The Global Knowledge Economy and Regional Concentration of Manufacturing in Australia

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1. Introduction

This paper is concerned with the implications of the knowledge economy for the spatial distribution of economic activity in Australia, and with the role played by foreign direct investment and multinational enterprises (MNEs) in influencing that distribution. There are clearly two antithetical sets of forces in play globally: those working towards greater geographical *dispersion* of economic activities and those working towards increased geographical *concentration* of those activities. Globalisation and localisation have therefore become opposite sides of the same coin. That is, at the same time as economic activities, and perhaps particularly those of MNEs, are becoming dispersed around the world they are also being increasingly concentrated in particular regions or 'sticky places'. An important part of this process is the emergence of clusters of asset augmenting activities, whereby MNEs and local firms concentrate many of their activities in small regional areas, *inter alia* to take advantage of the dynamic externalities associated with the use of intellectual capital.

For countries removed from the mainstream of knowledge based wealth creation – whether by the 'tyranny of distance', by the fact of underdevelopment or by immersion in processes of transition to a market economy – these are issues of fundamental importance. The concentration of economic activity in particular regional clusters may well lead to a process of divergence between nations, and between regions within nations. For example, if these growing clusters are heavily concentrated in the Triad countries, per capita income levels in countries outside the Triad may well fall relative to those of the leading nations, rather than converging towards common levels in line with standard economic theory and national aspirations. On the other hand, if individual 'distant' countries can capture MNE activity in dynamic regional clusters, this is likely to contribute strongly to accelerated economic growth. Further, where the activities of national firms and MNEs do develop some vigorous regional clusters in individual nations, the disparities between regions within those nations may be greatly exacerbated. This clustering may promote overall growth, but if adjustment is slow between regions it may also lead to real hardship and to under-utilisation of resources in slower growing regions.

Thus many countries distant from the mainstream of knowledge based wealth creation have a number of related concerns:

[1] The authors are much indebted to Galina Tikhomirova, Fiona Sun and Margarita Kumnick for advice and assistance in relation to this paper.

- whether it can be ensured that, as nations, they will participate fully in emerging global growth processes;
- what policies, in respect of both MNEs and local firms, will best secure this participation; and
- whether this participation, if it is achieved, will generate growing divergence on a regional basis within the nation.

The objective of this paper is to explore the reality of these phenomena, and the diversity of policy responses to them, for the case of one small, open economy far removed from the main sources of knowledge generation – Australia. After briefly reviewing some recent relevant developments in economic theory, our analysis focuses particularly on the role of foreign direct investment and of both local firms and MNEs within Australia, and on some of the regional aspects of this involvement.

There are three main themes in the argument. Firstly, two recent developments in economic theory (new growth theory and the new economic geography) both explore, in different ways, the impact of the forces of dispersion and concentration in the growth process referred to above. They imply that in certain circumstances these forces can lead to increased divergence in growth outcomes between nations or regions, as activity is concentrated in certain 'sticky places' at the expense of other regions. In both cases this concentration may become more pronounced in the knowledge-based economy, as access to relevant knowledge becomes a central determinant of competitiveness.

Secondly, the particular outcome for a given nation or region will depend heavily on the activity of MNEs and local firms within that nation. In Australia, MNEs tend to be dominant, especially in the higher tech manufacturing industries, but often lack substantial export or innovation focus. That is, many of the activities of MNEs are directed at making use of Australian assets or producing for the domestic market, rather than at creating new assets for global markets. Australian owned firms, while in many cases more active in such matters, are generally very small and find it difficult to compete globally. The past pattern of activities of MNEs have contributed to the pronounced concentration of manufacturing in particular areas in Australia, and changes in the regional distribution of manufacturing have reflected changes in the global positioning of MNEs and the difficulties of local firms. But Australia has not as yet captured many substantial asset-generating activities of MNEs, which may have created knowledge-based developments of world scale. There is little sustained evidence yet for Australia of the emergence of dynamic clusters of asset augmenting activities, whereby MNEs and local firms concentrate many of their activities in small regional areas, to create and produce products for global markets. But there are some hopeful signs.

Our third theme relates to the policy issues raised by these facts. In Australia the policy debate on such matters has turned upon a central choice: that between pure market forces and measures to enhance the operation of markets, on the one hand, and more interventionist policies in the pursuit of MNE activity and of the development of local firms on the other. We note certain examples of national and state policies and conclude that, after two decades of active experimentation and in spite of a range of successful

initiatives, neither the Australian government nor regional authorities have settled on adequate responses to the forces of the knowledge economy. While the reasons for this relate partly to failures in Australian institutions and policy processes, the underlying issues may be of more general interest. Certainly, the future prosperity of Australia – whether it continues to keep pace with leading nations such as the USA in growth in GDP per capita or falls behind – largely depends on effective national strategies to develop dynamic clusters of asset augmenting activities.

2. Divergence in the Knowledge Economy

The presumption among many economists for some time has been that, given a growing reliance on market mechanisms and an open world economy, a steady process of convergence among nations towards common income levels could be expected. The IMF expressed this consensus when it said that 'there are many reasons to expect a converging pattern, especially in a more open and integrated world economy' (IMF 1997, p. 78). The reasons cited included large technology gaps between countries, providing much scope for technological catch-up, and big differences across countries in capital-output ratios, implying that in a world with free capital movements funds should flow to countries in which capital is relatively scare and the rate of return higher. Similar arguments should apply to regions within countries, for which the barriers to factor mobility are even lower.

This confidence was in part based on a particular interpretation of standard neoclassical growth theory. This theory, drawing on the seminal models of Solow and Swan, predicts that economies subject to market forces will converge in terms of per capita GDP levels, either absolutely (if the factors determining the steady state such as technology and preferences are assumed to be common among countries), or conditionally, that is relative to individual country steady state levels, if these and other factors assumed to determine the steady state vary across countries. A substantial body of literature (such as Mankiw, Romer and Weil 1992 and Sala-i-Martin 1996) argues that the neoclassical model with conditional convergence is consistent with the time series evidence for a wide range of countries, and parallel studies have suggested convergence within regions of major countries. But, if the determinants of individual country steady state levels differ significantly across countries, conditional convergence may involve 'convergence' to very different per capita GDP levels, and hence be consistent with marked divergence rather than with convergence in per capita income levels, as these terms are commonly understood.

Recent developments have thrown doubt on this general consensus from two directions. On the empirical side, recent work (e.g. Durlauf and Johnson 1995; Quah 1996a, 1996b; Durlauf and Quah 1998) as well as recent global trends have called into question whether there is any sense in which the world's nations or regions can be realistically said to be converging to common income levels. On the theoretical side, there has been over the past decade or so an explosion of new theoretical literature bearing on

these issues, initially in terms of new growth theories and more recently in terms of 'the new economic geography'. Neither the theoretical nor empirical issues can be pursued extensively here (for a detailed discussion see Sheehan and Grewal 1998), but some further comments on the theoretical literature may serve to place the subsequent discussion about Australia in a richer context.

There are many similarities in both the problems addressed and the techniques used in the new growth theory and in the new economic geography literature. The new growth models abstract from transport costs and study the endogenous factors influencing long term growth rates, while the new economic geography explores the implications of transport costs and related factors for the distribution of economic activity. Both address the impact of increasing returns, and make extensive use of the framework of monopolistic competition to model increasing returns in an otherwise competitive framework. But while the new growth theory literature considers a wide range of mechanisms generating increasing returns, the new geography literature focuses primarily on pecuniary externalities, whose value may be influenced by transport costs.

2.1. New Economic Geography Models

The new economic geography models explore the implications of transport costs in a situation in which there are no differences in history or in technical capability between regions or countries, and regional outcomes emerge from the interaction of transport costs and particular characteristics of production and consumption. Typically, these models have two sectors – agriculture which is dispersed in fixed locations and shows constant returns, and manufacturing which is mobile and shows increasing returns. They generate a tension between *centrifugal* forces working towards regional dispersion of economic activity and *centripetal* forces favouring concentration. These are the equivalents of forces of dispersion and concentration referred to earlier. Some versions (e.g. Krugman 1991, 1995) have mobility of manufacturing labour as well of capital, and can be thought of as modelling the distribution of activity *within* a country; others (e.g. Krugman and Venables 1995) do not permit labour mobility, and can be thought of as addressing the distribution of activity *across* countries.

In the Krugman (1991) model, for example, the centrifugal force opposing concentration is the economies to be achieved by dispersed production in serving a widely spread market, so that if manufacturing is small relative to agriculture its plants will be highly dispersed to meet the needs of the farmers. The centripetal forces arise from the forward and backward linkages between manufacturing and the market: manufacturing both supplies goods to workers and creates locations with higher income than other locations, so that there are incentives for manufacturing firms to cluster in specific locations. In Krugman and Venables (1995) there are two types of manufactured goods (intermediate goods and final goods) and specialisation in the production of intermediate goods with increasing returns generates external economies, the counterpart of the linkages between firms in the earlier model.

Taking these two models together and abstracting from differences in their production structure, the broad message is reasonably clear. When transport costs are very high each nation or region has to be self-sufficient. When transport costs fall below a critical value exchange between areas becomes a possibility. In this stage differences between areas (including real wage differences between countries in the international case) will set in train forces to bring about a concentration of activity, as the strength of the centripetal forces (firm linkages or external economies) begins to offset the declining advantages of diversification. But as transport costs continue to fall to very low levels, the strength of these centripetal forces will also begin to erode. The value of being close to suppliers and markets will fall relative to real wage differences, peripheral nations will gain and a new stage of convergence emerges. In the extreme, at zero transport costs, there are no proximity benefits in firm linkages nor any reason for intermediate goods production to cluster in particular countries.

So both models generate a three stage process, related to transport costs: at very high transport costs activity is widely dispersed; as transport costs fall concentration begins to take place, as the centripetal forces related to backward and forward linkages prevail; as transport costs become very low activity again becomes dispersed, as the value of those linkages is eroded by the continued fall in transport costs.

2.2. The New Growth Models

The new growth models abstract from transport costs, effectively assuming them to be zero, and generally exclude labour mobility. They can be used, however, to study two main types of situation closely related to the topic of the regional implications of the global knowledge economy. One type is that in which nations differ in history, typically in the starting stocks of human or physical capital or of technology. The other consists of situations in which, because of endogenous changes in the range of products available on the market, imperfect competition and incomplete markets prevail and lead to multiple equilibrium growth paths for countries similar in economic conditions and history. Using a range of other assumptions and the standard techniques of neoclassical economics, the new growth models study the properties of the steady state optimum growth path(s). For a review of this literature see Romer (1994) and Aghion and Howitt (1998).

In such models differences in history or initial technical capability can generate sustained and even growing divergence in economic outcomes in the absence of transport costs, and such divergence can also emerge from cumulative processes in a context of imperfect competition and endogenous products. The resulting position of countries which are locked into low-income levels is often referred to as a poverty trap. Azariadis (1996) has valuably surveyed the emergence of poverty traps, and of divergence more generally, in new growth theory models with complete markets and a given set of products. In this analysis three important types of case which generate divergent outcomes in appropriate growth models are:

- external increasing returns, arising from technology and/or human capital;
- industrialisation under increasing returns; and
- internal increasing returns and complementarities between industries.

While the details of individual models differ widely, in broad terms the country relatively strong in the factor generating increasing returns and driving growth (say R&D, human capital, increasing returns manufacturing or linkages in the form of complementarities between industries) will enter a sustained growth path, while the country relatively weak in the relevant factor will enter a low or indeed even zero growth path. Similar results can be obtained in models introducing the endogenous development of new goods into the economic system (e.g. Romer 1990, 1994; Grossman and Helpman 1992).

2.3. Impact of the Knowledge Economy

It is beyond the scope of this paper to elaborate either of these sets of models further, or to explore the impact of the rise of the knowledge economy on them in a systematic way. Our central conjecture is simple, namely that the knowledge economy intensifies, for both sets of models, the strength of the centripetal forces generating concentration relative to that of the centrifugal forces driving dispersion. Rising knowledge intensity is likely, in the context of these models, to generate increased concentration of economic activity.

The knowledge economy is envisaged as a world in which goods and services are becoming much more complex and knowledge intensive, both in terms of broad product capability and in terms of being tailored to the specific requirements of particular users. Frequently cited characteristics of such an economy include the following (see for example OECD 1996 and Sheehan and Tegart 1998):

- increasing R&D intensity, with much shorter lead times for the development of new products and shorter product lives;
- heavy sunk costs related to the creation, production and distribution of goods, giving rise to increasing returns to scale;
- increasing externalities and indeed complementarities between firms and industry, and within the firm increasing economies of scope, as products and the product chain become more complex;
- the increasing importance, as products become more closely targeted to customer needs, of backward and forward linkages to suppliers and customers, with these linkages often geographically driven in spite of lower cost communications; and
- the vital role of human capital, and of the substantial external benefits available to firms from a high general level of human capital.

In the new economic geography models, the centripetal forces arise either from backward or forward linkages between firms or from external economies deriving from the production of intermediate goods. But because, in a standard neoclassical framework, these benefits are mediated only by transport costs, their benefits reduce as transport costs become very low. In a knowledge intensive economy, these linkages will be driven, for example, by shared tacit knowledge and human capital, and by learning by doing. Thus although transport costs will continue to fall as the economy becomes more knowledge intensive, reducing the centrifugal forces related to the costs of supplying

remote regions, the value of linkages or external economies driven by knowledge factors will increase.

A similar argument applies to the new growth models. The rise of the knowledge based economy seems likely to intensify precisely those features (e.g. externalities associated with R&D and human capital, increasing returns internal to firms, complementarities between industries and between firms, factors associated with the creation of new goods) which generate geographic concentration and divergent outcomes between economies in new growth models.

Thus on either approach there seem to be general theoretical reasons for anticipating an increasing divergence in levels of economic activity between countries as the knowledge economy develops. Countries which possess strong capabilities for the generation and application of knowledge, or which can develop those capabilities through the attraction of MNEs or the development of their own firms, are likely to prosper. Furthermore, the development of the relevant capabilities is likely to involve the growth of geographical clusters of innovative, knowledge based firms and related institutions. The increased importance of new ideas based on tacit knowledge has increased the importance of local regions as a key source of comparative industrial advantage. Countries which do not meet these conditions are in danger of falling further behind the leading nations.

3. Multinational Enterprises, Local Firms and Policy Challenges

In the face of such renewed pressures for economic polarisation, the outcome for individual countries in the knowledge economy will depend on many factors. Of these factors, three – the activities of MNEs, the performance of local firms and the development of clusters of asset augmenting activities – are likely to be of special importance. Economic outcomes are being increasingly driven by flows of capital, technology and management expertise across borders and by the activities of MNEs which lie behind these flows, as they pursue their desired global allocation of activities. Central also will be the character and dynamism of local firms and the interplay of MNEs with these local firms. For example, do the resource and knowledge flows from abroad enhance rather than destroy local firms and local structures for the generation and application of knowledge? Finally, the emergence of geographical clusters of firms and knowledge-based institutions facilitating the innovation process will also be critical. Indeed, innovative regional clusters are becoming in some ways more important than footloose MNEs in the production and application of new knowledge. These three factors, together with their regional impact and the policy challenges to which they give rise, are addressed in relation to Australia in the remainder of this chapter.

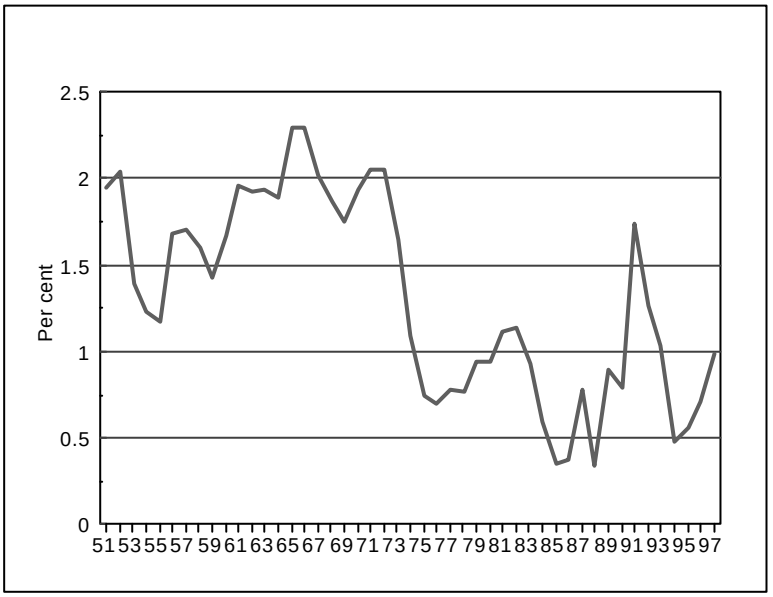
3.1. Foreign Direct Investment in Australia's Development

Since the arrival of the First Fleet in 1788 and the displacement of the aboriginal occupants of the continent, foreign direct investment has played a central role in the

development of a Western society and economy in Australia. This was true not only for the colonies in the nineteenth century, when the focus of such investment was primarily on agriculture, property and mining, but has continued to be true since Federation in 1901, with an increasing emphasis on manufacturing and more recently on service industries. The nature of the Australian economy and the structure of firms cannot be understood without close attention to foreign investment and to the resulting ownership patterns.

The two decades after the Second World War saw substantial net foreign investment flows into Australia, even though this post Bretton Woods period was one of only modest capital flows internationally. This is evident from Chart 1 which shows net direct foreign direct investment into Australia as a share of GDP (using a 3-year moving average to smooth out annual fluctuations) since 1948-1951. As the chart shows, net investment averaged 1.8 per cent of GDP between 1951 and 1973 inclusive, but fell substantially after 1973, to average only 0.8 per cent between 1974 and 1997. Thus the net flows of direct investment into Australia were much lower in the later period.

Chart 1. Foreign Direct Investment, Net Inflow
% of GDP, 3-year average



Source: Australian Bureau of Statistics, Balance of Payments, Cat. No.5302.0.

It is important to note, however, that since the mid 1980s, that is since the opening up of the Australian economy to global markets, the low level of *net* inflows relative to the pre 1974 period is due to increased *outflow* rather than to lower *inflows*. From the mid 1980s outward foreign investment from Australia, traditionally quite low, has increased sharply, exceeding 2 per cent of GDP in the early 1990s and remaining over 1 per cent of GDP in 1994-1996. Thus the reduction in net inflows shown in Chart 11.1 is consistent

with a continuing gross inflow of about 2 per cent of GDP after 1985 and a much higher net outflow than in the earlier period.

Since the Plaza Accord of 1984, foreign direct investment has increased rapidly on a global basis. For example, gross outflows of direct investment from OECD countries (the sum of gross outflows from each country rather than the gross outflow from the region as a whole) averaged 1 per cent of OECD GDP over 1982-84, but by 1995 reached 3 per cent of GDP. Australia has not been a major beneficiary of this upsurge, with gross inflows of foreign direct investment after 1985 being at about the same level (as a share of GDP) as in the pre 1974 period. The major change has been the growth in Australian investment abroad, in large part driven by the emergence of Australian MNEs. In spite of this recent change, Australia's domestic industrial structure needs to be seen as resulting in good part from continuing waves of foreign investment, but with continuing interplay between local and international investors.

For the purpose of this paper, it is useful to simplify this somewhat and simply distinguish between three types of *motive* lying behind foreign direct investment and the activities of MNEs:

- asset utilising activity, which seeks to make use of existing assets in Australia (particularly resource assets) as the basis for national or international businesses;
- market utilising activity, which aims to develop businesses (perhaps based on existing MNE products or technology) to serve the Australian market, and
- asset generating activity, which aims to create in Australia or to harness new assets recently created in Australian (often of a knowledge intensive kind) for the development of global businesses.

Asset utilising investment, particularly based on the agriculture and mining industries, was central to the development of the Australian economy, and remains important today. During much of the 20th century, and particularly in the two decades of rapid growth after the Second World War, much foreign direct investment in the manufacturing industry has been market utilising, designed to develop businesses to serve the Australian market behind tariff walls rather than to compete globally. Thus two among the many challenges facing policy makers since the mid 1970s were to re-orient inward looking manufacturing to a global vision and to encourage asset generating activity. The reality of these challenges can be more clearly understood by examining the structure of Australian industry and its ownership composition.

3.2. Foreign Ownership and the Structure of Australian Industry

Viewed from the perspective of international competitiveness, one of the key deficiencies of the Australian economy, especially in the manufacturing sector, lies in its firm structure. This has two principal aspects: the small scale by international standards of many firms, especially Australian-owned firms, and the relatively dormant state of many of the foreign owned firms operating in Australia. Given the limited scale of the overall economy, the dominance of foreign owned firms in many industries and other factors such as a weak venture capital industry and the distance from larger markets, most Australian owned

firms are small by international standards. Many multinational companies have established subsidiaries in Australia as either representative sales offices or as production units to serve the local market, with little mandate for innovation, product development or exporting. The end result has been a firm structure not well suited to the requirements of the global economy.

A significant proportion of *large* firms operating in Australia are foreign owned, and many have limited commitment to innovation, R&D and export activity in Australia. Whereas only 1.9 per cent of all firms operating in Australia had any foreign ownership as at 30 June 1995, 34.5 per cent of firms with 200-499 employees and 46.7 per cent of firms with 500 or more employees are at least partly foreign owned (Industry Commission and DIST 1997). Indeed, 29.3 per cent of these larger firms are at least 50 per cent foreign owned. Thus foreign ownership is of very substantial dimensions in the ranks of larger firms operating in Australia. This increases the economic importance of their limited business mandate and goals within Australia and within the global economy.

One important feature of the two Innovation Surveys conducted by the Australian Bureau of Statistics (in relation to 1993-94 and 1996-97) is that they provide us with a rare glimpse of the firm size and ownership structure of Australian manufacturing industry. While these detailed data are confined only to manufacturing industry, the surveys do provide information on performance by ownership for disaggregated manufacturing industries. Using these data, Tables 1 and 2 provide information for 1993-94 on a more restricted set of firms than the full set of manufacturing firms covered by the Innovation Survey, namely all manufacturing firms undertaking R&D over the three year period to June 1994. Subsequent comments here refer only to such firms, unless otherwise stated. The technology classification used is that of OECD (1994).

The estimated number of firms operating in each of the four R&D intensity categories in Australian manufacturing, and undertaking R&D over the three year period to June 1994, is shown in Table 1, classified by Australian and foreign ownership. A firm is defined at the management unit level, which in most cases corresponds to the legal company unit, but in large diversified companies may correspond to business units. It is classified as foreign owned if more than 50 per cent of its shareholding is held by overseas interests although, as we will see below, a slightly broader classification is available for 1996-97. Tables 1 and 2 provide the total value of sales, exports and R&D for those firms by ownership, and a range of analytical ratios.

For manufacturing firms undertaking R&D, the ABS estimates that foreign firms accounted for $46.6 billion or 36.7 per cent of total sales in 1993-94. The foreign share of sales was particularly pronounced in higher technology industries – being 53.0 per cent in the high R&D intensity category and 65.4 per cent in the medium high category – but was less pronounced in the medium low and low R&D intensity categories (26.3 per cent and 25.6 per cent respectively). In other words, foreign firms have a truly dominant position in Australian high tech and medium high tech manufacturing industry, but are much less dominant in lower tech industries. These facts are, of course, explicable in terms of

the historical development of Australian industry, but nevertheless define the context in which industry and technology policy must operate.

Table 1. Number and Size of Firms: Australian Manufacturing, by Ownership and Technology Intensity, 1993-94

	Number of firms		Average sales			Total sales (all firms)
R&D intensity	*Australian*	*Foreign*	*Australian*	*Foreign*	*Ratio: Foreign/ Australian*	*Share: Foreign/ Total*
	(number)		*($ million)*		*(%)*	*(%)*
High	377	43	8.9	87.8	8.9	56.0
Medium High	1415	167	7.4	119.3	16.1	65.4
Medium Low	2745	213	7.4	34.0	4.6	26.3
Low	3779	225	12.0	69.6	5.8	25.6

Source: ABS Innovation Survey 1993-94, unpublished data. Refers only to firms undertaking some R&D over the three-year period to June 1994, except when stated.

Table 2. Sales, Exports and R&D: Australian Manufacturing by Ownership and Technology Intensity, 1993-94

	Foreign share of sales	Exports/Sales		R&D/Sales	
R&D intensity		*Australian*	*Foreign*	*Australian*	*Foreign*
High	53.0	24.4	11.6	6.2	4.9
Medium High	65.4	12.6	12.7	2.5	1.6
Medium Low	26.3	26.0	20.8	1.7	0.9
Low	25.6	16.4	14.0	1.0	0.6
Total Manufacturing	36.7	18.7	14.3	1.6	1.4

Source: ABS Innovation Survey 1993-94, unpublished data. Refers only to firms undertaking some R&D over the three-year period to June 1994.

A quite clear picture about the performance in 1993-94 of manufacturing firms which undertake some R&D emerges from the tables, particularly in relation to the higher R&D intensity industries. In these industries a small number of foreign firms, which are large in scale by comparison with their Australian counterparts, controlled a high proportion of sales, but had a lower R&D/sales ratio and a lower propensity to export in 1993-94 than the Australian firms. In the high tech category, the 43 such foreign firms had average sales of $87.8 million, by comparison with average sales of $8.9 million for 377 Australian

firms, exports as a share of sales of 11.6 per cent (Australian firms 24.4 per cent) and an R&D/sales ratio of 4.9 per cent (Australian firms 6.2 per cent). Thus both the size and the performance differences between Australian and foreign high tech firms are dramatic.

Given the importance of high tech firms in the knowledge economy, this fact clearly has given rise to some important policy issues. One is the vital importance of developing improved R&D and export performance by high tech foreign firms operating in Australia. The other is the importance of fostering small, high export and relatively high R&D Australian companies in the high tech sector. The interplay between these two themes is something to which we will return in the final section of this paper.

The picture is similar in the medium high tech group, with one exception. Relative to Australian firms, foreign firms were even larger (average sales of $119.3 million as against $7.4 million for local firms) but Australian firms had a 50 per cent higher R&D/sales ratio (2.5 per cent as against 1.6 per cent). The difference is that neither group has a high export/sales ratio, the figure in both cases being less than 13 per cent. In the medium low and low R&D intensity industries, the dominance of foreign firms is much reduced, as is their size relative to Australian firms, but for both groups Australian firms have substantially higher export propensities and R&D/sales ratios.

These data thus bring out several central facts about Australian manufacturing of immediate relevance to Australia's response to the global knowledge economy, including:

- the dominance of foreign firms in the higher tech industries, but their relatively poor performance in terms of R&D and exports;
- the small scale of Australian firms generally but their relatively strong export and R&D performance, particularly in the high R&D intensity group; and
- the problematic character of the medium high tech industries, of which motor vehicles and chemicals are the largest elements, which have low export and R&D performance and two thirds of the sales of which is controlled by foreign firms.

While it is beyond the scope of this study to seek comparable international data, it is clear that these three facts are distinctive features of the Australian industrial structure, and have been central facts determining the policy challenge facing Australian and regional governments.

4. Industrial Activity by Ownership and State

It has been argued above that the nature of Australian industry has been heavily shaped by the activity of foreign MNEs, and that the character of their involvement in the economy, and their interplay with local firms, remain of critical importance. These issues inevitably have strong regional dimensions, and these dimensions also constrain the available policy responses. Thus before examining the policy issues we explore the geographical aspects of the role of MNEs and local firms in industry development in Australia. In this section consideration is given to the pattern of ownership of industry by state, and to some trends

in that pattern over a limited time span, while in Section 5 we examine the geographical concentration of Australian industry by micro-region. Both analyses are heavily constrained by data limitations, arising from the paucity of data on foreign ownership and the limitations imposed by confidentiality requirements when information is sought by ownership, industry and region. In this section the source of data is again the ABS Innovation Survey, and we again limit the coverage to firms undertaking some R&D.

4.1. Industrial Activity by Ownership and State

Australian manufacturing is heavily concentrated in the two largest states, New South Wales and Victoria, and within those states in Melbourne and Sydney. In 1993-94, 39.2 per cent of total manufacturing sales originated from NSW and 38.5 per cent from Victoria, with the other major contributors being Queensland (10.3 per cent) and South Australia (6.8 per cent). A similar position is evident for exports in 1993-94, although the position of the smaller states is stronger in exports than in sales, reflecting the reduced importance of the domestic market as a reason for manufacturing activity outside the two largest states (see Table 3). Taking account of the different sizes of the states, the greatest concentration of manufacturing activity, in terms of sales per capita, in 1993-94 was in Victoria and South Australia.

Table 3. State Share of Total Manufacturing Sales and Exports, 1993-94 and 1996-97

	Sales (%)		Exports (%)	
	1993-94	*1996-97*	*1993-94*	*1996-97*
New South Wales	39.2	34.3	31.8	30.7
Victoria	38.5	40.5	35.0	36.6
Queensland	10.3	9.6	12.5	8.2
South Australia	6.8	8.8	10.3	10.3
Western Australia	3.1	5.6	4.2	12.2
Tasmania	1.8	0.9	4.7	1.9
Australia	**100**	**100**	**100**	**100**

Source: ABS Innovation Surveys 1993-94 and 1996-97, unpublished data. Refers only to firms undertaking some R&D over the three-year period to June 1994.

Even in the period of only three years separating the two data sets, substantial change has taken place in terms of the location of activity. The main trends have been the decline of NSW (especially in terms of sales), of Queensland and Tasmania as locations of manufacturing, with some increase in Victoria and more substantial relative increases in South Australia and Western Australia. The growth of the share of sales in these last two states, and of the export share in Western Australia, has been very striking. As this has been a period of slow growth in total manufacturing sales overall - an increase of only 4 per cent in value over the three year period - these quite sharp changes reflect both specific industry developments and the activity of MNEs in consolidating, reducing or

expanding production in particular locations. These influences become clearer in the more detailed data considered below.

4.1.1. The High Tech Industries

These factors are particularly evident in the high tech industries (Table 4), which show both pronounced regional patterns and sharp changes in those patterns. In 1993-94 the high tech industries were heavily foreign owned and heavily concentrated in NSW. In this year, 53 per cent of sales originated from foreign owned firms, and 62.5 per cent of sales (and 60 per cent of exports) originated from NSW, with only 30.5 per cent of sales (and 27.6 per cent of exports) originating in Victoria. There were, however, quite substantial differences between the foreign and Australian owned components of these industries in the two states.

Table 4. Sales and R&D Intensity, by Ownership and State, Australian High Tech Industries, 1993-94

State	Share of total Australian sales (%)			Ratio of R&D to sales (%)		
	Foreign	*Australian*	*Total*	*Foreign*	*Australian*	*Total*
Ownership						
1993-94						
NSW	36.2	26.3	62.5	5.9	2.6	4.6
Victoria	15.7	14.9	30.5	2.6	10.4	6.4
Other States	1.1	5.8	6.9	2.9	11.1	9.7
Australia	**53.0**	**47.0**	**100**	**4.9**	**6.2**	**5.5**
1996-97						
NSW	32.4	11.1	43.5	6.3	8.3	6.8
Victoria	21.0	17.5	38.5	2.1	10.0	5.7
Other States	9.3	8.7	18.0	9.9	7.4	8.7
Australia	**62.7**	**37.3**	**100**	**5.4**	**8.9**	**6.7**

Source: ABS Innovation Surveys 1993-94 and 1996-97, unpublished data. Refers only to firms undertaking some R&D over the three year period to June 1994. Ownership categories refer to majority foreign ownership and majority Australian ownership respectively.

In NSW foreign companies had a modest R&D intensity (but a very low export propensity of only 9.4 per cent) whereas locally owned firms had a very low R&D intensity but a high export propensity, exporting 27 per cent of sales. This presumably reflects the concentration of foreign firms in computing, telecommunications and pharmaceutical activities directed primarily at the local market, with local firms concentrated in office machinery and equipment and telecommunications equipment manufacture with a low development capability but a genuine export focus. In Victoria, the

reverse is true – local firms had a high R&D intensity (10.4 per cent) while foreign firms a low one (2.6 per cent), whereas both types of firm had export propensities in the 16-17 per cent region and this is also broadly the case for the other states taken as a whole.

The three-year period has seen quite dramatic change. Overall sales of high tech firms operating in Australia fell by 8.7 per cent over this three-year period, and the nation's reliance on imports of high tech products increased further. Sales of Australian owned high tech firms fell by 27.5 per cent. High tech sales in NSW fell by 36.4 per cent over this time, while rising by 24.9 per cent in Victoria and more than doubling in the other states combined, albeit from a low base. Relevant factors in these trends were the collapse of the office and computing equipment industry, sales of which fell by 78.6 per cent, the activity of MNEs in acquiring small Australian companies, perhaps particularly in the telecommunications equipment industry, and the continuing involvement of multinationals in a small way in response to Federal and State Government programs.

Table 5. Sales and R&D Intensity, by Ownership and State, Australian Medium High Tech Industries, 1993-94

State	Share of total Australian sales *(%)*			Ratio of R&D to sales *(%)*		
Ownership	*Foreign*	*Australian*	*Total*	*Foreign*	*Australian*	*Total*
1993-94						
NSW	13.5	11.2	24.7	1.5	3.5	2.4
Victoria	39.5	15.9	55.4	1.7	1.5	1.6
Other States	12.4	7.4	19.8	1.2	3.2	2.0
Australia	**65.4**	**34.6**	**100**	**1.6**	**2.5**	**1.9**
1997-96						
NSW	8.7	11.9	20.6	2.1	2.0	2.1
Victoria	36.7	13.4	50.1	1.8	1.8	1.8
Other States	19.0	10.2	29.2	1.8	1.9	1.8
Australia	**64.4**	**35.6**	**100**	**1.8**	**1.9**	**1.8**

Source: ABS Innovation Surveys 1993-94 and 1996-97, unpublished data. Refers only to firms undertaking some R&D over the three year period to June 1994. Ownership categories refer to majority foreign ownership and majority Australian ownership respectively.

One result of these trends has been a sharp increase in the role of MNEs in Australian high tech industries – MNE sales rose by 8.1 per cent by contrast with the fall in local firm sales of 27.5 per cent over the three year period, while MNE exports rose 95.1 per cent and local firm exports fell 32.2 per cent. By any standard these must be regarded as disturbing trends, with only a few bright spots. Many small, low R&D local firms have not been able to survive, and have collapsed or been taken over by MNEs. MNE activity has increased slightly, and their exports have increased substantially, but this has been in part

by taking over local firms, and the average scale of MNE activity in Australia has fallen. Far from signalling the emergence of dynamic, knowledge intensive clusters, these data suggest that the expansion of large scale high tech manufacturing is bypassing Australia. The main bright spot is the growth of a significant amount of locally-owned, R&D intensive activity in Victoria.

4.1.2. The Medium High Tech Industries

The picture for medium high tech industries, of which the dominant items are motor vehicles and chemicals excluding pharmaceuticals, is in some respects the mirror image of that for the high tech industries (Table 5). The industries are heavily concentrated in Victoria rather than in NSW and are highly dominated by MNEs, with a very low R&D intensity and a low export propensity, both of which are uniform over MNEs and locally owned firms. They are thus the classic case of industries established by foreign investment in an era of protection, with a focus on the domestic rather than world market. For some time now an emphasis in policy has been to shifted these industries to a more outward looking, innovative focus. Total sales have increased slowly over the period, but exports have increased by 25%, implying a significant rise in export intensity from a low base. The main dynamic within the industry has been a regional one, as large MNEs have consolidated their activities in a smaller number of locations in search of globally more competitive plants.

5. Concentration of Activity by Micro-Region

Given the history and ownership patterns of Australian industry, sketched above, it is to be expected that there has been substantial concentration of manufacturing activity at a small scale regional level in Australia. As will be outlined below, the data suggest that this is indeed the case. Such geographical concentrations of activity could prove to be a base for dynamic clusters of asset augmenting activity and should certainly reflect the diverse dynamics associated with the rise and decline of both MNEs and local firms. The data set used to analyse these issues is the ABS Manufacturing Census for 1993-94 and 1996-97, which provides information on manufacturing performance by industry and region, although the level of cross-classified detail is restricted by confidentiality requirements. More specifically, we study the pattern of manufacturing turnover for these two years for nine manufacturing industries and 183 statistical subdivisions throughout the country.

Tables 6 provides information on two main measures of concentration for 1993-94, in this case applied to the concentration of industry turnover in specific regions across the 183 subdivisions. The first three columns of figures show the shares of industry turnover held by the top 5, 10 and 20 regions or subdivisions, and the next column shows the Herfindahl index of concentration (the sum across the full 183 subdivisions of the squares of individual shares). It is clear that Australian manufacturing is highly concentrated regionally. For manufacturing as a whole, 36.6% of turnover is located in the top 10 regions, and for four of the nine industries over half of turnover is in the top 10 regions. Levels of concentration are particularly high in three industries – printing and publishing;

petroleum, coal and chemicals; and machinery and equipment. In each of these cases more than 70% of turnover is located in the top 20 regions, and for the first two over 40% is in the top 5 regions.

Table 6. Measures of the Geographical Concentration of Australian Industry, 1993-94

Industry	Share of total manufacturing Turnover (%)			Herfindahl index of concentration	Foreign ownership share (%)
	Top 5 regions	*Top 10 regions*	*Top 20 regions*		
Food, beverages and tobacco	21.8	31.5	46.3	1.7	40.5
Textiles, clothing and footwear	37.5	52.3	66.5	4.0	27.3
Wood and paper	20.9	33.7	52.6	1.8	n.a.
Printing and publishing	47.0	60.9	75.6	6.4	n.a.
Petroleum, coal and chemicals	40.7	57.9	72.7	4.4	60.0
Non-metallic minerals	29.7	44.4	62.2	3.0	13.9
Metal products	34.5	45.8	57.9	3.5	11.4
Machinery and equipment	32.5	52.3	74.4	3.6	61.6
Other manufacturing	25.3	40.0	61.5	2.6	34.7
Total manufacturing	**23.7**	**36.6**	**56.2**	**2.1**	**36.9**

Source: For columns 2-5, ABS Manufacturing Census, 1993-94, unpublished data. The Herfindahl index of concentration is measured over the 183 sub-divisions, and is equal to the sum of the squares of the market shares of each sub-division, multiplied by 100. Thus if each of the 183 sub-divisions had an equal share of turnover the index value would be 0.55, will if only 10 regions had an equal share of all the turnover the value would be 10. For column 6, ABS Innovation Surveys 1993-94, unpublished data. Refers only to firms undertaking some R&D over the three year period to June 1994. The ownership category refers to majority foreign ownership.

In each of these three industries high concentration levels seem to be linked to the activities of MNEs, although not necessarily only foreign owned MNEs. In printing and publishing the concentration of activity is particularly focussed on the inner Sydney region, and is clustered around the centres of activity of the big Australian media empires of Fairfax, Packer and Murdoch. In the other two industries much of the concentration seems to be linked to the activities of large foreign owned MNEs in particular locations, notably the petroleum refiners, the major chemical companies and the motor vehicle manufacturers. Two other areas with relatively high concentration levels in spite of low levels of foreign ownership are textiles, clothing and footwear and metal products. The former has traditionally been concentrated in the inner city areas of Melbourne and Sydney, and is heavily dependent on migrant workers, while the latter has been dominated

by the activities of one company (BHP). and by the specific locations of those activities. As one would expect, concentration levels are a good deal lower in the resource related industries of food, beverages and tobacco, wood and paper products and non-metallic minerals, given the need for many types of plant to be located close to the source of the input materials.

Thus manufacturing industry is highly concentrated on a regional basis in Australia, in patterns which reflect the activities of foreign and Australian owned MNEs and the specific characteristics of the industries. How is this pattern of concentration responding to the new pressures on both MNEs and small local firms arising from the global knowledge economy? Indeed, does it provide a base for the emergence of dynamic clusters of asset generating activities, involving both MNEs and local firms, which are the special focus of this book?

It is not possible to provide a general answer to these vital questions here, but some indications can be gleaned by looking in more detail at one of the nine industries covered in Table 6, machinery and equipment. As we are dealing at a high level of industry aggregation to maximise the amount of regional detail available, this is a broadly defined industry, covering motor vehicles and other transport equipment, electronics equipment and appliances, scientific instruments and industrial machinery. In Table 7 we analyse the characteristics of the top 30 regions in Australia in terms of turnover in this industry, grouping them by contiguous regional clusters where these exist. Some interesting dynamics are apparent.

While total turnover for the machinery and equipment industry grew by only 14.2% between 1993-94 and 1996-97, in three areas a much more rapid growth rate was experienced. In the inner areas of south eastern and eastern Melbourne, turnover grew by 71.7% and the regional share of industry turnover rose from 4.9% to 7.1%. While activity is still small in absolute terms, this is a region of rapid growth in knowledge based instruments and equipment, drawing on the strong knowledge resources of Melbourne. It is indeed one of Australia's best prospects for a dynamic, asset generating cluster.

In the northern and western parts of Melbourne there is a larger concentration of activity, with turnover in four contiguous regions growing by 47.9% over the period and these regions accounting for 20.6% of national turnover in this industry in 1996-97. This is particularly driven by the motor vehicle industry. As the MNEs dominating this industry have moved from a multi-domestic form of organisation to integrated global production in search of greater competitive efficiency, the Australian industry has become leaner, more efficient and more concentrated in areas such as northern and western Melbourne. With increased specialisation, a more competitive range of local suppliers to the MNEs has also arisen, and these tend to be clustered around the major plants. Again, this region shows signs of further expansion, based on specific local application skills and cost advantages rather than major R&D activities.

Finally, turnover in the machinery and equipment industry in Perth has grown strongly between 1993-94 and 1996-97, amounting to nearly 5% of total national turnover in the

latter year. Of particular importance here is the expansion of these industries to serve the growth of the mining industries in Western Australia and the remarkable cluster of shipbuilding activities in this region.

Table 7. Regional Concentration, Growth and Decline in the Machinery and Equipment Industry, 1993-94 and 1996-97: Activity of the top 30 regions

Region	Turnover ($ million) *1993-94*	*1996-97*	Share of national turnover (%) *1993-94*	*1996-97*	Growth in turnover (%) *1993-4 to 1996-7*
South Eastern and Eastern Inner Melbourne (2 regions)	1739	2895	4.9	7.1	71.7
Western and Northern Melbourne (4 regions)	5717	8457	16.1	20.6	47.9
Perth (4 regions)	1339	1948	3.8	4.8	45.4
Darling Downs	197	257	0.6	0.6	30.7
Newcastle	699	849	2.0	2.1	21.5
Geelong	508	587	1.4	1.4	15.6
Brisbane City	1465	1640	4.1	4.0	11.9
Adelaide (3 regions)	6087	6547	17.2	16.0	7.6
Sydney (10 regions)	7700	8011	21.7	19.5	4.0
Central Melbourne	1954	1189	5.5	2.9	-39.1
South Eastern and Eastern Outer Melbourne (2 regions)	1868	1063	5.3	2.6	-43.1
Total – 30 Top Regions	**29272**	**33443**	**82.6**	**81.6**	**14.2**

Source: ABS Manufacturing Census, 1993-94 and 1996-97, unpublished data.

6. Cross Currents in Australian Policy

The policy issues confronting contemporary governments are daunting, to say the least, as they seek to find the best path to advance national prosperity in a period of fundamental change. In Australia the policy debate on such matters has turned upon a central choice: that between pure market forces and measures to enhance the operation of markets, on the one hand, and more interventionist policies in the pursuit of MNE activity and of the development of local firms on the other. While there have been important achievements in both these areas, the overall coherence of policy settings and their long run effectiveness have been undermined by continued dispute on this central issue. Two examples are used here to briefly illustrate some of the successes and the failures, and their relevance to the matters documented above.

6.1. Australian Economic Policy 1983-1990

Economic policy in Australia at the federal level has traditionally been dominated by the Australian Treasury, which has been a high quality institution pursuing the common agenda of most Treasuries around the world, namely market based efficiency, government frugality, fiscal balance and low inflation. The Hawke Labor Government was elected in March 1983, while the Australian economy was still in the midst of the 1982-83 recession. Its election policy emphasised recovery from recession and job creation in a context of contained inflation, the proposed policy initiatives being primarily expansionary and mildly interventionist in nature.

Under the influence of a range of diverse forces, from Treasury to Australian Council of Trade Unions, the structure of economic policy which emerged in Australia over the period 1983-1993 was quite distinctive. On the one hand, free market principles were pursued aggressively in some areas, as evidenced in the deregulation of the financial system, the virtual abolition of tariffs, the introduction of competition into many hitherto monopoly sectors and the extensive program of microeconomic reform which was put in train. Yet the linchpin of policy over the decade remained the Prices and Incomes Accord, a centralised agreement to contain wages in the context of other policies to spur growth. A complex series of industry specific policies were been put in place, in areas ranging from motor vehicles and footwear, clothing and textiles to information technology products and pharmaceuticals. Major new science and technology policies were put in place, which have contributed to a fundamental change in the innovative activities of much of Australian industry. However, these 'interventionist' policies were directed not at protecting inefficient or unproductive activities but at assisting firms and individuals to prepare for and then to engage in internationally competitive activities. Australia indeed developed its own unique blend of 'plan and market'. (For further documentation see Sheehan et al. 1994, 1995 and Sheehan 1998.)

For example, there is little doubt that, taken as a whole, the science and technology policies amounted to the most powerful set of measures for the development and commercialisation of science and technology that Australia has yet seen. And the impact was equally striking. Business spending on R&D as a share of GDP increased fourfold between 1981-82 and 1995-96; the R&D intensity of manufacturing (the ratio of R&D to value added) also trebled, from 1.0 per cent in 1983 to 3.2 per cent in 1993, and many industries approached or exceeded OECD average levels; high tech exports grew by 26 per cent per annum (in current US$) between 1986 and 1993, *albeit* from a low base.

In many respects the results of the broader mix of policies were impressive too, at least up until 1990. The orientation of Australian business changed dramatically over this time, there was a flowering of new technology based businesses, employment grew strongly and inflation was relatively well contained, even in the late 1980s boom. But many of these benefits were swept away in the serious mismanagement of monetary policy over the period 1988-92, and the resulting deep recession of 1990-92. However, even from a broader perspective, the distinctive set of policies was deeply flawed. In particular:

- they arose from the fortuitous outcome of strong, contending forces rather than from a shared vision of optimum economic policies;
- individual elements were always at risk, as the balance of power between contending forces changed;
- as a consequence, there were no structures put in place for overall coordination of the policy set, or for assessing outcomes and planning future developments; and
- individual policies were often introduced in a crisis situation, when a particular development provided a political opportunity, and hence without proper planning or foresight.

In short there was no national or even Government consensus about this set of policies, but rather competing views about free markets and intervention, and hence no systematic coordination mechanisms but rather intense institutional competition.

In the 1990s views of successive governments have shifted away from the view that both open, free market policies and judicious, market conforming interventions form an inevitable part of the optimum mix in the knowledge economy. The emphasis has been on opening markets and removing impediments to competition; incentives for local firms and for the commercialisation of technology have been scaled back, as have systematic policies to change the character of existing MNE activity, to encourage other multinational firms to undertake asset generating activities in Australia and to influence the regional pattern of economic activities. While in some respects the results of these policies have been impressive, the continued erosion of high tech manufacturing activity in Australia remains a matter of serious concern.

6.2. The Victorian Economic Strategy 1983-1990

In April 1982 the Cain Labor Government was elected in the State of Victoria, a state which contains about 25 per cent of Australia's population but accounts for about 35 per cent of national manufacturing output and R&D. Perceptions about Victoria's long term future were depressed in the early 1980s, because of its dependence on manufacturing at a time at which growth prospects in Australia were seen as being largely concentrated on resources and tourism. One element of this Government's election policy was that it would introduce systematic, strategic initiatives to address Victoria's long term economic growth and competitiveness. In April 1984 the first strategy statement *Victoria: The Next Step* was published, and for the next six years this strategy was the over-riding focus of government policy.

Its basic objective was to promote long-term growth in income and employment by strengthening the international competitiveness of the economy. This was to be achieved by action on two fronts. Firstly, diverse reforms impinging on both the public and the private sector would be pursued (e.g. increased efficiency in public instrumentalities, reform of taxes and charges, improved regulatory processes), to make the general environment more competitive. Secondly, nine areas of competitive strength were identified—areas where Victoria was seen as having the foundations of continuing

international competitiveness—and plans of action were developed to enhance those strengths and to encourage greater economic development on the basis of them.

Another important feature of the Economic Strategy was action driven by the view that, especially in the knowledge intensive sectors, Victoria lacked the competitive firms and other institutions to take full advantage of its competitive strengths. This led to a systematic attempt to create, in partnership with the private sector, firms and other institutions which were of a scale to compete effectively themselves or which would assist firms to become more competitive. Many but not all of these institutions were effective, and companies spawned lie at the heart of the relatively strong level of high tech activity in Victoria noted in section 4.1.1 above. While not all initiatives were equally successful, this aspect of the experiment did suggest that carefully planned initiatives involving public/private cooperation can indeed augment the nation's competitive base.

It is difficult to separate the impact of the Economic Strategy from the turmoil of 1990 and the controversy to which it gave rise. On the one hand, the attempt to provide a coherent long term vision was strongly supported by business and other economic agents; Victoria's performance relative to other states on the major economic indicators was much stronger over the 1983-1990 period than either before or since; many institutions and structures were created which are central to the State's economy today. On the other hand, the experiment in coordination was abandoned in 1990 in an environment of great hostility and controversy, with accusations of uncontrolled debt levels and with an intense focus on initiatives which proved unsuccessful. Reflecting a collapse of confidence and other factors, the economic performance of Victoria in the early 1990s was weaker than that of the rest of Australia taken as a whole, although recovering in recent years.

6.3. Conclusion

As the 20th century draws to a close, economic policy in Australia as in many other countries remains uncertain about the proper balance between policies to facilitate and policies to govern the market. The opening of the Australian economy over the past decade and a half has brought both benefits and costs. But the lack of any major Australian capability in rapidly growing high tech industries is a matter for serious concern, as is the lack of major concentrations of knowledge intensive activity. Certainly, the future prosperity of Australia – whether it continues to keep pace with leading nations such as the USA in growth in GDP per capita or falls behind – largely depends on effective national strategies to develop dynamic clusters of asset augmenting activities. While the debate is growing, the strategies are not yet in place.

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