there are any general locational laws at work influencing the dispersion of economic activity over the nation as a whole. We shall then discuss the measures adopted by governments in Australia to influence the location of economic activity, in

particular, decentralization policies and the fostering of growth centres.

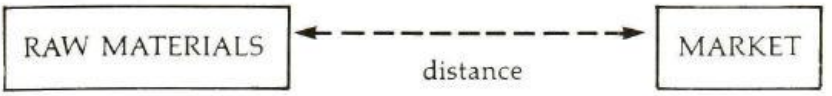
Location theory

There are a number of important factors that individual producing units—businesses, industries or firms—take into account when making a decision as to where they will set up their enterprises. These factors include the cost and availability of transport, and the relevant state government regulations and charges; access to markets and suppliers; telephone and telegram charges; servicing and maintenance of facilities; education facilities, i.e. access to universities, technical colleges and good schools; wage levels, productivity, turnover, absenteeism, and the availability of labour; the cost of land and buildings; housing for employees; property taxes; the nature and extent of government assistance; and the cost of public services such as water, electricity and gas supply, noxious waste disposal, and industrial fuel (Report on Industry Location Survey 1969). As a rule location models focus on some of these factors.

Location theorists are usually concerned with the optimum location of firms in economic terms. Their aim is to develop a theory which can both explain why firms and industries locate where they do, and predict where firms and industries will locate.

The original work on location theory, termed the least cost approach in the literature, was developed by Alfred Weber (1928) and others during the nineteenth and early twentieth centuries. These writers made the following simplifying assumptions in order to isolate major variables for analysis: first, that sales revenue is constant over all locations; second, that firms are profit maximizers; and third, that production costs are constant over space. Given these assumptions it could be argued that firms will choose a location where costs are least.

The main contribution of the least cost approach was its emphasis on the impact of transportation costs on location. It is useful to concentrate on transport costs since these vary in a patterned manner over space, whereas, for example, labour costs vary in no regular fashion. The simplest of the least cost approach models assumes that firms have a market at one location and a raw material source at another.[1]



The optimum location point is where transport costs are minimized, given that transport costs are some function of distance and weight.

Although the assumptions clearly create a highly simplified model, several predictions can be made from the model which tend to be consistent with the behaviour of firms for which transport costs are a high proportion of total costs. First, if the production process involves a loss of weight (e.g. ore refining), loss of bulk (e.g. sugar from cane), or a decrease in perishability (e.g. fruit canning), the firm will normally locate close to the raw material source. Second, if the process involves a gain in weight, bulk or perishability (e.g.brewing), the firm will locate close to the market. Third, location between the market and the raw material source will not in general occur since freight rates per mile diminish as distance increases, which makes one long haul cheaper than two hauls over the same distance. Moreover, location between the market and the raw material source would result in the payment of both loading and unloading charges for both raw materials and finished products, rather than for just one of them. The important exception occurs when there are transhipment points between the source of the raw material and the market. Goods brought by water must be taken off ships and put on truck or rail and vice versa, thus providing the opportunity to process materials after they have been taken off one carrier and before they are put on another. This factor partially accounts for the growth of ports.

The economists who built upon Weber's work on location (Isard 1956; Losch 1954) attempted to make the model more realistic by introducing several markets and raw-material sources, by removing the assumptions of equal production costs and equal sales revenue over all locations, and by relaxing the assumption of profit maximizing behaviour of firms. Their work has provided insights into relevant location factors, but as yet no universal theory of location encompassing all industries has been formulated.

Smith (1966) developed a model which is concerned with establishing the profit maximizing location of the firm. It considers how both costs and revenue vary over space. He derives a space cost curve and a space revenue curve and combines them so as to obtain the profit maximizing location.[2] The space cost curve

shows how costs of production vary over space for a constant level of output. The curve is similar to the firm's normal cost curve in some respects. Basic costs refer to the cost of producing a given level of output irrespective of location, which is similar in nature to the fixed costs for the normal cost curve. Locational costs relate to the "spatial premium" in the costs of productive factors over the basic costs and/or additional costs (transport) incurred in bringing production inputs to the factory location. Figure 8 indicates a space cost curve, with the source of an essential raw material located at point X. Locational costs are at a minimum at X and rise proportionately with distance from X. The steeper the gradient of the cost line, the more localized the plants are likely to be. For example, a footloose industry would have an almost horizontal average cost curve. The importance of this model is that it indicates spatial variations in average production costs.

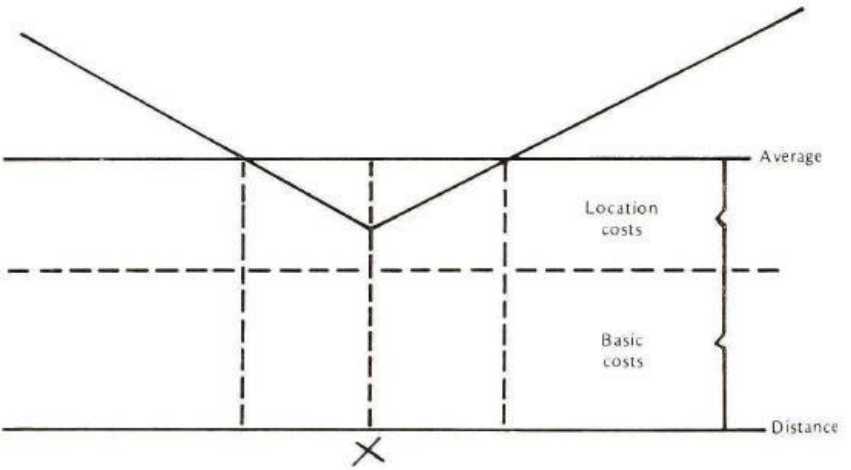


Fig. 8. Space cost curve (*Source:* adapted from Smith 1966)

Revenue variations over space can perhaps best be seen in terms of demand. There are a number of factors which are likely to cause quantity and quality variations in demand over space. The distribution of population, for example, is one such factor. Since population is not evenly distributed, demand will vary according to the characteristics of the people living in a particular region. For

example, we would expect the demand for disco-type entertainment to be higher in a region with a relatively young population than in an area where the population is relatively old. Another important factor is demand elasticity. The total receipts of a factory depend on the elasticity of demand over the whole range of locations between the factory location and the boundary of the market area. Then there is the structure of transport costs to consider. For goods where freight charges are a high proportion of the market price, interregional differences in transport rates may cause location on demand grounds in one region rather than another. In regions with costly transport structures, it is necessary for a factory to locate at a point where demand is greatest in the vicinity of the factory.Other factors affecting demand would include the interdependence amongst firms and the spatial distribution of resources.

A spatial demand cone reflecting some of these variables is shown in Figure 9. *B* is the factory site within a city where revenue

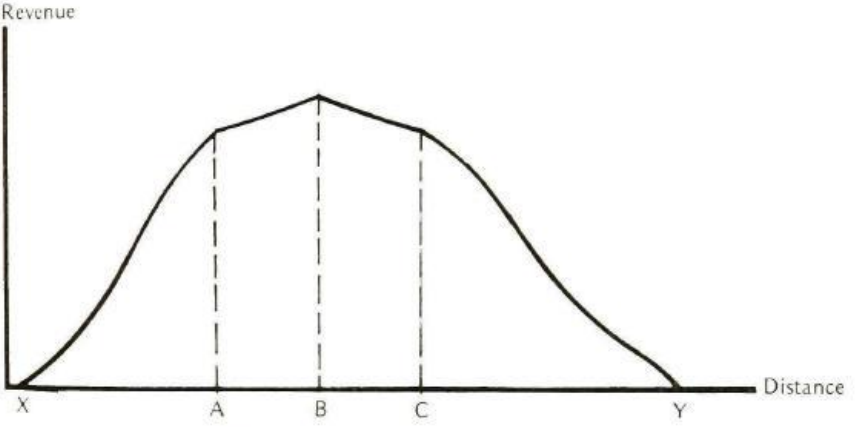


Fig. 9. Spatial Demand Cone (*Source:* adapted from Smith 1966)

is maximized. In the surrounding zone, *AC*, revenue decreases slightly. *X* and *Y* are potential factory locations situated at such a distance from the city and surrounding area of influence that the demand for the products of these firms would be zero. The shape of the cone is explained by such factors as population densities, the spatial distribution of average income, and transport rate structure.

Central place theory

Having considered some of the factors which affect the location of the individual producing unit, it is now appropriate to look at general factors which affect the spatial structure of regions. Central place theory is the most significant of these general spatial theories.

Central place theory seeks to relate central places to their hinterlands. It defines a central place as a settlement providing services for the population of its hinterland[3]. The essence of the theory is that a certain amount of productive land supports an urban centre. The centre exists because essential services must be performed for the surrounding land. These services can be ranked in higher and lower orders depending on the demand threshold and the range of demand. In turn the number and size of central places supplying each service is determined, and hence a place hierarchy develops.

A concept with an important role in central place theory is that of the range of a central good. The market range of a service activity is that distance which people are willing to travel to reach the service; it is the outer limit of the market area for the service activity beyond which people will look to another centre. The market range may be a simple function of linear distance, but will more likely be influenced by time, cost and quality of the service. Range may vary between centres according to such factors as the size and importance of the centre and the income level of the hinterland. Threshold demand implies that there is a minimum size of market below which a centre will be unable to supply a central good. Population may be used to determine at which point a threshold is reached. For example, it may require 300 people for a corner shop but 2000 for a movie theatre. This concept is considered in detail later.

A number of simplifying assumptions are usually made in central place theory. The landscape is assumed to be an even plain with a uniform distribution of natural resources and an even spread of population. Also, central places provide goods and services of fixed sizes for the surrounding hinterland, so that any two central places supplying the same centralized services will be surrounded by hinterlands of equal size. If these circular trade areas are packed into a plain, certain vacant spaces will remain unserved. If we require that all consumers should be served, then the circles must overlap. However, if we assume that consumers are rational, then

they will visit the closest store to save transport costs. The areas of overlap will be bisected and the trade areas will become hexagons (Losch 1963).

Empirical evidence in the United Kingdom (Glasson 1974) lends support to the existence of central place hierarchies. However, a number of criticisms should be noted. A fundamental flaw is that the theory assumes a uniform distribution of population, which simply does not occur in reality. Moreover, the theory has been criticized for its static approach in identifying the relationship between centres and their hinterlands at one point in time, but failing to take into account the evolutionary process of the spatial structure. Improvements in transportation, for example, will alter the size and shape of market areas (Ullman 1941). The rigidity of the hexagonal trade areas is another problem. However, Mills and Lav (1964) have argued that the emergence of hexagonal market areas is not critical to a central place hierarchy model, thus making the theory less rigid and more applicable to reality. Finally, there is the problem of actually ranking central places. This involves the dual problem of the identification of central places—which Glasson (1974) points out may be confused by the problem of urban sprawl—and the choice of criteria to rank the centres, since population alone may be an incomplete measure of centrality.

To date, most discussion of central place theory has been concerned with whether perfect hexagonal market areas aligned in equally perfect hierarchial structures exist. A fuller appreciation of the economic concepts behind central place theory will render it a more useful tool. This is where the concept of threshold becomes important. The question that one should ask is: Why does Sydney (for example) provide a particular service when Wollongong does not? The answer, in part, lies in demand for the service —the demand must reach a certain threshold level (usually measured in terms of population) before the service is supplied. This is called the threshold demand concept. Since central place theory explains the spatial ordering of services in terms of demand, it is useful in this context. However, central place theory explains the spatial ordering of services *only* in terms of demand, yet on the supply side there are also important considerations. There is an opportunity cost involved in supplying a service or good to a new market area, and this must be seen to be less than the opportunity cost of remaining in, say, a central business district. Von Thunen (1966) considered the concept of opportunity cost in relation to location, and linked it to land rent, transport costs and profit levels.

In summary, given that threshold demand is not interpreted in its strict form (e.g. perfectly hexagonal market areas), and that important determinants in the supply of services are considered then central place theory is of value in explaining the location of economic activity throughout regions in the economy.

Location policies in Australia

We now turn to examine location policies in Australia, which have been directed mainly at decentralization.

Federal policies

The federal government's role in formulating and implementing policies to influence location is somewhat inhibited by Sections 51 and 99 of the Constitution, which require that the Commonwealth should not discriminate between states or parts of states in raising taxes, nor, by any law or regulation of trade or commerce or revenue, give preference to one state or any part thereof over another state or part thereof.

But the Constitution does not appear to inhibit spatially-differentiated subsidies or area-based grants, as the Commonwealth Grants Commission has functioned without any legal challenges to it. The Grants Commission provides two sets of grants—one to meet the claims of states for special assistance, and the other, since 1973, to supplement the resources of local government.

In recent years, the federal government has become actively involved in urban and regional development, the prominent expression of which is the growth centres policy. Beyond such deliberate involvement, of course, there are many of the federal government's policies which, though adopted with other purposes in mind, have significant implications for urban and regional development. These include the location of government offices, public authority administration and operational centres, tertiary institutions and defence bases. There are spatial implications also in tariff policies, other industry assistance measures, and federal transport expenditure.

Moreover, there are spatial implications in federal government decisions concerning environmental protection. The requirement that environmental impact statements be provided for new investments subject to federal control has obliged the initiators of such

investment projects to have regard to a wider range of effects of their investments than previously they had. The effects attributable to location of the investment project must now be set out clearly.

State policies

State government location policies, like those of the federal government, are also both explicit and implicit. State government policies include urban planning, decentralization incentives, growth centre development, differential transport charges, and charges for such services as water and energy. Unlike the federal government, state governments have the power to implement direct industry location assistance and restraint measures.

State government incentives for decentralization fall into the following broad groups: loans for the construction of factories and houses; loans for general purposes; provision of industrial estates and construction of factories; and a variety of minor subsidies covering such things as removal of plant and equipment, and grants for the training of labour.[4]

State government development programs with locational implications fall into two broad categories: development incentives for resource-rich regions like Mount Isa, Central Queensland, or the Pilbara; and investment in centres where government administration may be regionalized.

Decentralization

Decentralization has been part of "conventional wisdom" for a number of decades. Consequently, debate on the topic has largely been concerned with identifying the best form of decentralization rather than with whether or not decentralization is necessary (Simons and Lonergan 1976). Decentralization is often taken as the antonym of centralization, though it can mean population growth at the periphery of urban areas. Policies of decentralization have changed from the scattering of population by means of agricultural expansion schemes, to state government policies for secondary and, to a much lesser extent, tertiary industry expansion. In recent years, particularly in New South Wales, policies have concentrated on encouraging decentralization to only a few of the larger country centres. The policy of concentrating on a few growth centres is known as selective decentralization.

There are two conventional arguments for decentralization: that

it will stop the drift to the cities, and that it will solve the problems of large cities.

In other words, decentralization is supposed to solve the Australian regional problem as we defined it earlier.

However, several writers (Jensen 1972; Simons and Lonergan 1976) have argued that decentralization may not be a solution to the problems it is supposed to solve. They suggest that preoccupation with selective decentralization should not be allowed to direct attention or resources from the pressing economic and social problems of our large cities. They argue that the solution to specific city problems may be better organization and not the distribution of these problems over the landscape. Braby (1976) questions the usefulness of decentralization policies for solving urban problems, and argues that we should redistribute population and employment more evenly *within* existing cities. The policy favoured by Braby involves the restructuring of cities on a "multi-nodal" pattern and the dispersion of employment from central city areas to suburban employment nodes. On the other hand, recent increases in the price of petrol have sparked a renewed interest in inner city living according to observers of the Australian property market (McCathie 1979).Indeed the chief planner of the New South Wales Planning and Environment Commission has recently stated that one of the major features of the new approach to planning in the 1980s will be a switch from urban sprawl to inner and middle distance consolidation (Jay 1979). Other advocates of urban concentration suggest that this will be beneficial in relieving unemployment problems (Little and Carter 1979).

The previous discussion suggests that more attention should be directed to the problems existing in the city, and that with increasing petrol prices, people and industry may be less likely to leave the metropolitan area. However, with the recent increased importance of mining and associated processing activities in Australia, a growth stimulus has been given to a number of non-metropolitan urban areas. Some thought should therefore be given to ways in which the growth potential of these areas can be encouraged. A consideration of the main aspects of growth pole theory can provide a basis for such an exercise.

Growth centres

The concept of the development or growth pole was at the centre of the "new cities" program in Australia. The French were the

first to develop this concept, and it has played a major part in their regional planning. As we saw earlier, in Chapter 4, a growth pole is normally conceived of as a concentration of economic activity in a particular spatial location. The concept of dominance is crucial in growth pole theory (Hansen 1968). Dominance is described as an influence exercised by one unit on another. The economic unit exercises this effect by reason of its dimension, its negotiating strength, its activity, or because it belongs to a zone of dominant activity.

When considering the concept of dominance, we must take into account the function of the propulsive industry or firm, which is an industry or firm that will propel a region into economic growth. Some would argue that there are three basic characteristics of a propulsive industry or firm: first, it must be relatively large in order to generate sufficient direct and potential indirect effects; second, it must be in a relatively fast-growing sector; and, third, the quantity and intensity of its interactions with other sectors should be significant so that linkage effects will be transmitted. It may also be argued that a propulsive industry is simply one that is a producer of external economies. Whatever definition is accepted, the nature of the interactions occurring needs to be considered carefully.

A propulsive industry often locates in a region not because the area possesses characteristics which have a causal role in its implantation, but because of some unrelated decision at head office.In this instance, the propulsive industry is not the primary phenomenon in the growth process; even if the industry does induce other activities, it is itself induced, and thereby constitutes only one link in the process of polarized growth (Hansen 1968). If the stimulating effects of big industrial undertakings on general economic growth have been overestimated, so have the importance of both bigness and type of industry in traditional growth pole theory. But even if a propulsive industry is considered to be as much an effect of the polarization process as the cause of it, growth pole theory as mentioned has not given a satisfactory explanation of the agglomerating process. It is often argued that the industries most attracted by the external economies generated by growth are not characterized by a highly oligopolistic structure, but are rather industries with numerous small and medium-sized firms.

It is useful to consider the criteria used by the French for the selection of their growth poles. First, a potential growth pole has to have a population large enough to provide a labour market suf-

ficiently wide and varied to offer attractive employment opportunities in most occupations, and to serve as an attraction to both indigenous and immigrant firms. Second, the cities chosen have to possess a sufficiently wide range of activities to allow them to become potentially competitive with Paris. Features considered essential are: a sophisticated powerful financial and banking system; availability of such services as higher education, hospital and medical services, and administration; and a fully developed commercial network. Third, the growth poles are selected according to what is described as their "area of influence". A number of different indicators of influence are used: migration flows, telephone calls, rail and road traffic. French regional planners do not select growth poles simply on the basis of the existence of a number of large manufacturing industries. Attention is paid to the process of polarization as a consequence of the presence of existing or potential external economies.

In the Australian context it has been suggested that a growth centre should have an economic structure which incorporates the following six characteristics (Task Force on New Cities in Australia 1972). The growth centre must be large enough to support not fewer than 150,000 people, be able to earn income from outside the immediate region, be diversified so as to avoid being vulnerable to the fluctuating fortunes of particular industries, have a pattern of base industries that will support local ancillary services at reasonable cost, be able to present a balanced range of job opportunities (to employ workers of various ages, skills, sexes, and so on), and have industries with products that incur low transport costs in relation to their value.

There has also been considerable debate on the form that growth centres should take. For example, Jensen (1972) lists four alternative types of growth centre. The first is a completely new city built on rural land far from any established city. The second is a completely new city sited on rural land near to an existing town, but far enough from it to remove it from the main ambit of the existing town. The third is an existing town well away from the metropolis and used as a nucleus for the new city. And the fourth is a satellite town or city started in a growth corridor of an existing city or on its periphery.

The third type amounts to stimulating the growth of one or more existing provincial cities, e.g. Townsville or Tamworth. The first and second types involve the planning and development of large new urban areas. The fourth type is unacceptable in the context of selective decentralization because it may reasonably refer only

to a satellite of a metropolitan area and is likely eventually to become part of that conurbation.

Given that some form of selective decentralization is desirable, and as indicated in a previous section this is debatable, the question is whether the diversion of population should be to new cities or to augmented existing provincial cities. In order to attract people from metropolitan areas to newly developing areas, employment opportunities and living conditions are required that are at least equal to, and preferably superior to, conditions in the metropolis. This may require new public and private infrastructure to handle incoming workers and their families. Since existing provincial cities already have much of this infrastructure there is a strong argument that, on cost grounds, selective decentralization should be based on existing provincial cities.

Notes

1. See Alonso (1972) for a more detailed discussion of the least cost approach.
2. For a detailed and rigorous discussion of Smith's approach see Richardson (1972, pp. 59-80).
3. These services may be classified as follows: distribution and transportation of goods; processing and distribution of information, including organization, administration and education; and attendance to personal and collective needs such as security and health.
4. See the Committee of Commonwealth/State Officials on Decentralisation (1972, pp. 74-79) for a detailed outline of state decentralization incentives for every state.

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Further Reading

Macro Aspects of Location

Berry, B. J. L. 1967. *Geography of Market Areas and Retail Distribution*.London: Prentice-Hall (presents a very detailed description of the various types of urban spatial hierarchies).

Australia Location Policies

Scott, R. H., Beattre, D. and Lang, C. 1977. Location Theory and Policy. Paper Presented at the Sixth Conference of Economists, University of Tasmania. May 1977 (contains an excellent discussion on location policies in Australia, with some useful comments on the state of location theory).

Questions for Discussion

1. You have been contracted by a firm to provide economic advice on relocation. Outline the issues you would consider relevant.
2. Examine the relevance of location theory in explaining the location of economic activity in your region.

7

Moving the Workers

We now come to look at migration as a way of dealing with, and partly explaining the reason for, the Australian regional problem. There are a number of ways of encouraging people to move from one region to another. For example, subsidies for education and retraining of people who are unemployed or employed in low-income-producing work will enable them to re-enter the workforce and take up available job opportunities in regions where skilled workers are needed. Potential migrants may be encouraged, too, by direct financial assistance, such as the payment of travel and removal expenses, by initial subsistence allowances to cover the period of a job hunt and to help with temporary accommodation, and by housing subsidies and allowances to defray other resettlement costs. But such policies of encouragement need to be seen in a broader context.

In this chapter we shall consider why people move from one place to another, the patterns of migration within Australia, and the implications of these factors for regional planning.

Why people move

There are three main variables which people take into account when making the decision to move from one place to another. They are the gain in earnings to be made from moving, the costs (in money terms) of moving, and the intangible (non-money) costs and benefits of moving[1].

Returns from migration

When individuals move from one place to another in search of work, they receive an increment—either positive or negative— in their real earnings. This increment may arise from a change in nominal earnings, from a change in the costs of employment, from a change in prices, or from a combination of these. Though all three are important, we will concentrate on the first, since it has clear implications for regional planning.

Neoclassical general equilibrium theory predicts that where interregional differentials in real wages exist, labour will migrate from low-wage regions until real wages are equalized. There are a number of crucial assumptions to this theory: that labour is homogeneous in both the regions, that there are constant returns to scale, that migration costs are nil, that there is a perfectly competitive labour market, and that workers will move in response to wage differentials and for no other reason. This model predicts a convergence of regional income per head over time.

A number of reservations about this model are often raised. First, there is no guarantee that the strength of labour flows will achieve convergence, since labour may be immobile. Moreover, there may also be substantial time lags in the movements of labour. Second, even if labour is mobile, and wages per head are high in the prosperous region, there may not be sufficient job opportunities there to justify migration. Third, incoming workers will probably bring their own savings with them, which will have a positive multiplier effect on the income of the growing region and a negative effect on the income level of the declining region. Fourth, the low-income-per-head region may not catch up, even if it has a high birth rate to replace the loss of labour. And, finally, the high-income-per-head regions will attract the more dynamic elements from low-income regions, thus exascerbating the imbalance.

Another model, put forth by O'Kun and Richardson (1967), combines regional aspects of growth and income in order to predict the effect of internal migration on the regional inequality of per capita income. They assume a closed economy, not subject to international migratory movements, and composed of four types of regions: low per capita income and stagnant (LS); low per capita income and growing (LG); high per capita income and stagnant (HS); and high per capita income and growing (HG). A stagnant region is one in which there occurs, over time, relatively little or no increase in per capita income; a growing region, correspondingly, is one in which there is growth over time. The low and

high concepts are concerned, not with the rate of growth, but with the level of per capita income at a point in time. The model considers only migratory movements from one region to another of a different category.

The low-income stagnant region will tend to experience a net outflow of migration. This region can be regarded as a region of origin only, and it is generally an agricultural area. Out-migrants from this area will consist primarily of unskilled labourers and their families. As a result of out-migration, income per head in the region will increase both in the immediate and the distant future. Migrants from this region will flow to the other three categories described above.

The low-income growing region will lose migrants to the high-income growing region and gain migrants from the low-income stagnant region. In advanced countries the net result for low-income growing regions is likely to be a loss of population. When migrants flow from low-income stagnant regions to low-income growing regions, in the short run there will be a tendency for the growth rate of the low-income growing regions to be retarded, though in the long run the result may be either retardation or acceleration of the growth rate.

The high-income stagnant region will attract people from the low-income stagnant region but lose them to the high-income growing region. Out-migrants may tend to be of relatively "high quality" in terms of occupation and education. Consequently, quality deterioration in the labour force of the high-income stagnant region is linked to quality improvement in the labour force of the high-income growing region. Thus the high-income stagnant region is a net exporter of labour.

The high-income growing region is the recipient of large flows of migration from other regions. The growth rates of this type of region and of slowly-growing regions will probably diverge in the long run.

Both the neoclassical and the O'Kun and Richardson models are unrealistic, but were considered here for illustrative purposes. The concept of average income plays an important part in most labour mobility models similar to the two described above. However, very few people have any idea of the average income received in their own region or occupation (Langley 1977). Average income should be regarded only as an approximation to what the individual could expect to earn in alternative employment.

Moreover, the variables that the O'Kun and Richardson model

ignores are factors that we suggest are important in any study of migration. These factors include the attachment of prospective migrants to friends and relatives, the presence (or absence) of infrastructure at the region of origin and the region of destination, lack of knowledge about employment opportunities, and the marital status of the migrant. These are considered later when the intangible costs of moving are considered. Models like those considered above are unrealistic because they examine only the money returns to migration; however, the non-money returns, such as job satisfaction, better education and entertainment facilities, and improved social life, are likely to be significant factors in the migration decision.

Direct costs of migration

Another factor affecting migration is distance. It is generally argued that the greater the distance between regional centres, the lower the volume of population movement that will occur. The level of migration can be related to a distance variable, using a gravity potential model. The gravity model, in its simplest form, determines a set of flows from each point of origin to all other points (destinations). These flows are assumed to be directly proportional to the "attraction" at each destination and inversely proportional to the travel impedence (transportation cost or time) between the origin and the destination. In brief, gravity models attempt to measure a theoretical attracting force.

The hypothesis states that the number of migrants to a given centre, X, will vary in proportion to the population of centres sending the migrants divided by the distance to the attracting centre. If there are three centres then total number of migrants to X is proportional to

$$\frac{P_1}{d_1X} + \frac{P_2}{d_2X} + \frac{P_3}{d_3X}$$

where P = population and d = distance.

Direct costs of migration often include the increase in expenditure for food, lodging, and transportation (for both migrants and their belongings), all of which are affected by distance. But these costs are very small in relation to the total costs—the direct costs plus the intangible costs—of migration. Therefore, it is still necessary to develop a theoretically satisfying explanation for the inverse association between migration and distance.

Intangible costs and benefits of moving

The first non-money costs to consider are opportunity costs—the earnings forgone while travelling, searching for and learning a new job.[2] Part of these forgone earnings will be a function of the distance of migration. A second form of non-money cost should be considered: people are often reluctant to leave familiar surroundings, family and friends. These are referred to as psychic costs. The concept of psychic cost is very important, and it can be measured quantitatively as a transportation cost by figuring the needed frequency of visits to the place of origin so as to negate the agony of separation from family and friends (Langley 1977).It is argued that the needed frequency of contact is a function of age, and most probably increases with age for people who migrated as adults. Also, the longer the distance of migration the lower will be the frequency of reunion and the greater the psychic cost.

A number of other factors will influence a person's "propensity to move". Very few people have complete knowledge of, for example, job opportunities, accommodation and social activities at their place of destination. Relatives and friends may act as a source of information and also help reduce certain psychic costs if they are resident in the destination region. The marital status of the migrant will also have some effect on the propensity to move.

Internal Australian population movements

The principal long-term population redistributional trends in Australia have been the net movement from the countryside to the metropolis, and, to a lesser extent, the expansion of metropolitan centres through an invasion of peripheral areas (Rowland 1979).[3] Between 1966 and 1971, nearly four million Australians (39.4 per cent of the enumerated population) changed their usual place of residence; of these, however, only 1.3 million persons (31.9 per cent of those who moved) changed their place of residence and statistical division simultaneously (Langley 1977).

Internal migration can be divided broadly into interstate and intrastate categories. Table 10 records the proportions of state and territory populations moving within Australia from 1966 to 1971. Because of the size of Australia, interstate migration is often a long-distance movement entailing a complete break in family and community bonds. But interstate movement comprises only a small

Table 10. Proportions of State and Territory Populations Moving within Australia, 1966-71

Mobility 1966-71	*State of Residence in 1971*								
	NSW	*Vic.*	*Qld*	*SA*	*WA*	*Tas.*	*NT*	*ACT*	*Total*
Never moved	61.1	62.5	57.4	64.4	55.6	61.6	41.3	44.1	60.6
Moved within states									
in capital city s.d.s.[a]	18.6	22.1	12.7	19.1	19.8	10.4	–	20.1	18.5
in non-metropolitan s.d.s.	9.5	6.1	11.9	5.0	7.0	12.0	16.6	–	8.3
to capital city s.d.s.	2.4	2.5	3.8	3.3	5.1	2.9	–	–	2.9
from capital city s.d.s.	2.5	1.7	2.9	2.3	3.1	1.8	–	–	2.3
between non-met s.d.s.	2.6	1.8	5.1	1.8	2.6	6.7	5.0	–	2.8
Moved between states									
between capital city s.d.s.	1.4	1.6	1.9	1.7	2.9	1.4	–	20.0	1.9
other moves	1.9	1.7	4.4	2.3	3.7	3.2	37.1	15.8	2.8
Total percentage	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total numbers	3 613 748	2 763 603	1 431 671	935 364	746 314	317 237	52 503	106 800	9 967 240

[a] statistical divisions

Source: Rowland (1979, p. 36).

part of the total volume of migration in Australia, since the majority of moves occur over short distances—within urban centres, or between urban centres and neighbouring rural districts. Approximately 3.5 million people, or 35 per cent of the population moved within states from 1966 to 1971, whereas less than half a million people moved between states. The largest category of those that changed statistical divisions were people who moved from a statistical division somewhere in the state to the capital division of the same state (nearly 25 per cent).

One of the main features of interstate migration during this period was its reciprocal character, whereby shifts in one direction tended to be balanced by moves in the opposite direction (Rowland 1979). Although nearly half a million people were interstate migrants, only very minor alterations occurred in the relative distribution of population between states. The population proportions fell by about 0.3 per cent in each of three states—New South Wales, Victoria and South Australia—while other parts of the mainland had corresponding gains through migration.

On an intrastate basis, movement inside statistical divisions predominated over moves between divisions—27 per cent of the population shifted within the same statistical division while 8 per cent went to another statistical division of the same state. Our attention here mainly focuses on the latter (interregional migration). Most interregional migrations within states were directed to or from capital cities rather than between non-metropolitan areas.In most cases, the net movement was substantially in favour of the state capitals over the 1966-71 period.

In the period 1971-76, the pattern of population change in Australia differed markedly from that which had characterized the late 1960s. As mentioned in Chapter 1, the most important demographic factor operating during this period was the severe cut-back in the intake of international migrants. Leaving aside the substantial effects of international migration on capital city population growth, three changes are discernible in our internal migratory habits during this last census period. First, at the national level, there was a considerable rise in population movement between states, which was due primarily to increased departure from New South Wales and an increased volume of arrivals in Queensland and the Australian Capital Territory. Second, factors such as environmental considerations and the high cost of urban land have caused an invasion of metropolitan peripheries. Dispersal was practicable for many people, such as those beginning families,

people who were willing to commute long distances, and others who already worked in outer areas. Third, the departures from capital cities also reflected shifts to regional centres and coastal districts. The growth of coastal regions is mainly due to an increasing proportion of the growing numbers of retired, older people, who have sufficient resources to be able to seek pleasant and low-cost environments in which to live. The movement of population to other large non-metropolitan centres has been promoted by government influence on the growth and siting of economic activities (for example, the university at Armidale, the defence centre in Townsville, the growth centre policy for Albury-Wodonga), and substantial investment increases in mining and associated activities (for example, at Bowen and Gladstone).[4]

However, Rowland (1979) indicates that by the end of the 1970s there were signs that some of these newer influences were waning in significance. In other words, the so-called migration turnaround might, to some extent, be the result of short-term fluctuations in population movements. If this is correct, then the long-term redistribution of population from the country to the city is likely to continue.

Who are the migrants?

A large body of Australian research has concentrated on rural-to-urban migration since, as mentioned previously, the rural-to-urban category historically has been the largest component of inter-regional migration in Australia, and since the economic and social consequences of this type of migration have been considered to be more adverse than other forms of migration. Thus we have a fairly clear idea of the characteristics of the rural-to-urban migrant.

Most of the studies show that the net migration losses experienced by rural communities in Australia are highly selective of females and of the school-leaving age groups generally—the 15–20-year-olds. Consequently, the population of many rural areas is characterized by an increasing sex imbalance and general ageing compared with urban areas. Besides the school-leaving age group, other age groups which usually predominate in this rural out-migration are the 21–25 and 40–45 age groups. People leaving for retirement constituted about 10 per cent of all out-migrants. A large proportion of the out-migrants belong to professional and

managerial groups; semi-skilled and unskilled manual workers tend to have a comparatively low level of mobility. Moreover, the average income of out-migrants is greater than the average income for the population of the region (Hugo 1974; Widdows et al 1974; Montague 1977).

Most school leavers head for capital cities or major towns; for example, in Queensland their destination is either Brisbane or Townsville, Mackay and Rockhampton. For adult migrants the destinations are more varied than for school leavers. Because rural areas are losing skilled workers, young people and professional and management groups, any attempt to increase economic activity in these areas may be severely hampered. This is of great importance for regional planning.

The type of person leaving the city to live in non-metropolitan areas is usually less stereotyped than the rural out-migrant.People moving for employment reasons to areas such as Townsville and Albury-Wodonga would be well educated, having some skilled trade or tertiary qualification, whereas those moving to mining development areas such as the Bowen Basin and Mount Isa would have a lower general educational and skill level. Also, the former type of migrant is usually married with children, whereas the latter is single. The non-metropolitan retirement areas attract older people who, even though they may be well educated, do not usually utilize their skills once retired. The non-metropolitan centres that experienced the higher population growth rates in the 1971-76 period were predominantly mining and retirement areas (Mandeville and Butler 1979). Consequently, a substantial part of the population flow towards non-metropolitan areas is composed of older and less-well-educated people than that in the opposite direction. Thus, in terms of the labour force, one might say that though certain non-metropolitan areas were quantitative gainers in the 1971-76 period, they were qualitative losers[5].

Motivation for moving

Earlier in this chapter we saw the general, theoretical costs and benefits of moving from one region to another. When we turn to consider the reasons for the out-migration occurring in country regions, we can deal in much more concrete terms.

Economic reasons are probably the most important motivation for moving. Lack of local employment opportunities, whether in

the form of suitable alternative jobs or promotional avenues within current work, is a continuing problem in rural areas. A survey of major country centres in New South Wales indicated that 59 per cent of workers could see no hope of transferring to a better job within the same town, while a majority of respondents considered that better alternative work could be found in Sydney. Skilled tradespeople were the most severely affected occupational group in this instance. The survey also found that one in every two people in country towns considers the range of employment there to be unsatisfactory, and one person in three views the quality of country town jobs as inferior to that of city jobs. Not only is the range of employment opportunities limited, but also, and more obviously, the total number of jobs available in country towns is insufficient. Research undertaken by Christensen (1973) and Walker (1978) indicates that unemployment rates in non-metropolitan areas are generally higher than those in the capital cities (see table 5).

There are many causes of dissatisfaction with the quality of life in rural communities, such as the lack of entertainment; the limited nature of social contacts; the lack of choice and expense of consumer goods; the isolation in terms of poor roads, insufficient public transport, infrequent mail services, no television, poor and inappropriate housing, medical facilities and so on. For example, in the New South Wales survey it was found that people in high status professional and managerial occupations expressed discontent at the quality of night life in country centres. Theatres and restaurants were said to be too limited in range and quality.

A major problem facing most country towns is the absence of any tertiary education. This is one of the prime reasons for the large number of school leavers migrating out of country towns. In some instances, the school leaver's parents also move out as well.

Transfer by an employer and retirement are also factors which contribute to out-migration from rural areas.

But there are also beneficial aspects to country living. Life in a country town is more relaxed than life in a capital city. For example, shops, institutions and jobs may be a short distance from home, so there is none of the harrassment and loss of time that city commuters have to endure. There is also little pollution or major crime in rural areas. Job satisfaction, too, may be better in the country. And the majority of people in the country centres consider that the cost of living there is lower than in the city.

This, along with the lower cost of housing, appears to be a prime reason for satisfaction with country town life.

The above factors could have acted as reinforcing agents for the more dominant economic factors underlying the 1971-76 urban-to-rural migration pattern. Neoclassical economic models argue that interregional migration is caused by differential employment opportunities and income levels between regions. The population flows to mining and public administrative areas can be explained using these types of models. However, less is known about the causes of the migration of retired people to non-metropolitan areas (Murphy 1979). An important economic incentive to retirement migration is the possibility of making a capital gain by trading down from a house on relatively high-valued land in a city to a house on a cheaper block in a non-metropolitan centre. McKay and Whitelaw (1976) in their analysis of migration data from the 1971 census, found evidence to support this proposition. Other financial gains from living in non-metropolitan centres include reduced outlays on rents and rates, as well as savings in day-to-day trip costs. A better climate is probably a major reason for migration to retirement areas in Queensland and northern New South Wales.

Some implications for policy

When we come to consider the application of migration policies to the two aspects of the Australian regional problem—urbanization and rural decline—there seem to be two possible approaches, one for each aspect of the regional problem. One would be to encourage people to move to decentralized locations, and the other would be to reduce the tendency for people to migrate from rural areas to urban areas.

Let us deal with the latter possibility first. An obvious, but simplistic, solution to the problem might be to remove the reasons that people have for migrating from rural areas. For example, young people often complain about the lack of suitable entertainment facilities, and this is often cited as a major determinant of out-migration. Does this mean that regional policy should take the form of providing these facilities for teenagers? It would probably not be economically feasible always to provide the type of entertainment required. In the same way, it is not feasible to build tertiary education facilities in all rural communities. To a large

extent it is our belief that the role of the policy-maker is severely restricted when it comes to reducing the rural-to-urban population drift.

However, there is more scope when we consider the urbanization aspect of the problem. We suggested in Chapter 6 that a policy of selective decentralization may be of benefit in attracting economic resources to alternative locations. Much of the attention focused on selective decentralization has been concerned with inducing the "right" type of industry (be it secondary or tertiary) to centres capable of spontaneous growth. However, very little attention has been paid to methods of attracting the "right" type of labour to these locations. We have just seen a number of reasons why people leave rural areas—reasons which have policy implications for regional planners concerned with establishing growth centres. In order to attract people to certain selected locations and keep them there, adequate economic and social facilities need to be provided. The kinds of facilities that are not economically feasible in rural communities, the absence of which are the major cause of out-migration from these areas, should be of first priority in selected growth centres. In other words, a study of the characteristics of out-migrants and their reasons for migrating, will have beneficial policy spillovers for regional planners involved in selective decentralization programs.

Notes

1. See Sjaastad (1962) for a discussion of the costs and returns of human migration.
2. "Non-money" refers to instances where there is no outlay of money.
3. The discussion in this section draws partly on Rowland (1979).
4. The movement to resort and development areas in the north of Australia and to large non-metropolitan urban areas could be similar to what Berry (1976) has called the "counterurbanization" process in the United States.
5. Alonso (1977) reached a similar conclusion with regard to the urban-to-rural drift in the United States.
6. See "Some Sociological Aspects of Life in New South Wales Country Towns". In *Studies Commissioned by the Committee of CommonwealthsState Officials on Decentralisation*, 1975.

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Questions for Discussion

1. Population migration reflects people's personal reasons as to where they want to live, and therefore is not amenable to economic analysis. Discuss.
2. What factors do you consider important in affecting a person's propensity to migrate?

8

Computer Models in Regional Analysis

Margaret Mead called computers an "antidote to complexity" in that they allow us to deal with many variables and to consider complex interrelationships. There are many possible applications of computers to the problems of regional planning. In this chapter we shall introduce computer models in a general way, and then consider the basic concepts of two types of models—linear programming and systems simulation—along with some discussion of their applications in the regional and urban context. The third type of computer model we need to consider—input-output analysis—will be dealt with in the next chapter.

Computer models

A model can be defined as a simplified representation of some aspect of reality. Types of models include verbal models, iconic or scale models, analogue models, and symbolic or mathematical models.

Verbal models describe the system purely in words. For example, they might make a statement that economic growth in the region is five per cent per year. Verbal models might appear useful but they are not rich in ability to describe complexities.

Iconic or scale models look like the system they attempt to simplify. A model aircraft would be an example. A major drawback is a lack of adaptability or flexibility in the model once it has been constructed.

Analogue models do not look like the system, but show connections. A graph would be an example.

In symbolic or mathematical models symbols represent components. Computer models are in this category and may be defined as a formal representation of our understanding of system behaviour. Note that the term "computer model" is not synonymous with the term "computer program". A computer program or algorithm is simply a set of instructions which tells the computer to do something. Computer models are run or operated via a computer program.

Before discussing computer models in particular, we should attempt to answer the following question, Why is there a need for modelling? First, the definition of a model offers an obvious clue. The real system is usually complex and difficult to analyze; a model helps to overcome this joint problem through simplification. Second, cost, time and other factors often make the manipulation of the real system impossible. In the case of the economy, simulated experiments have to be conducted since economists cannot conduct controlled experiments the way physical scientists do. Third, for certain systems, such as sub-atomic particles, monitoring the real system may interfere with it. Fourth, there is no alternative to modelling if the "real" situation does not exist, for example, the Adelaide metropolitan-area economy in the year 2000.

The philosophy underlying computer models is the systems approach[1]. A system can be defined as a set of related components, and the systems approach is a way of looking at the world as if it were organized systematically. That is, many phenomena—social, economic, biological and physical—can be viewed as a complex of systems, and the interactions between them can be analyzed. Then, by introducing appropriate control mechanisms, the analyst can alter the behaviour of the system to achieve objectives. Intuitively we all understand this concept of everything affecting everything else, and that actions taken to control one part of the system may have completely unexpected effects elsewhere. For example, building freeways to solve transport problems can create social problems by destroying tightly-knit communities. With the increasing complexity of society, the ability to distinguish favourable policy outcomes from unfavourable ones is no longer a simple matter. The systems approach and computer models can help.

Computer models can be distinguished first by the manner in which they incorporate uncertainty, time and space, and second by whether they are descriptive, predictive or prescriptive. Deterministic models disregard uncertainty, while in stochastic models

the element of chance is built in. Static models project the system for one point in time only while dynamic models include the time element. Spatially-aggregated models consider the region as a whole. Most computer models describe the system and can also be used for predictive purposes. A prescriptive model, however, evaluates and chooses among alternatives. Most computer model predictions are conditional predictions, that is, they predict outcomes from a particular event, *ceteris paribus*.

The role of computer models in economic planning

In general, computer models can provide information about the operation of the economy and how it reacts to change so as to provide a useful aid for government and business in decision-making. More specifically, computer models are used to explore the set of alternatives open to planners.Usually there is a considerable range of policy alternatives open to policy-makers and the best choice is not readily apparent. Models can generate various alternative projections or simulations of the region in the future, assuming application of various policies. Thus several conditional predictions can be made, allowing alternatives to be evaluated. This use of the model's results should improve decision-makers' specifications of their objectives. Costs and trade-offs can be specified clearly, enabling decision-makers to appreciate the available alternatives. Further, the process of building the model improves the modellers' understanding of the system. They are forced to specify relationships carefully and unambiguously, which helps to dispel superficial thinking.

Fundamental considerations

There are a number of questions that the modeller has to ask when designing or building a computer model. First, and most important, is What is the purpose of the exercise? In other words, What aspects of the regional system are to be modelled and what questions will the model be used to answer? Framing proper questions can be difficult. The question How can we put the region's resources to best use? is vague, but the question How can we reduce the cost of interactions between activities in zones? focuses more specifically on a workable transportation problem. Second, there are questions regarding the construction phase of the model: What variables should be included? What theories and assumptions considered? What level of aggregation should be used? and What data

is available? Third, What are the limits on the size and complexity of the model? Limits are imposed by the resources such as time, money and personnel available to build the model. Fourth, How well does the model actually predict? The concepts of verification —Does the model do what the modeller intends?—and validation —How well does the model result fit the real world situation?—are important here.

Problems and drawbacks of computer models

Too often models and their results are taken literally by the clients of model builders. Some people regard the computer model as a method of providing "the answers to all our problems". However, models are only tools to aid decision-making, a simplification of reality; all of the complexities of the real world can never be modelled. Certain assumptions, such as assuming away time, uncertainty and space, are made in order to achieve this simplification of reality, and consequently results always need to be interpreted in the light of these fundamental simplifying assumptions. Finally, of course, no single model can be adequate for all purposes.

Linear programming models

The basic concept of linear programming (LP) is quite simple. If the analyst has a number of ways of doing something, resources available, and an objective which can be quantified, then there is potentially a problem which can be analyzed with LP. Our experience with LP has been in connection with modelling a region's farm sector, so we shall use the farm environment to illustrate the technique. Farmers can engage in a variety of production activities such as wheat, sheep or cattle; they have various resources such as land, labour, capital; and they have some kind of objective such as to maximize profit. Their problem is one of allocation: How should they allocate their resources among end uses? or What is the best combination of enterprises to satisfy their objectives?

In the LP format, the problem for one particular farmer is set up in matrix form, listing the activities along the top and the resources (constraints) down the side. The matrix is compiled, the information is coded for input into the computer, and a computer run is made using the standard SIMPLEX alogrithm. The result is a printout which gives the optimum combination of activities, subject to the farmer's objective and resource constraints, and sub-

ject, too, to the information originally compiled in the matrix. Assumptions underlying the model include those of linearity and additivity. These are discussed in Chapter 9 in connection with the input-output model.

Applications of the model

There are five common urban and regional applications of linear programming.

Urban transportation models (e.g. see studies cited in Massey 1968) focus on the problem of planning industrial location so as to minimize transportation costs. The method involves the division of the city into zones and the establishment of an LP model to minimize inter-zone transport costs. There are certain constraints in individual zones and on the city as a whole.

Urban land use plan design models (e.g. see studies cited in Massey 1968) set out to minimize the cost of developing residential, industrial or other land uses, subject to constraints such as demand for land use within the region, balance of land uses within and between zones, and development costs of a land use.

Plant location models (e.g. Cassidy et al. 1970) incorporate certain aspects of location theory (see Chapter 6), for example, the location of firms so as to minimize transportation costs.

Interregional spatial allocation models (e.g. Heady and Hall 1968) are concerned with modelling the spatial aspects of agricultural industry using regions as the basic producing unit. These models attempt to allocate farm production to locations in which production is most economical, and also to examine the allocation of agricultural production and land use under conditions of changing technology, different levels of export demand, or alternative government policies.

Regional representative farm models (e.g. Guise and Walker 1976) model the region's farm sector using representative or typical farms which represent all the farms of that type or size in the region. Analysis with these models usually involves predicting market supply under the same conditions as we saw with interregional spatial allocation models—changing technology, different levels of export demand, and alternative government policies.

Drawbacks and advantages of linear programming

We have already said that any computer model can be criticized on its assumptions. In the case of linear programming, the assump-

tions of linearity and additivity are at odds with scale economies, externalities and other agglomeration factors which dominate the build-up of economic activity. Further, the assumption that individuals and firms seek to maximize profit or minimize costs is too one-dimensional. Individuals and organizations have other objectives, most of which are non-quantifiable and therefore cannot be built into the model. The fact that the values in the LP matrix are single and deterministic is a drawback. However, this is offset somewhat by the ease with which change factors can be built in, and the model re-run. Another disadvantage, however, is that data requirements are usually considerable, though this drawback can be offset somewhat by defining the necessary data at an early stage of the model-building process.

An advantage of the prescriptive aspect of the model—i.e. the selection of the optimum solution—is that planning work is focused on the solution which is the best one in a modelling sense. Another advantage lies in the speed of computation; many runs are possible, allowing analysis of alternatives, interactions and sensitivities. This provides the possibility of feedback between the computation process and the planning or execution process.

Systems simulation models

The word "simulation" is confusing in a general sense, since simulation covers all model-building activities. Models are simplified representations of reality and thus all models are simulations of reality. However, systems simulation refers to a variety of highly flexible computer models which are usually dynamic and stochastic. The system which can be modelled is anything the modeller wishes to define as a system or subsystem. Examples of possible regional and urban subsystems that could be delineated appear in figure 10.

Urban and regional systems simulation models have a number of general characteristics. First, they attempt to model one or more of the urban and regional subsystems that we saw in figure 10. Second, this approach can be regarded as a general framework for analyzing problems which allows the analyst to focus on basic relationships and the feedback effects involved. Third, these models often incorporate other modelling techniques as building blocks in a systems simulation framework. In the Australian context, the paper by Karlquist et al. (1978) discusses a systems model

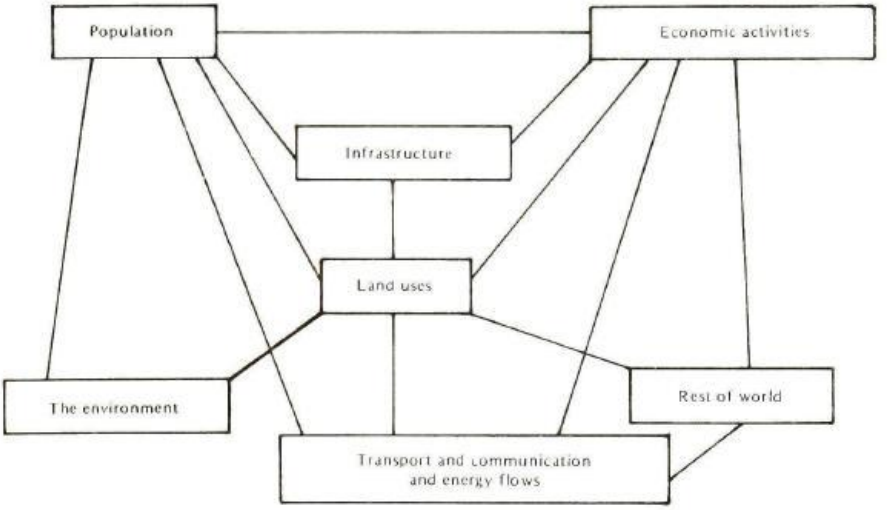

Fig. 10. Urban and regional subsystems

that uses input-output as a component, while the paper by Guise and Walker (1976) uses LP in a systems framework. Fourth, as mentioned previously, systems simulation models are usually dynamic and stochastic, and thus, fifth, tend to be expensive to construct.

Books have been written on the techniques of constructing systems simulation models (e.g. Naylor et al. 1966). We will therefore list here only what are considered key steps in this construction process. The first step is to define the problem and system to be studied. The second step requires a synthesis of the model by using flow diagrams to show linkages, by specifying algebraic relations, and by then coding for the computer.The next step is to determine whether the model is performing to the specification of the builder, and whether it is adequately representing the real system for the intended purpose. Fourth, it is necessary to perform a sensitivity analysis, which will determine how sensitive the results are to changes in assumptions about relationships between variables. This analysis discovers whether further investigation and refinement of the model are required. Fifth, results are generated and analyzed. In practice there is usually considerable recycling or retracing through steps 1-4 before there is sufficient confidence in the model to proceed to its actual use.

Notes

1. For a detailed discussion of the systems approach see Churchman (1968) or Emery (1969).

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Systems Simulation

Hamilton, H. R. et al. 1969. *Systems Simulation for Regional Analysis: An Application to River Basin Planning*. Cambridge, Mass: M.I.T. Press (simulation study of a river basin involving the whole economy of a region; a good example of use of systems models in regional context).

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Questions for Discussion

Think of a regional economic planning problem. How would you set up a computer model to analyze this problem?

9

Economic Impact Analysis

The discussion in Chapter 6 suggested that one way of relieving some of the pressure on the capital cities was through the process of selective decentralization. Now if a policy to encourage industry and services to move into a particular region is to be implemented, it is necessary to evaluate the impact that these activities will have on the region in which they are to be located. This chapter reviews the alternative methods available for measuring the *quantitative* impact of some economic stimulus on a region.

One quantitative measure of economic impacts is the multiplier, which was introduced briefly in Chapter 5. The multiplier involves the concept of ripple or spin-off effects. For example, if an industry locates in a region, it will employ people. In addition, it will generate multiplier or ripple effects through the whole regional economy. Support industries will be stimulated and various consumer services will enjoy an upswing in activity. The multiplier concept emphasizes the interrelationships of sectors (industries) within the regional economy and seeks to explain and quantify the total change in the regional economy resulting from a given economic stimulus. In particular, multipliers are used for predicting short-run regional change. This work is termed "impact analysis" and uses techniques such as economic (export) base, input-output, and to a lesser extent, Keynesian multiplier analysis and interregional income theory. These techniques are discussed in this chapter, while a final section briefly introduces the technique of cost-benefit analysis and its application in a spatial context. For readers particularly interested in input-output models, the

Appendix supplements the text with more detail on this technique.

Before examining the formal multiplier techniques, it is useful to spend a few moments examining the term "impact". As we shall see, input-output analysis can produce a set of regional income multipliers to measure the effect of an impact, while Keynesian multiplier analysis produces an income multiplier. But the concept of income is not identical in both models. Therefore the measure of impact resulting from both models is different. Though it is important to be aware that the multipliers produced by the various models are not directly comparable, the overriding concern here is that the measures of impact derived from the models focus only on quantitative aspects of change within a region. They can measure only economic impact, for example, of constructing an aluminium smelter plant, and in doing so they illuminate only part of a many-faceted problem. They shed no light on the social and environmental impact of a project (Stone 1973).

Economic base analysis

As we saw in Chapter 4, the essence of economic base analysis is that the growth of a region or a city is determined by its function as an exporter to the rest of the world. Exports include goods and services sold outside the region plus expenditures by outsiders in the region. Export industries are considered the prime mover of economic activity and are the economic base of the region. Various supporting industries necessary to service those basic industries and their workers comprise the non-basic sector. Thus the economic base analysts academically divide the whole regional economy into two sectors: basic industries and non-basic industries.

Implicit in this division of activities is the cause and effect relation which constitutes economic base theory. If demand for the region's exports increases, the basic sector expands directly, and this in turn generates an expansion in the supporting non-basic industries. Thus basic industry has the prime mover role, with any changes having a multiplier effect on the regional economy.

The economic base multiplier is usually calculated in terms of employment (number of jobs) and can be expressed as[1]:

$$\text{Base multiplier} = \frac{\text{total employment}}{\text{basic employment}}$$

Algebraic manipulation yields:
Total employment = (base multiplier) × (basic employment)
And similarly the change, Δ, in total employment is:
Δ Total employment = (base multiplier) × (Δ basic employment)
The economic base multiplier helps analysts explore, evaluate and predict the implications of economic decisions and changes, and thus aids forward planning. For example, if the future prospects of basic activities in a region are estimated, then the economic base multiplier is applied to estimate the total employment. Given this information, the future demand, for example, for public services can be estimated.

Operational considerations and problems

The unit of measurement can present some problems in economic base analysis. Usually employment is used as the unit of measurement, but output or household income may also be used. There are advantages in using employment as the unit of measurement in that employment figures are relatively easy to obtain compared with other economic data, and results can be converted into population or household terms using such ratios as the average number of dependents per worker. However, there are some disadvantages associated with employment as the unit of measurement.Changes in productivity, for example, are not considered, yet a firm may increase its output, thus leading to higher wages and more spending, without increasing its labour force. There is the problem, too, of obtaining data on and converting part-time and seasonal employment into equivalent full-time employment. And there are also problems associated with commuters crossing regional or urban boundaries. Ideally, more than one unit of measurement should be utilized and the results compared.

The major problem with the implementation of economic base analysis is the question of identifying a region's basic and non-basic industries. A direct method of doing this would be to survey all firms in the region, but such a procedure would be time-consuming and costly, and it would encounter the problem of respondents misallocating output to local use rather than to indirect exports. At least two indirect methods have been utilized to identify the region's basic and non-basic industries. The simpler is the assumption approach whereby the analyst assumes that all of certain categories of economic activity are basic. The difficulty

with this method is that most industries usually have both basic and non-basic components, and the economy in most instances will have an overall complexity that precludes such simplifying assumptions. The second indirect method involves the use of the location quotient, which is a measure of the relative importance of an industry in the region compared with the nation, or,

$$LQ = \frac{\text{per cent regional employment in industry A}}{\text{per cent national employment in industry A}}$$

The underlying rationale is that if an industry is relatively more important in the region than in the nation, i.e. if its location quotient is greater than 1, the industry has a higher degree of specialization in the region than in the nation, and is usually regarded as an exporter. Underlying the location quotient method are such assumptions as that regional and national demand patterns are uniform, and that regional productivity by industrial sector is also uniform. Moreover, the technique ignores the fact that some national output is for foreign consumption. These limiting assumptions weaken the reliability of the location quotient method, but it does have the advantage of being inexpensive and easy to apply. Each of the methods of identifying basic activity is likely to produce very different estimates. This underlies the difficulty of estimating the basic/non-basic ratio and the questionable reliability of the multiplier produced.

A third problem in economic base analysis is the choice of an appropriate study area. The difficulty is that the basic/non-basic ratio changes with the size of the region under consideration. For example, in a village the hotel and petrol station are export activities, whereas at the urban level these become service or non-basic activities.

Conceptual problems

There are a number of crucial conceptual issues in economic base analysis.

The first is the assumption that basic industry is the prime mover of economic activity. This assumption is sometimes invalid because a region with developed non-basic activities (for example, with a developed infrastructure) will attract basic industry. These non-basic activities will, therefore, be a determining factor in an area's level of economic activity.

The second is that economic base analysis concentrates on exports and ignores the possible importance of imports. However, an increase in basic employment may have a limited multiplier

effect on non-basic activity if much of the extra income flows out of the region in the form of expenditure on imports. Further, an economy may grow by increasing exports, but it also can grow by replacing imports with products from within the region (this is called import substitution).

Third, it is not known how long multiplier effects take to work their way through the economy. And fourth, the estimation of future impacts rests on present or past base ratios. Since development usually involves structural change, which in turn will affect the base ratio, there are problems with such estimates.

Application of the model

Given the problems, both operational and conceptual, associated with economic base analysis, should it be applied in regional analysis and planning? Opinions differ; for example, Richardson (1970) argues that it should not be used. However, we think there are at least three reasons why economic base analysis is relevant. First, it is simple and easy to apply; it illustrates some features of a region's economic structure and produces an estimate of the likely impact of short-run change. Second, if the analyst is concerned with measuring impact in small regions which have a high level of dependence on specialized export activities, for example, Australian mining towns such as Mt Isa or Broken Hill, then the limitations of economic base are less severe. Third, economic base analysis can serve as a point of departure for more elaborate models such as input-output analysis.

Although extensively used overseas, the technique of economic base does not seen to have found wide acceptance in Australia. Some examples of Australian applications of this method of impact analysis are Bunker (1964), McCalden (1969) and Shrapnel (1974).

Input-output analysis

Input-output is both an accounting framework and a computer model. In terms of our introduction to computer models in Chapter 8, as a computer model, input-output is a static, deterministic, descriptive, predictive, spatially-aggregated model. Input-output is the most powerful of the multiplier impact techniques, and is becoming increasingly applied to regional analysis in Australia.

The transactions table

The regional economy is defined as the set of individuals and organizations in a particular spatial unit which produce, distribute, and consume goods and services. Input-output identifies the interactions or flows in dollar terms between sectors comprising the regional economy for a given year. Thus it provides a quantitative picture of the economy for a particular time period. A matrix of dollar flows between sectors, termed the transactions or flows matrix, is formed by listing the sectors of the economy across the top and down the side, as illustrated in table 11, a hypothetical

Table 11. Hypothetical Input-Output Transactions Table ($ million)

Outputs → / Inputs ↓	Processing sector				Final demand	Total output
	A	*B*	*C*	*D*		
Industry *A*	202	182	10	12	335	741
Industry *B*	32	68	2	26	339	467
Industry *C*	47	35	991	334	1372	2779
Industry *D*	86	59	565	561	1762	3033
Primary inputs	374	123	1211	2100	3181	6989
Total inputs	741	467	2779	3033	6989	

input-output transactions table. Each row of the matrix indicates the distribution of an industry's output to other local industries and to the final demand categories. Final demand (final users) relates to the end products of economic activity, such as sales to government, household consumption, investment and exports. For example, industry *A* sells $182 million worth of its products to industry *B*, $10 million worth to industry *C*, $12 million to industry *D*, and $335 million to final demand. Each column of table 11 indicates industry purchases, or inputs, from other industries and the primary input category. Primary inputs are items such as wages and salaries, profits, taxes, imports, and other items of value added. For example, industry *A* buys $32 million worth of products from industry *B*, $47 million from industry *C*, and so on down the column.

The transactions table represents the descriptive and accounting aspect of input-output. First, it describes the economy by providing a comprehensive "snapshot" of a regional economy at a particular time. Second, explicit data on particular aspects of the economy

can be read from the transactions table, for example, the relative sizes of industries, relative propensities to import, and the size of the wage component. Third, the flows matrix is a framework for organizing economic data—a system of regional accounts.

Input-output multipliers

Simple mathematical transformations can be made on the flows matrix to derive multipliers for each sector of the economy. This is the predictive aspect of input-output. The multipliers allow the analyst to determine the impact on the whole economy of changes in the demand for the products of a particular industry. The multipliers can relate to output, employment or household income, and their use for predictive purposes involves various assumptions which are discussed later.

The multiplier concept was discussed in connection with economic base theory, so this is an appropriate point to compare and contrast input-output with economic base analysis. See figure 11 for this comparison.

Economic Base		*Input-Output*
Two sectors, basic/non-basic	1.	No limit on the number of sectors
Multiplier measures the impact of a change in exports only	2.	Multiplier measures a variety of impacts – changes in government spending – changes in household consumption – changes in investment – changes in exports
Multiplier can be calculated simply	3.	Multiplier calculations require computerized matrix inversion

Fig. 11. Comparison of input-output and economic base multipliers

Assumptions of the model

Input-output models enable the derivation of sets of multipliers that are disaggregated, recognizing that the total impact on income, output and employment will vary according to which sector experiences the initial expenditure change. But the multipliers derived from input-output analysis always need to be considered in the light of the assumptions which have to be made. The first is linearity: each industry is assumed to have a linear production func-

tion which implies constant returns to scale and fixed input proportions. The second is homogeneity: each sector is assumed to have a fixed set of products that are not produced by any other sector. The third is additivity: the total effect of carrying on several types of production is assumed to be the sum of the separate effects. Thus external economies and diseconomies are assumed away, along with any sort of synergistic effect.The fourth is sector grouping: firms in a sector can be grouped on the assumption that there is a single input structure for each sector.

Applications of the model

In Australia there has been a considerable amount of work in input-output, and thus a detailed description of certain aspects of the technique is presented in the Appendix. The Appendix discusses the various input-output multipliers in detail; provides background on constructing regional input-output tables, and the history of the technique and its application in Australia; and finally discusses the use of input-output in environmental studies.

Keynesian multiplier analysis

Keynesian multiplier analysis is used for deriving regional income multipliers[2]. Its use has been confined mainly to the United Kingdom, though it has been used in Australia, in relation to the Albury-Wodonga growth centre.[3]

Before we look at the basic model, there are a number of important points to note. In the Keynesian system, income refers to the regional equivalent of national income, which is a broader interpretation of income than that used in the input-output system, and is equivalent to the value of consumption, investment and government expenditure and the balance of interregional trade.

The theory of Keynesian multiplier analysis is as follows: A money injection into a system will cause an increase in the level of income in that system by some multiple of the original injection, i.e. where ΔYr represents the change in the level of the region's income, J is the injection and Kr is the value for the regional multiplier. The conventional formulation of the multiplier assumes that the level of investment, government expenditure and regional exports will remain constant and autonomous. The multiplier then makes allowance for the various leakages during the multiplier process, such as the proportion of additional income consumed,

c, direct taxation, td, decline in transfer payments with the rising level of income, u, imported consumer goods, m and indirect taxation, ti. The multiplier is expressed as follows:

$$Kr = \frac{1}{1 - c\,(1 - td - u)\,(1 - m - ti)}$$

Inter-regional income theory

The impact of a particular project is not confined only to a particular region, but may also be felt in surrounding regions. Consequently, it is necessary to appreciate these interregional effects. Metzler (1950) demonstrates how an increase in income in one region (say, due to an injection of government expenditure) will dissipate its impact to other regions, thus increasing their incomes. Metzler argues that as income expands throughout a system of regions, each region's exports and imports will rise, and it is almost inevitable under such conditions that the balance of trade of most if not all of the regions will be effected. The extent to which each region's balance of trade is finally affected will depend on the size of its interregional multiplier.

The first step in calculating the interregional multiplier is to construct a simplified model of income determination in a closed system of three regions. The net income of a region, y, consists of consumption expenditure, C, plus net investment, I, plus exports, X, minus imports, M, i.e.

$$y = C + I + X - M$$

The following assumptions are made: First, that consumption, net investment and imports are all dependent upon the domestic income level. Second, that exports of region 1 are a function income in regions 2 and 3. Third, that prices and costs are constant. And fourth, that the system is initially in equilibrium, and that a disturbance takes place in region 1, the effects of which are traced through the three-region system.

Let $M_1\ (y_1)$ be an import function showing how total imports of region 1 from regions 2 and 3 are related to net income (y_1) of the importing region. Then

$$M_1\ (y_1) = M_{21}\ (y_1) + M_{31}\ (y_1) \qquad \text{(i)}$$

Since the system as a whole is closed, one region's imports are another region's exports. For example, region 1's exports can be described in terms of imports by regions 2 and 3 from region 1.

Now both consumption, C, and investment, I, can be combined in a total expenditure function, E, rather than using separate functions for each component. Thus the formula for a region's income now becomes:

$$y = E - M + X$$

It is now possible to construct the following system of equations:

$$y_1 = E_1(y_1) - M_1(y_1) + M_{12}(y_2) + M_{13}(y_3) \quad \text{(ii)}$$
$$y_2 = E_2(y_2) - M_2(y_2) + M_{21}(y_1) + M_{23}(y_3) \quad \text{(iii)}$$
$$y_3 = E_3(y_3) - M_3(y_3) + M_{31}(y_1) + M_{32}(y_2) \quad \text{(iv)}$$

where, for example, $M_{12}(y_2)$ = the imports of region 2 from region 1 and $M_{13}(y_3)$ = the imports of region 3 from region 1 and so on. It should be noted that X does not appear in the set of equations because as explained above one region's imports are received as another region's exports.

We now come to the inter-regional multiplier. Let A_1 represent autonomous investment in region 1 which imparts a disturbance to the equilibrium of the system. This will cause an increase in the level of income in region 1, which is indicated in the following equation.

$$y_1 = E_1(y_1) - M_1(y_1) + M_{12}(y_2) + M_{13}(y_3) + A_1 \quad \text{(v)}$$

The degree of income expansion in region 1 resulting from the stimulus A_1 will depend on the interregional multiplier. The magnitude of this multiplier depends on the size of what we call primary and secondary effects.

The primary effects work in this way: An increase in income in region 1 will produce more imports to the region from regions 2 and 3. That is, M_{21} and M_{31} in equations (iii) and (iv) have increased, where M_{21} = imports of region 1 from region 2 and M_{31} = imports of region 1 from region 3. This means that the exports of regions 2 and 3 to region 1 have increased, thus causing their incomes to increase. In other words, some of the increase in income in region 1 has leaked to regions 2 and 3.

Now since the exports of regions 2 and 3 have increased, thus causing (y_2) and (y_3) to increase, this in turn will have a secondary effect on region 1. That is, because the incomes of regions 2 and 3 have increased, they will import—depending on their marginal propensities to import—from region 1. Thus $M_2(y_2)$ and $M_3(y_3)$ in equations (iii) and (iv) have increased. This will cause the income of region 1 to increase, and that of regions 2 and 3 to decrease

as a result of import leakages. That is, $M_{12}(y_2)$ and $M_{13}(y_3)$ have now increased.

In Australia, only in Queensland have interregional multipliers been calculated. Huxley (1973) has estimated interregional trade flows in Queensland for 1970-71. Lack of suitable data on interregional trade transactions is the major factor preventing the widespread application of the model described above.

Cost-benefit analysis and regional impact analysis

Cost-benefit analysis is a technique which attempts to measure a particular project's economic benefits and costs to the nation as a whole. Benefits and costs refer to streams of gains and losses in economic welfare incurred by society over the life of the project, measured in monetary terms. From the point of view of the regional analyst, the difficulty with cost-benefit analysis is that it ignores the spatial distribution aspects of costs and benefits. For example, the benefits of a project to the nation may outweigh the costs of that project to the nation. Consequently, on the grounds of economic efficiency the project should proceed. But, before that decision is made, the regional analyst would like some information on the spatial distribution aspects of costs and benefits.

It is useful for illustrative purposes to discuss briefly the decision not to mine Fraser Island. The Fraser Island Environmental Inquiry (Australia 1976) pointed out that "consideration of the distribution of benefits and costs of a decision to prohibit or curtail the export of minerals from Fraser Island suggests that a strong case exists for regional economic losses to be made good by the nation as a whole" (p. 173). The people who benefited most from the government's decision not to allow sandmining on Fraser Island were those who value the island in its underdeveloped state. The people concerned were residents of the region, but also many Australians living outside the region. The latter most definitely were in the majority. Those who lost from the decision were the owners of the sandmining venture, the Commonwealth and Queensland governments (through loss of taxation and royalty revenues), the employees who lost their jobs and faced costs in finding other employment, and those who would have received additional incomes created in the region as a result of the mining operations. If, for the present, we ignore the sandmining companies and the respective governments, then a situation existed where most of

the benefits arising from a curtailment of sandmining operations were distributed throughout the nation, whereas the costs were spatially-specific, essentially to the Maryborough region. The inquiry found, with the aid of input-output analysis, that sandmining activities had added about $5million per annum to the income of the region.

In this case input-output analysis was used to measure quantitatively the specific negative impact on the Maryborough region of the withdrawal of sandmining activities. Thus when cost-benefit analysis is linked to a multiplier analysis technique such as input-output, some indication of the spatial aspects of costs and benefits can be gained.

Notes

1. More sophisticated formulations of this model appear in papers by Stone (1973) and McColl and Throsby (1971).
2. See Brownrigg (1971) for a discussion of the theoretical nature of Keynesian multiplier analysis.
3. The technique was used by the New South Wales Department of Decentralisation and Development (1973) to estimate the multiplier effect of Borg-Warner (Aust.) Ltd on the Albury-Wodonga complex. This study used the model developed by McColl and Throsby (1971).

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Questions for Discussion

1. What are some of the policy and planning uses that can be made of multiplier impact results?
2. Outline the essential features of economic base and input-output as techniques of impact analysis and also discuss their relative strength and weaknesses.
3. Can multipliers be applied mechanistically in the analysis of regional economic impacts?
4. The techniques presented in this chapter leave out of account much that may be important, for example, intangibles. Discuss.

10

Australian Regional Economic Planning Instruments

Previous chapters outlined aspects of the Australian regional problem, suggested reasons for its existence and examined selected economic theories and techniques that we consider useful for the regional economic planner. It is now time to consider policy and planning. It is not our intention here to give an historical account of all regional policies implemented by federal, state and local governments,[1] nor shall we consider non-economic regional planning policies such as the regionalization of administration, the adoption of common regional boundaries, and the establishment of regional administrative centres and regional organizations, though these policies have economic implications[2]. In this concluding chapter we shall simply outline the policy instruments which provide a framework for regional economic policy in Australia, and raise some past issues and future prospects in regional policy and planning.

Regional economic instruments

Chapter 3 outlined the problems that usually confront the regional economic planner. In tackling these problems, federal and state governments have available a number of regional economic instruments (McMaster 1976): regional public expenditure policies, controls on the location of economic activity, government manpower policy, and regional price policies. All four of these instruments have been mentioned in one way or another in previous chapters, so all we shall do here is to draw the threads together.

In regional public expenditure policy governments allocate their capital and current expenditure so that some regions get a proportionately greater share of government spending than other regions. This may involve the provision of public infrastructure such as roads, sewerage, hospitals or educational facilities. The federal and state governments may also transfer the location of government spending by moving public servants and government departments, as happens in a program of selective decentralization. Regional economic impact analysis should be undertaken to indicate which type of expenditure will have the greatest impact in the region.

Governments exert controls on the location of economic activity in at least two ways. First, they provide financial incentives so that industry will locate outside urban areas. Second, they apply restrictions, such as building permits and higher land taxes, to discourage industry from locating in metropolitan areas. Before governments can offer a suitable range of financial incentives or disincentives to alter the location of industry, it is essential for them to have detailed knowledge of the economic factors that affect the location of various types of industries. For example, it is pointless offering firms reduced freight rates so as to alter their location if transport costs are an insignificant proportion of their total production costs.

In order for a regional policy concerned with influencing the location of economic activity to be successful, it may be necessary to supplement it with an active regional manpower policy. It was argued in Chapter 7 that the success of selective decentralization would, to some extent, depend on whether metropolitan dwellers could be motivated to migrate to the growth centres. Once suitable employment opportunities and attractive living and working conditions are available in a region, a policy is required to help reduce barriers to mobility. This may include the provision of accurate information about employment opportunities and living conditions in these new cities.

Both federal and state governments possess a wide range of regional price policies—regionally discriminatory devices which alter the relative price of inputs or outputs among regions. These pricing policies include telephone subsidies, rail freight subsidies, the petroleum equalization scheme subsidy, zonal income tax deductions, and low-interest-rate finance for land and factory buildings.

Future prospects and past regrets

Regional economic planners have at their disposal a number of techniques and models which enable them to evaluate and implement the policy alternatives mentioned above. This book has attempted to equip the reader with some basic knowledge of the essential tools. As Australia moves into the 1980s new regional problems will emerge. However, the basic, evolving tools of regional economic analysis will be applicable irrespective of the nature of the regional problem and the direction in which policies move to overcome the problem. The key word, of course, is "evolving", for we are not suggesting that the applicability of the tools of regional economic analysis remains the same irrespective of time. For example, some writers (Mier 1960; McLuhan 1964; Mandeville and Butler 1979) are suggesting that technological change brought by computers and telecommunications will have significant implications for the location of economic activity; so significant that the basic tenets of location theory may have to be reconsidered. The pragmatic and problem-oriented nature of regional economics will ensure that the discipline's tools of analysis will evolve appropriately with time. In the meantime we feel that the techniques and models presented in this book are, and will continue to be for some time yet, valuable methods of assessing the desirability of regional and urban economic policies.

Our past regrets are that too many urban and regional planning decisions have been made without being subjected to economic scrutiny. In the case of urban freeway systems, for example, economic analysis could have been used to answer questions such as: Are they economically desirable from the point of view of the whole community? What present and future effect will they have on the areas in which they are constructed? and What are the costs and benefits of freeways as opposed to alternative transportation systems? Also it can be argued that the failure of some selective decentralization programs is attributable to policy-makers' lack of knowledge about factors influencing a firm's decision to relocate and why people like to live in metropolitan areas. We would argue that present urban and regional problems in Australia are, to some degree, the result of a lack of economic accountability of decision-makers in the past. Our future hope, to which this book is dedicated, is that regional and urban policy-makers and planners will apply much more widely the available tools of regional economic analysis.

Notes

1. See Stilwell (1974, pp. 147-48) for such an account.
2. Wilmoth et al. (1976) discuss in detail such regional policy alternatives.

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Questions for Discussion

1. Are the regional economic techniques and models presented in this text capable of dealing with regional economic problems as they exist in Australia today?

2. What are the urban and regional implications of zero or near zero rates of population and economic growth?
3. Is concentration of economic activity and population inevitable in the future?
4. What are the implications for the location of people and industries as a result of changing information technologies?

Appendix: Input-Output Analysis

Input-output multipliers

Table 11, the hypothetical input-output transactions table on page 000, is the basis for the following calculations.

In addition to the transactions table there are two other important tables or matrices in the input-output system. First, the table of direct coefficients (see table 12) is calculated from the trans-

Table 12. Direct Coefficients (Matrix *A*)

Inputs ↓ / Outputs →	*A*	*B*	*C*	*D*
A	.27	.39	.00	.02
B	.05	.15	.01	.01
C	.06	.07	.11	.15
D	.12	.13	.19	.17
Primary inputs	.50	.26	.69	.65
Total	1.00	1.00	1.00	1.00

Source: Calculated from table 11.

actions table by dividing column entries by respective column totals. The columns of the table of direct coefficients show the amount of inputs required from each industry to produce $1 worth of output of a given industry. For example, in table 12 for each dollar's worth of output of sector *A*, that sector required direct

purchases of 27 cents (202 ÷ 741) from firms in that sector, 5 cents (32 ÷ 741) from sector *B* and so on.

Second, the table of interdependence coefficients, which is also called the inverse matrix, summarizes the total multiplier effects (see table 13). This table, calculated by matrix inversion, indicates

Table 13. Leontief Inverse Matrix, $(I-A)^{-1}$ (Inter dependence Coefficients)

	A	*B*	*C*	*D*
A	1.42	.66	.02	.05
B	.09	1.22	.02	.02
C	.15	.20	1.17	.22
D	.25	.33	.27	1.26
Output multiplier	1.91	2.41	1.48	1.55

Source: Calculated from table 12.

the total expansion in all industries as a result of a delivery of $1 worth of output to final demand by each industry in the regional economy. It is useful to explain in greater detail what this means. If there is an increase in the final demand for the products of industry *A*, there will be direct increases in purchases by industry *A* from industries *B*, *C* and *D*. These direct effects are indicated in the table of direct coefficients. But, in addition, when industry *B* sells more of its output to industry *A*, *B*'s demand for the products of the other industries will likewise increase. These effects will spread throughout the regional economy and are summarized by table 13, which thus represents both direct and indirect coefficients. This is facilitated by the use of the Leontief inverse matrix ($(1\text{-}A)^{-1}$) which is the key instrument of input-output analysis. This device permits an immediate evaluation of the effects of change in final demand on industry gross output, and as we shall see shortly, also allows us, with a little manipulation, to calculate the values for income multipliers.

The last row of table 13 indicates the output multiplier, which measures the change in total output in the economy resulting from a $1 change in final demand for the products of a particular sector. For example, by summing the first column, it is seen that a $1 change in final demand for the products of sector *A*, will cause a change in total regional output of $1.91.

The first step in the development of sector multipliers is to "close" the basic transactions table with respect to households. This is shown in table 14 as matrix A*. Households are part of the primary inputs and final demand sectors of the original transaction table.

Table 14. Direct Coefficients Including Households in Processing Sector (Matrix A^*)

	A	*B*	*C*	*D*	*H*
A	.27	.39	.00	.02	.15
B	.05	.15	.01	.01	.30
C	.06	.07	.11	.15	.12
D	.12	.13	.19	.17	.18
H	.15	.10	.35	.20	.11

Source: Calculated from table 13

The next step in making an input-output multiplier analysis is to compute the direct and indirect requirements per dollar of final demand for the new system which includes households in the processing sector. This is done by use of the Leontief inverse matrix, and the results are indicated in table 15.

Table 15. Direct and Indirect Coefficients (Matrix $(I-A)^{-1*}$) Including Households in Processing Sector

	A	*B*	*C*	*D*	*H*
A	1.66	0.92	0.36	0.29	0.73
B	0.31	1.46	0.33	0.25	0.67
C	0.34	0.42	1.46	0.42	0.61
D	0.49	0.59	0.61	1.51	0.72
H	0.56	0.62	0.81	0.58	1.72

Source: Leontief inverse of table 14.

Using the procedure discussed above it is possible to derive a table of multiplier coefficients, as shown in table 16. The direct, indirect, and induced income changes, also referred to in the literature as the regional income multipliers, relate to the total income effects of a change in sales of $1 of output to final demand. The

Table 16. Regional Output and Income Multipliers

Sector	Output multiplier	Direct income change	Direct and indirect income change	Indirect income change	Type I income multiplier	Direct, indirect and induced income change	Induced income change	Indirect and induced income change	Type II income multiplier
A	1.91	0.15	0.32	0.17	2.13	0.56	0.24	0.41	3.73
B	2.41	0.10	0.36	0.26	3.60	0.62	0.26	0.52	6.20
C	1.48	0.35	0.46	0.11	1.31	0.81	0.35	0.46	2.31
D	1.55	0.20	0.34	0.14	1.70	0.58	0.24	0.38	2.90

type I and II income multipliers, on the other hand, are ratios measuring the total income effects following a $1 change in household payments resulting from a change in final demand for the output of a particular sector. The method of calculating each of these multipliers in table 16 is as follows.

1. Direct income changes are measured by the household row coefficient obtained from table 14.
2. Direct and indirect incomes changes are calculated by summing the products of column entries in the inverse matrix (table 13) and the supplying industry's household coefficient. Consider the following example.

   Industry *A*: (1.42 × 0.15) + (.09 × .10) + (.15 × .35) + (.25 × .20) = .32 The reason for this is that a $1 increase in final demand from *A* will change output by $1.42 in *A* and also household inputs (i.e. labour) by $.15. Hence the multiplication, $1.42 × $.15 to get the direct and indirect income change. The same procedure is used for industries *B*, *C* and *D*.
3. The indirect income change is the direct and indirect income change minus the direct income change.
4. The type I income multiplier is obtained by dividing (2) by (1).
5. The direct, indirect and induced income changes are merely the entries in the household row of table 15.
6. The induced income change is (5) minus (2).
7. The indirect and induced income change is (5) minus (1).
8. The type II multiplier is (5) divided by (1).

Regional impact analyses are frequently preoccupied with the employment-creating effects of industrial expansion because regional policy-makers may be primarily and legitimately concerned with forecasting jobs. If direct employment change is defined as the number of employees per $1000 of output for each sector, employment multipliers can be calculated, and interpreted with respect to employment, in a similar manner to the income multipliers. See table 17. The results in table 16 and 17 can be interpreted in terms of output, income and employment effects.

The output multiplier for a sector measures the change in total output resulting from a $1 change in final demand for the products of that sector. If the policy aim was to maximize total output then sector *B* would be the one to stimulate the most.

Sector *C* produces the largest change in direct income. It utilizes 35 cents worth of labour inputs for every $1 worth of output. Sector *B*, on the other hand, is least labour intensive because it only

Table 17. Regional Employment Multipliers

Sector	Direct employment change	Direct and indirect employment change	Type I employment multiplier	Direct, indirect and induced employment change	Type II employment multiplier
A	0.25	0.49	1.96	0.69	2.76
B	0.20	0.55	2.75	0.79	3.95
C	0.10	0.24	2.40	0.53	5.30
D	0.40	0.53	1.33	0.76	1.90

utilizes 10 cents worth of labour inputs for every $1 worth of output. It does not necessarily follow, however, that labour-direct income changes are associated with large multipliers. For example, sector *C* in our hypothetical model is quite labour intensive, while sector *B* is capital intensive. A labour-inte;ive industry will produce a larger direct income change than one which is capital intensive. But, when the direct and indirect incomes changes are taken into account, the differential between the two industries mentioned above (.35 - .10 = .25) is now much less (.46 - .36 = .10). The labour-intensive industry in the above example has the largest direct income change, but the reverse is true when we examine indirect income changes. This would explain why the type I income multiplier for the capital-intensive industry (sector *B*) is much greater than that of the labour-intensive industry. In fact, the most labour-intensive industry (sector *C*) has the smallest type I income multiplier (1.31). The reasons for this are fairly clear. An industry which uses a great deal of labour but not many other inputs will probably have fewer interactions with other industries than one which utilizes a considerable amount of capital equipment. When an industry which uses a great deal of capital expands its output, the chain reactions this sets off will spread throughout many sectors of the economy.

The type II income multiplier is another measure which takes into account the direct and indirect effects indicated by the output model plus the induced changes in income resulting from increased consumer spending. The induced income change for sector *C* is the largest (.35), which is to be expected since it is a labour-intensive industry, and would therefore provoke a greater increase in consumer spending. The type II multiplier is the largest for sector *B* (6.20). In summary, if the planning objective is to

maximize the income of a region, then emphasis should be given to sector *B*.

The direct employment change, i.e. the slope of the employment-production function, for a particular sector, measures the rate of change of employment associated with a $1000 increase in final demand. In our hypothetical model, sector *D* has the largest direct employment effect and sector *C* the least. When we look at the indirect changes in employment which indicate the interaction effects, we see that sector *B* produces the largest indirect change (.55 - .20 = .35). This explains why the type I multiplier is the largest for this sector (2.75).

The induced employment change shows the increase in employment due to an increase in consumption. An initial change in final demand will lead to direct and indirect changes in output, and these lead to the employment changes described by the type I multiplier. The change in employment, in turn, leads to a change in income, and hence to a change in consumer demand. The induced employment change is the greatest for sector *C* (.53 - .24 = .29), which means that this sector causes the greatest increase in consumer demand. This explains why this sector has the largest type II employment multiplier. If the planning objective is to maximize employment in the region, sector *C* should be stimulated.

Building regional input-output tables

In the literature on input-output there are a number of manuals available offering guidelines on the construction of regional input-output tables.These would include Isard and Langford (1971), Richardson (1972), Jensen (1976), Mandeville and Powell (1976) and Jensen, Mandeville and Karunaratne (1979). All of the manuals point out a series of steps which are to be followed by analysts wishing to construct regional input-output tables. These steps are:

1. *Purpose.* With all modelling exercises it is important to establish the purpose at the outset. In the literature the stated purpose usually relates to increasing the understanding of the economic structure of an area and to performing an impact analysis.
2. *Choice of region.* The region chosen is usually a statistical collection unit or a combination of statistical collection units such as local government areas, statistical divisions or states. The problems

of what a region is, and how a region should best be defined, outlined in the Introduction, come to the fore here in an operational sense.

3. *Choice of base year.* The year that the transactions table relates to is, again for data reasons, usually a census year, or the latest year that statistical collection agencies such as the Australian Bureau of Statistics can provide required data on sector outputs and employment.

4. *Definition of sectors.* The number of sectors and their definition relate directly to the purpose of the study, but data considerations are important here, too, for as the number of sectors increases, data requirements, and thus costs of the study, will also increase.

5. *Estimation of the interindustry linkages.* Data requirements for input-output models are heavy and the Australian Bureau of Statistics does not collect regional data on interindustry transactions. There are three basic approaches to estimating inter-industry linkages.

The first approach is by direct survey. This involves carrying out a direct survey in the region with questionnaires to find out what firms buy from other firms and the pattern of sales to other firms. Each sector is sampled. Ideally a stratified random sample would be taken, but, in practice, in input-output work, the analyst usually obtains data wherever possible with the aim of covering a certain percentage of establishments in each sector. The main drawbacks with the survey approach are that it is expensive and time consuming. All of the above-mentioned manuals for building input-output tables, with the exception of the last, relate to constructing survey-based regional input-output tables.

The second approach is the non-survey method. The various non-survey techniques attempt to bypass the costly survey approach to the construction of regional input-output tables. Most of the non-survey techniques are concerned with estimating regional tables from the national input-output table. This will involve some method of adjusting the national table as the national industry structure will be a poor representation of the region. The largest source of variation between regional and national industry structures arises from the greater "openness" of regional economies. This is so because the import component of any industry will normally be much greater at the regional level than at the national level. Further, the industrial mix within any sector may vary considerably between the region and the nation, and regional technical production functions may differ from those observed nationally.

The hybrid non-survey/survey technique is the final approach. This is a compromise between tbe above two approaches in order to gain the advantages of both and to avoid the main disadvantages. The approach here is to use non-survey techniques to estimate the elements of the transactions table, but then to replace the matrix entries for key sectors with survey-based estimates or other superior data. To date, the most comprehensive methodology for the production of low cost, hybrid tables is the Generation of Regional Input-Output Tables (GRIT) system developed at the University of Queensland (Jensen, Mandeville and Karunaratne 1979). GRIT has been designed for general use in the production of regional input-output tables from both national tables and other data sources. It is based on a combination of non-survey methods, but allows interference in the mechanical application of these methods at the discretion of the analyst according to the availability of survey or other superior data.

History of input-output and its applications in Australia

Although input-output has its origins in general equilibrium theory, it was Wassily Leontief, a Russian immigrant to the United States, and Nobel prize winner, who pioneered the technique in the 1930s in relation to the economy of the United States. Since World War II, the use of input-output has spread rapidly throughout the world. At least forty countries, developed and less developed, socialist and non-socialist, have built national input-output tables and there are an increasing number of metropolitan, regional and small area studies. In the early 1950s, when attention was first turned to applying input-output to sub-national areas, crude non-survey techniques were applied. Unadjusted coefficients taken from the national table were used, and this approach came under heavy criticism on accuracy grounds. Thus, throughout most of the 1960s, analysts concentrated on constructing survey-based regional input-output tables. However, in the late 1960s and early 1970s attention again focused on the non-survey and hybrid techniques as the demand grew for a wider application of the input-output approach in regional and urban planning. Given the dearth of statistics on regional inter-industry flows, the survey approach has been too costly in terms of time and resources for widespread application to regional planning problems.

In Australia there has been a considerable amount of work done

in input-output. Thus the relative emphasis given to the technique in this book. Nationally the Australian Bureau of Statistics has been building input-output tables for the Australian economy since the 1950s. The latest table is for the year 1974-75 and consists of 109 sectors (ABS 1979).Regional input-output saw its genesis in Australia in 1967 when Max Parker published his tables for Western Australia. Table 18 outlines the regional input-output tables that had been built in Australia until 1979, together with some of the characteristics of these tables. At the time of publication work has been completed on the construction of GRIT tables for South Australia, the Northern Territory, and was still proceeding for Western Australia and Victoria.

Table 18. Australian Regional Input-Output Tables

Analyst	Region	Base year	Number of sectors	Construction method
M. Parker (1967)	State of Western Australia	1953-54 1958-59	30 50	survey
T. Mules (1967)	State of South Australia	–	–	non-survey
G. McCalden (1969)	Town of Muswellbrook, NSW	–	–	survey
R. Jensen (1976)	Central Queensland (3 statistical divs)	1965-66	26	survey
Mandeville & Powell (1976)	Dubbo, NSW and surrounding Shires (Central Macquarie statistical sub-div.)	1968-69	25	survey
B. Harvey (1976)	Bourke, NSW plus surrounding shire	1967-68 1969-70	13	survey
G. Edwards (1977)	State of Tasmania	1968-79	45	survey
D. McGaurr (1976)	City of Toowoomba	1970-71	15	survey
S. Huxley (1973)	Queensland (interregional)	1970-71	3 sectors 11 regions	survey
J. Dickinson (1977)	Northern region of Queensland	1970-71 1971-72 1972-73	42	survey
R. Jensen T. Mandeville N. Karunaratne (1979)	State of Queensland and its ten statistical divisions	1973-74	11, 19, 36 according complexity of region	hybrid non-survey survey

Environmental analysis and input-output

The input-output framework can be extended to examine environmental aspects. In particular the basic interrelation between the economic and the ecologic subsystems of the region can be analyzed.Conceptually this involves extending the inputs and outputs for any economic sector to cover inputs from the ecologic system (water, air, land, fossil fuels) and outputs to the ecologic system (water and air pollutants, heat, noise, solid wastes). Table 19 illustrates an example of a combined economic and ecologic input-output transactions table.

Table 19. Combined Economic-Ecologic Input-Output Transactions Table

		Economic sector 1 2 3 ...	Final demand	Outputs to environment
Economic sectors	1			
Primary inputs	2			
Inputs from environment	3			

The empirical implementation of the model illustrated in table 19 requires a workable classification on ecologic commodities and industry data in units of physical quantities of ecologic commodities per dollar of output. There has been some work done on this in the United States (Isard 1969), and Hughes (1979) is attempting to implement the model empirically in Australia. Karunaratne and Jensen (1978) have reviewed the differing approaches in the literature for applying input-output to an analysis of environmental considerations.

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Index